

# MEETING OUR GREATEST CHALLENGES: INNOVATION TO FORGE A BETTER FUTURE

Scientific discovery, technological breakthroughs, and innovation are vital for responding to the biggest challenges and opportunities we face as a Nation, including addressing climate change, improving the health of all Americans, enhancing access to clean water and healthy food, and ensuring the Nation's security. They are also key drivers of long-term economic growth and job creation.

Over the past seven years, the President has nurtured the American spirit of innovation. The Administration has prioritized research and development (R&D) funding and created a network of manufacturing institutes to bolster American innovation and increase exports. In addition, the largest investments in clean energy in American history have been made, creating hundreds of thousands of new jobs that will thrive in a low-carbon future. Pollution has been cut from power plants, vehicles, and agriculture, and the President has led the world in forging an unprecedented agreement to combat climate change.

However, there is still more work to do to harness technology and use it to drive economic growth and progress, not just for the year ahead,

but for decades to come. Accelerating the pace of American innovation is essential to ensuring we keep up with the evolving economy and the rapidly changing world around us. As the President said in his 2016 State of the Union Address, we face the key question of "how to make technology work for us, and not against us, especially when it comes to solving urgent challenges like climate change."

The Budget makes significant investments to make technology work for us as we strive to meet the Nation's biggest challenges. It increases investment in our transition to climate solutions like clean energy, which will help to grow the economy and create new jobs. It invests in a new, sustainable transportation system that speeds goods to market while reducing America's reliance on oil, cuts carbon pollution, and strengthens our resilience to the effects of the changing climate. It invests in medical research to help develop treatments and cures that have the potential to save millions of lives and avoid heartbreak for countless families. It also provides critical funding to ensure that R&D keeps us on the cutting edge from manufacturing to space exploration to agriculture.

## CREATING A CLIMATE-SMART ECONOMY

When the President visited Alaska in August 2015, he described the urgent and growing threat of a changing climate as "a challenge that will define the contours of this century more dramatically than any other." In 2015 the record set by 2014 as the warmest year on record was broken. Climate change is already disrupting the Nation's agriculture and ecosystems, water and

food supplies, energy, infrastructure, and health and safety. If we address this growing challenge, we can minimize the damage to the economy and reduce threats to national security.

Climate change is not only a danger to avoid. It is an economic opportunity to seize. Not only can we act to protect the Nation from this threat,

we can harness it to build a climate-smart economy of the future. Moving toward a climate-smart economy will improve the air we breathe, the soil we farm, and the water we drink. In doing so, we can create jobs and opportunity for millions of Americans by building the climate solutions the world needs.

The President has been focused on this challenge since his first inaugural address, when he committed this Nation to combating climate change and protecting the planet for future generations, and tremendous progress has been made. The United States has led by example, with historic investments in growing industries like wind, solar, and biofuels, creating a new and steady stream of middle-class jobs. We have set the first-ever nationwide standards to limit the amount of carbon pollution power plants can dump into the air. America is on track to double the distance cars can go on a gallon of gas. We are also making investments in communities smarter—to avoid future risks of flooding and sea level rise by establishing the Federal Flood Risk Management Standard. From Alaska to the Gulf Coast to the Great Plains, the Administration has partnered with local leaders who are working to help their communities protect themselves from some of the most immediate impacts of a changing climate.

The recent global climate agreement of 195 countries reached in Paris is a tribute to this U.S. leadership. The Paris Agreement is ambitious, with every nation committing to putting forward successive, ambitious, nationally determined climate targets in five-year intervals. It establishes strong and binding transparency requirements, including periodic reviews and independent assessments, to help hold every country accountable for meeting its commitments.

As we have made significant progress addressing climate change, the economy has continued to grow, evidence against the tired claims that we must choose between these critically important priorities. Economic output has reached all-time highs while carbon pollution has dropped to its lowest level in nearly two decades.

Yet we must do more domestically and internationally. Building on the historic Paris Agreement, the Budget makes critical investments in creating a climate-smart economy, one that lays the foundation to transform the Nation's transportation system, grows American leadership in clean energy, accelerates clean water innovation, helps communities prepare for the effects of climate change and become more resilient, protects the Nation's most treasured natural resources, and demonstrates America's global leadership in helping other countries reduce their carbon emissions and accelerate their transition to low-carbon economic growth.

### ***21<sup>st</sup> Century Clean Transportation Plan***

The Nation's transportation system was built around President Eisenhower's vision of interstate highways connecting 20<sup>th</sup> Century America. That vision enabled economic expansion and prosperity, fostered a new era for automobiles, and supported the growth of the Nation's metropolitan areas. Unfortunately, today the remains of that system—the crumbling highways, bridges, and passenger rail system—are not ready to meet the challenges of a growing 21<sup>st</sup> Century economy. Due to underinvestment, American infrastructure that was once the envy of the world is now ranked 19<sup>th</sup> behind countries such as Poland, Hungary, and Spain.

As we look to the future, we must invest in a new, sustainable transportation system that speeds goods to market, expands Americans' transportation options, builds resilient and connected communities, and integrates new technologies like autonomous vehicles into our infrastructure system. Furthermore, to address the challenges of the 21<sup>st</sup> Century, the Nation needs a transportation system that reduces reliance on oil, cuts carbon pollution, and strengthens our resilience to the impacts of climate change.

There have been important infrastructure investments to advance these priorities. Through the Recovery Act, the Administration invested over \$48 billion for transportation, spurring more than 14,600 needed highway, transit,

bridge, and airport projects across America, improving nearly 42,000 miles of roads, repairing or replacing more than 2,700 bridges, and helping transit agencies purchase more than 12,220 transit vehicles. Since 2009 the TIGER multi-modal competitive grant program has provided nearly \$4.6 billion to 381 projects in all 50 States, the District of Columbia, and Puerto Rico, including 134 projects to support rural and tribal communities. The Build America Transportation Investment Center, established in July 2014, has provided technical assistance to increase infrastructure investment and economic growth by engaging with State and local governments and private-sector investors to encourage collaboration, expand the market for public-private partnerships, and put Federal credit programs to greater use. The Administration has worked with the Congress to pass the FAST Act, providing multi-year dedicated funding for surface transportation investments for the first time in a decade.

Yet much more remains to be done. To build a clean transportation system for the 21<sup>st</sup> Century, the Budget invests an average of \$32 billion per year over 10 years into a multi-agency initiative to refocus Federal investments, reward local and State governments for innovation, accelerate integration of new vehicle technologies, and ensure the safety of the transportation system. The Plan will:

*(1) Refocus Federal investment to enhance transportation options for American families.*

The proposal invests nearly \$20 billion per year above current spending to reduce traffic and provide new ways for families to get to work and to school by:

- Providing more than \$10 billion on average per year for the Federal Transit Administration New Starts, Small Starts, and Transit Formula Grants programs to invest in the safety, performance, and efficiency of existing, new, and expanded transit systems. It also creates a new Rapid Growth Area Transit program for fast growing communities to implement multi-modal

solutions to challenges caused by rapid growth.

- Reaffirming the Administration's commitment to high-speed rail by investing on average almost \$7 billion per year on a competitive basis, with an emphasis on incorporating advanced rail technologies.
  - Providing an average of \$1 billion per year for a multi-modal freight program that strengthens America's exports and trade by providing grants for innovative rail, highway, and port projects that seek to reduce both emissions and particulate matter that harm local community health.
  - Nearly doubling the amount of grant funding available through the TIGER program to support innovative, multi-modal investments in the Nation's infrastructure to make communities more livable and sustainable.
- (2) Reward State and local governments for innovations that lead to smarter, cleaner, regional transportation systems.*

The proposal provides approximately \$10 billion per year on average to transform regional transportation systems by shifting how local and State governments plan, design, and implement new projects, including:

- Proposing over \$6 billion per year on average for a 21<sup>st</sup> Century Regions grant program to empower metropolitan and regional planners to implement regional-scale transportation and land-use strategies that achieve significant reductions in per capita greenhouse gas (GHG) emissions and vehicle miles traveled, while improving climate resilience.
- Providing nearly \$1.5 billion per year on average in Clean Communities competitive grants to support transit-oriented development, reconnect downtowns, clean up brownfields, implement complete streets policies, and pursue other policies that make American cities and towns greener and better places to live.
- Providing nearly \$1.7 billion per year on average for Climate-Smart Performance

Formula Funds that are designed to re-orient transportation formula funding by rewarding States that make investments to mitigate transportation impacts like air pollution.

- Providing \$750 million on average per year for Resilient Transportation competitive grants to spur investments that bolster resilience to climate impacts. Cutting-edge projects would incorporate resilience strategies, such as adaptive materials, risk-sensitive design, and next generation transportation and logistics technology.

(3) *Accelerate the integration of autonomous vehicles, low-carbon technologies, and intelligent transportation systems into our infrastructure.*

The proposal includes just over \$2 billion per year on average to launch a new generation of smart, clean vehicles and aircraft by expanding clean transportation R&D, launching pilot deployments of safe and climate smart autonomous vehicles, accelerating the transition to cleaner vehicle fleets and supporting the creation of regional fueling infrastructure for low-carbon vehicles by:

- Providing almost \$400 million on average per year in funding over the next 10 years for the deployment of self-driving vehicles. Investments would help develop connected infrastructure and smart sensors that can communicate with autonomous vehicles, support R&D to ensure these vehicles are safe and road ready, and expand at-scale deployment projects to provide “proving grounds” for autonomous self-driving and connected vehicles in urban and highway settings.
- Expanding access to alternative fuels by 2020 and increasing the deployment of electric vehicles powered with clean sources of energy in communities across the United States by 2025 by providing an average of approximately \$600 million per year for the Department of Energy (DOE) to develop regional low-carbon fueling infrastructure including electric vehicles, biofuels, and other low-carbon options.

- Dedicating an average of around \$1 billion per year for DOE, the Environmental Protection Agency, and the National Aeronautics and Space Administration (NASA), to increase R&D in clean fuels and transportation technologies, including a new generation of low-carbon aircraft, and accelerate the Nation’s transition to the deployment of a cleaner public vehicle fleet.

(4) *Ensure transportation safety keeps pace with changing technology.*

- The Plan focuses on catalyzing rapid changes in transportation technologies. Accordingly, it would invest an average of \$400 million per year to ensure that these technologies are integrated safely into America’s transportation system.

Overall, the 21<sup>st</sup> Century Clean Transportation Plan will increase American investments in clean transportation infrastructure by roughly 50 percent above current levels while reforming the transportation investments already being made to move America to more sustainable, low-carbon investments. Between the Plan and resource levels under current law, the Budget proposes to invest nearly \$900 billion in the surface transportation system over 10 years through the Department of Transportation. The initiative will:

- **Strengthen the economy.** The investments would support hundreds of thousands of well-paying, middle-class jobs each year. It also would increase the competitiveness of U.S. businesses and the productivity of the U.S. economy by making it faster, easier, and lower-cost to move American-made products.
- **Reduce carbon pollution.** The plan would make public investments and create incentives for private-sector innovation to reduce America’s reliance on oil and cut carbon pollution from our transportation sector, which today accounts for 30 percent of U.S. greenhouse gas emissions. The investments in vehicle research and deployment would put commercial autonomous vehicles on the road both more quickly and more safely

while ensuring electric cars and other alternatives to oil-based vehicles have the technology and the charging infrastructure they need.

- **Make transportation easier for American families.** The plan would expand clean, reliable, and safe transportation options like transit and rail, making it easier for millions of Americans to get to work and take their children to school while reducing the seven billion hours that Americans currently spend in traffic each year.

The Plan would be funded by a new \$10.25 per barrel fee on oil paid by oil companies, which would be phased in over five years. The fee raises the funding to make the new investments we need while also providing for the long-term solvency of the Highway Trust Fund to ensure we maintain the infrastructure we have. By placing a fee on oil, the President's plan creates a clear incentive for private-sector innovation to reduce America's reliance on oil and invest in clean energy technologies that will power our future. It continues the President's call to utilize one-time revenues from business tax reform to provide a temporary near-term surge in investment to set us on the right path for the years ahead. In addition to transportation investments, 15 percent of revenues would be allocated to provide assistance to families with burdensome energy costs, including a focus on supporting households in the Northeast as they transition from fuel oil for heating to cleaner forms of energy.

### ***Doubling the Investment in Clean Energy R&D***

Since the President took office, the Administration has made the largest investments in clean energy in American history and the impact is clear. In 2014, renewables accounted for half of new electricity generating capacity placed in service. As of October, renewables were on pace to account for over 60 percent of new generation capacity placed in service in 2015. Last year, the price of solar energy fell by 10 percent and installations climbed by 30 percent.

America's growing clean energy sector is also creating jobs and advancing American economic leadership; the solar industry adding jobs 12 times faster than the rest of the economy.

While we have made significant progress in deploying clean energy technologies, accelerating clean energy innovation is essential to addressing climate change.

That is why the President joined other world leaders on the first day of the recent Paris climate negotiations to launch Mission Innovation, a landmark commitment to dramatically accelerate public and private global clean energy innovation by investing in new technologies that will define a clean, affordable, and reliable global power mix.

Through this initiative, so far 20 countries have committed to doubling their governmental clean energy research and development investment over five years. These countries represent more than 80 percent of the world's clean energy R&D investment. Mission Innovation is complemented by the Breakthrough Energy Coalition, a separate, private sector-led effort whose purpose is to mobilize substantial levels of private capital to support the most cutting-edge clean energy technologies emerging from the R&D pipeline. At the same time, the Administration's Clean Energy Investment Initiative has catalyzed more than \$4 billion in independent commitments by major foundations, institutional investors, and other long-term investors, along with executive actions to scale up clean energy innovation.

The U.S. Government is seeking to double its current base level Federal investment of \$6.4 billion in 2016 to \$12.8 billion in 2021. Initially, new funding would strategically target early stage R&D, which offers the greatest opportunities for breakthroughs and transformative change. However, the investment portfolio spans the full range of R&D activities—from basic research to demonstration. These programs address a broad suite of promising low-carbon technologies, including those that enable businesses and households to use energy more

efficiently, bioenergy, renewable energy, nuclear energy, electric grid technologies, carbon capture and storage, and advanced transportation systems and fuels.

Doubling this investment would require the equivalent of about a 15 percent year-over-year increase in clean energy R&D funding in each of the five years of the pledge. The Budget goes beyond this increase for 2017 by providing \$7.7 billion in discretionary funding for clean energy R&D across 12 agencies. About 76 percent of the funding is directed to DOE for critical clean energy development activities, including over \$2 billion for energy efficiency and renewable energy technologies. For example, the Budget provides over \$280 million for the EV Everywhere initiative and \$169 million for emerging technologies in the building sector.

Investments in clean energy R&D at other agencies that drive progress toward our pledge include \$512 million at the National Science Foundation (NSF) for research in a wide array of technology areas such as the conversion, storage, and distribution of diverse power sources, and the science and engineering of energy materials; \$348 million at NASA for research in areas such as revolutionary aircraft technologies and configurations to enable fuel-efficient, low-carbon air transportation, and \$106 million at the Department of Agriculture (USDA) for competitive and intramural research funding and education to support development of biobased energy sources that range from sustainable and economical forest systems and farm products to increased production of biofuels. These investments build on an ongoing commitment to advance renewable energy deployment and increase access to clean energy for all Americans.

The Budget also includes new mandatory funding across the clean energy research, development, demonstration, and deployment spectrum. The Budget provides \$150 million in mandatory funding for DOE's ARPA-E in 2017, which is part of the ARPA-E Trust proposal that seeks to increase over five years the program's transformational clean energy technology R&D.

The Budget provides substantial support for clean energy R&D as part of the Administration's 21<sup>st</sup> Century Clean Transportation Plan.

### ***Protecting and Increasing the Nation's Water Supply through Investment in Water Technology***

The Nation's water supply is one of our most precious resources. Yet the increasing frequency and duration of droughts place extensive pressures on the vitality of communities and ecosystems across America. In 2012 alone, droughts affected about two-thirds of the continental United States, impacting water supplies, tourism, transportation, energy and fisheries, and costing the agricultural sector alone \$30 billion. Future short-term droughts are expected to intensify in most regions of the United States, and longer-term droughts are expected to intensify in large areas of the Southwest, the southern Great Plains, and the Southeast. Climate change, along with population growth, land use, energy use, and socioeconomic changes, increases water demand and exacerbates competition among uses and users of water.

To increase the resilience of the Nation's water supplies to these stresses, the Administration has developed an aggressive two-part water innovation strategy with the goals of: first, boosting water sustainability through the greater utilization of water-efficient and water-reuse technologies; and, second, promoting and investing in breakthrough R&D that reduces the price and energy costs of new water supply technology.

By continuing to support efforts by U.S. businesses, industries, and communities to make efficient use of water—especially in water-stressed regions—and through better management practices and technology, we have the potential to considerably reduce water usage. High costs currently limit the ability of most communities to turn non-traditional water sources like seawater or brackish water into fresh water. Investing in innovative technologies designed to achieve “pipe parity” (the delivery of new supplies of clean and fresh water at a total cost, energy input, and carbon emission level

equal to traditional supplies) can provide communities in water-stressed regions with new and more effective options to meet their increasing water supply needs. The Budget addresses these challenges by investing in water conservation and R&D of new water supply technology. The Budget provides:

- \$98.6 million for the Department of the Interior's (DOI's) WaterSMART program through the U.S. Geological Survey (USGS) and the Bureau of Reclamation, which promotes water conservation initiatives and technological breakthroughs. This request is \$10.3 million above the 2016 Budget.
- \$4 million of new funding at USGS for near real-time assessment of water use during drought, which provides a regional and national picture of how water use is changing during drought.
- \$28.6 million to support R&D at the Bureau of Reclamation. These funds include \$8.5 million for the water technology solutions challenge program, an ambitious technology challenge prize focused on next-generation advanced water-treatment technologies; \$5.8 million for desalination and water purification, and \$2 million to continue the Open Water Data initiative to improve accessibility of data. This request is \$8.6 million above the 2016 Budget.
- \$25 million in new funding for DOE to launch a new Energy-Water Desalination Hub focused on developing technologies to reduce the cost, energy input, and carbon emission levels of desalination. DOE would also invest nearly \$20 million in complementary R&D on desalination technologies relevant to fossil, concentrated solar power, and geothermal applications.
- \$15 million in additional funding for USDA intramural research on safe and abundant water supplies to support U.S. agricultural production and agricultural practices that conserve water, such as building healthy soils that retain water. The agriculture sector is the largest consumer of fresh water in the United States.

- \$88 million for NSF to support basic water research. The investment would enhance the scientific and engineering knowledge base and enable new technological solutions that will increase the Nation's water supply and the quality of potable water and clean water for use in agriculture and industry processes or cooling.

### ***Partnering with Communities to Tackle Climate Risk***

Across the Nation, the effects of climate change, including more frequent and severe storms, floods, droughts, and wildfires, thawing permafrost, and sea level rise, are felt by communities, households, governments at all levels, and individuals who are on the front lines of the devastation these events often bring. For example, over the last decade, the Federal Government has incurred over \$350 billion in direct costs due to extreme weather and fire alone. Given its far-reaching impacts, it is our collective responsibility to better understand, prepare for, and adapt to our changing climate.

The Budget demonstrates the Administration's continued commitment to increasing the resilience of communities—and the ecosystems upon which they depend—in the face of growing climate-related risks. It invests in programs that advance our scientific understanding of projected impacts, assist communities in planning and preparing for future risks, and deliver risk reduction and adaptation projects on the ground. Through proactive investments in these areas, we can save lives and reduce long-term costs to families, communities and the Nation.

In all of these investments, the Administration recognizes that community demands and needs vary. For the past six years, the Administration has led efforts to transform the Federal Government into an effective partner that customizes support for local communities instead of relying on a one-size-fits-all approach. Place-based climate-preparedness efforts must be developed in partnership with those communities—by the people who live in them, work in

them, and stand to benefit from them. As the Federal Government works with community partners to prepare for climate-related risks, the Administration is starting where it makes the most sense: meeting communities where they are.

**Coastal Resilience.** Climate change impacts are often most clear in coastal areas, where communities are witnessing their coastlines receding under the pressures of sea-level rise, storms, and coastal erosion. The Budget includes a package of proposals aimed at reducing these risks and building the resilience of communities and natural resources to these impacts in a fiscally responsible way.

First, the Budget proposes a \$2 billion Coastal Climate Resilience program, which would provide resources over 10 years for at-risk coastal States, local governments, and their communities to prepare for and adapt to climate change. This program would be paid for by redirecting roughly half of the savings that result from repealing unnecessary and costly offshore oil and gas revenue sharing payments that are set to be paid to a handful of States under current law.

A portion of these program funds would be set aside to cover the unique circumstances that climate change forces some Alaskan communities to confront, such as relocation expenses for Alaska native villages threatened by rising seas, coastal erosion, and storm surges. The Budget also provides the Denali Commission—an independent Federal agency created to facilitate technical assistance and economic development in Alaska—with \$19 million, including \$5 million to coordinate Federal, State, and tribal assistance to communities to develop and implement solutions to address the impacts of climate change. It also includes complementary investments totaling approximately \$100 million across a number of agencies and \$150 million for a Coast Guard icebreaker in the Arctic to help address these challenges.

Second, the Budget invests \$20 million, a four-fold increase above the 2016 enacted level, to help

coastal regions plan for and implement activities related to mitigating extreme weather, changing ocean conditions and uses, and climate hazards through the National Oceanic and Atmospheric Administration’s (NOAA’s) Regional Coastal Resilience grants program. These competitive grants to State, local, tribal, private, and non-governmental organization partners would support activities such as vulnerability assessments, regional ocean partnerships, and development and implementation of adaptation strategies.

**Flood Resilience.** Climate change is expected to increase heavy downpours and cause more rapid snowmelt, which is likely to intensify flooding in many areas of the United States. That increased flood intensity—coupled with development patterns that put people in harm’s way—contributes to significant risks from future flood events. However, flood maps typically provide only a “snapshot” of flood risk at a certain time and become outdated as topographic, hydrologic, or climate conditions change, as development densities change or modify watersheds, or as engineering methods and models improve. To help communities and businesses understand the flood risks they face, the Budget includes \$311 million for National Flood Insurance Program Risk Mapping efforts to update the Nation’s flood maps.

**Drought Resilience.** The Budget continues the Administration’s strong support for USDA in its efforts to integrate climate considerations into existing programs and to use programs to drive resilience. The Budget continues the collaborative effort initiated in 2016 to provide information on the latest technologies and risk management strategies to help farmers, ranchers, and landowners mitigate the impact of climate change through USDA’s regional Climate Hubs. It also includes \$10 million for NOAA’s Regional Integrated Science and Assessments program, which would support expanded NOAA work with resource managers to utilize climate information to address drought and other challenges. The Budget’s \$98.6 million investment in DOI’s WaterSMART program—which provides critical water data, promotes water conservation



initiatives, and invests in technological breakthroughs—complements this effort. (See the previous section on Protecting and Increasing the Nation’s Water Supply through Investment in Water Technology.) In addition, the USDA’s Natural Resources Conservation Service (NRCS) is leading efforts to promote soil health and integrate soil health management practices into conservation programs and technical assistance. The Budget also continues efforts by the NRCS, initiated in 2016, to develop a soil carbon monitoring network to support ongoing GHG monitoring. This network is a key component of USDA’s Climate Strategy as it would allow USDA to verify, for the first time, the United Nations Framework Convention on Climate Change reporting and would also provide the foundation for a farm-scale database to house soil carbon data.

**Wildland Fire Resilience.** Warmer temperatures and drier conditions anticipated under climate change are projected to increase the frequency and intensity of future wildfires, increasing the risks they pose to nearby communities. It is a priority of the Administration to ensure adequate funds are available to fight wildland fires, protect communities and human lives, and implement appropriate land management activities to improve the resiliency of the Nation’s forests and rangelands. To accomplish this, the Budget again proposes to establish a new budget framework for wildland fire suppression, similar to how other natural disasters are funded. This new framework includes a base funding level of 70 percent of the 10-year average for suppression costs within the discretionary budget cap, and a cap adjustment that would then be used for only the most severe fire activity, which comprises two percent of wildfires, but 30 percent of suppression costs. Paying for the most severe and costly wildfire suppression activity with a cap adjustment reduces the need to transfer funds from other important programs designed to more comprehensively manage wilderness landscapes, including the mitigation of losses to property and timber from wildfire.

**Crop Insurance and Resiliency.** The Budget includes proposals for USDA’s crop in-

surance program that would incentivize farmers to choose production practices that minimize climate-change impacts, discourage farming on environmentally sensitive lands and highly-erodible soils, and enhance resiliency in the future through soil protection. These include reducing the farmers’ subsidy by 10 percentage points for harvest price revenue coverage and reforming coverage for prevented planting.

**Multi-Hazard Resilience.** The Budget invests in programs that provide the science and tools, technical assistance, and projects on-the-ground that enable communities to address the full range of climate-related hazards. It provides approximately \$20 million to continue expanding and improving data and tools—available through the online Climate Resilience Toolkit—to help Tribes, communities, citizens, businesses, planners, and others manage climate-related risks and improve their resilience to extreme events.

The Budget provides \$4 million to support a Resilience AmeriCorps pilot program at the Corporation for National and Community Service (CNCS) which would support roughly 175 AmeriCorps VISTA members to assist communities in planning for and addressing climate impacts. In addition to CNCS’ investment, the Budget provides \$2 million for NOAA to train the Resilience AmeriCorps members. The Budget also continues to support the Corps of Engineers programs that are already at work—such as the Flood Plain Management Services Program and the Silver Jackets—by providing \$26 million for technical and planning assistance to local communities to help them develop and implement nonstructural approaches to reduce flood risk.

The Budget also invests \$54 million in mitigation projects—including mitigation planning, facilities hardening, and buyouts and elevation of structures—through FEMA’s Pre-disaster Mitigation Grant Program. Studies on mitigation activities conclude that Americans save approximately \$4 for every dollar invested in pre-disaster mitigation.

### ***Preserving and Protecting Public Lands and Oceans***

America is home to some of the most beautiful landscapes on the planet. Our Nation is blessed with natural treasures from the Yosemite Valley to the Everglades, with verdant forests, majestic mountains, vast deserts, and lakes and rivers teeming with wildlife. These natural resources are not only beautiful, but are a vital economic engine, supporting hundreds of thousands of jobs in industries from recreation and tourism to timber and fishing and generating billions of dollars in economic activity.

America's natural landscapes face growing pressures, however, not only from agricultural, commercial, industrial, and residential development, but also from a changing climate that brings increased drought, wildfires and other dangers. As a result, the need for investments in natural and cultural resources on Federal and State lands is greater than ever. All of these forces necessitate coordinated efforts among Federal, State, tribal, local, and private land managers, who share a collective responsibility for preserving and restoring natural systems that are vital to mitigating climate impacts, such as soil and other carbon reservoirs.

The Budget includes robust funding to support such efforts. It invests in proven programs that allow Federal agencies and their partners to better understand, prepare for, and adapt to natural hazards, including those worsened by climate change. Public land management agencies administer programs that build the resilience of natural resources and communities to hazards, such as drought, coastal flooding, and wildland fire. These programs provide actionable science, data, and technical assistance that enhance the ability of natural resources to adapt to changing conditions, which in turn benefits our communities.

**Land and Water Conservation Fund.** Created 50 years ago, the Land and Water Conservation Fund (LWCF) is used to preserve historic resources, protect endangered wildlife, restore forest ecosystems, and provide recre-

ational opportunities for millions of Americans in iconic places that range from Grand Canyon National Park to local parks in nearly every county across the Nation. The highly successful program reinvests royalties from offshore oil and gas activities into public lands, with the goal of using the benefits of one non-renewable resource for the protection of another—our irreplaceable landscapes. Through the LWCF, the Budget invests \$900 million annually into conservation and recreation projects to conserve lands in or near national parks, refuges, forests, and other public lands. Through strategic and landscape-level land acquisition, public access to lands for sportsmen and hunters, and grants to States for recreation and conservation projects, the LWCF is a cornerstone of this Administration's conservation agenda.

**National Park Service (NPS) Centennial.** For over 100 years, NPS sites have preserved and shared our cultural and historical identity. The iconic places protected by NPS present America's unique history and draw tourists from across the United States and around the world. As we continue to celebrate the centennial anniversary of the Nation's great parks, the Budget proposes to increase park services for visitors and make targeted investments that would improve NPS facilities. This opportunity is an historic effort to upgrade and restore national parks and engage and inspire younger generations to visit and care for the Nation's parks into the future. With more and more American families living in urban spaces that often lack easy access to our great outdoors, it is vital to introduce a new generation to our public lands. That is why the Every Kid in a Park initiative provides all fourth-grade children free passes to U.S. public lands and waters. To support this effort, the Budget proposes \$25 million for youth engagement and bringing youth from underserved communities to national parks and forests.

As NPS enters its second century, it is working to assess and build resilience to the effects of climate change in its 86 ocean and coastal parks and over its 12,000 miles of shoreline. The effects of climate change deteriorate park shorelines,

threatening our resources, infrastructure, and public recreation opportunities. Working with scientists and other partners, NPS is developing adaptation strategies to protect these coastal resources and to boost their long-term resilience. Meanwhile, public lands continue to experience record visitation levels. Such visits do more than provide scenic views and inspiration—they drive an estimated \$51 billion in economic impact, and support hundreds of thousands of jobs in local communities across the United States.

The Budget proposes \$860 million in discretionary and mandatory funding to allow NPS, over 10 years, to make targeted, measurable, and quantifiable upgrades to all of its highest priority non-transportation assets and restore and maintain them in good condition. Doing so avoids increased deterioration and costs for future generations. The Budget also proposes matching funds to leverage contributions from the private sector for critical signature projects.

**Sage-Grouse Protection.** In September 2015 the DOI's Fish and Wildlife Service (FWS) issued a landmark determination that the greater sage-grouse does not warrant protection under the Endangered Species Act at this time. This decision was possible because of the collaborative strength of Federal, State, tribal, and private conservation efforts over many years and the continued commitment of all partners—including the Federal Government—to conserving the sagebrush habitat in what is arguably the largest landscape-level conservation effort in U.S. history. Moreover, the FWS determination and the conservation mechanisms in place provide the regulatory certainty needed for sustainable economic development across millions of acres of Federal and private lands throughout the western United States. The Administration is committed to meeting its responsibilities to conserve vital sagebrush ecosystems.

The Budget builds upon unprecedented investments provided in 2016 to protect the western United States' sagebrush ecosystems. On lands managed by the Bureau of Land Management and the U.S. Forest Service, the Administration

is committed to successful implementation of the sagebrush resource management plans, as well as the Administration's comprehensive rangeland fire strategy. The Budget proposes \$23 million over the 2016 level within DOI—and more than twice the amount of funding enacted in 2015—for activities directly affecting sage-grouse protection. Across private lands, NRCS is investing \$211 million by the end of 2018 to help hundreds of ranchers conserve or restore 3.7 million acres of additional habitat.

**Ocean Science and Conservation.** About a third of the carbon dioxide in the atmosphere dissolves into the ocean, and the increased global carbon dioxide levels are the main driver of ocean acidification, which in turn affects marine ecosystems. To address this complex issue and increase understanding of the consequences of ocean acidification on marine resources, the Budget includes \$22 million, a \$12 million increase over 2016 levels. To help fishing communities, which face significant climate challenges, become more resilient to the impacts of fisheries disasters, the Budget provides \$9 million. These competitive funds would assist communities in becoming more environmentally and economically resilient through activities such as ecosystem restoration, research, and adaptation.

### ***Leading International Efforts to Cut Carbon Pollution and Enhance Climate Change Resilience***

Because climate change is a global challenge, it is imperative for the United States to couple action on climate change at home with leadership internationally, as called for in the President's Climate Action Plan. To support this objective, the Budget provides \$1.3 billion in discretionary funding to advance the goals of the Global Climate Change Initiative (GCCCI) through important multilateral and bilateral engagement with major and emerging economies. This amount includes \$750 million in U.S. funding for the Green Climate Fund, which would help developing countries leverage public and private financing to invest

in reducing carbon pollution and strengthening resilience to climate change.

Assisting these countries in meeting emissions reduction commitments and developing their economies along low-emissions pathways would play a vital role in mitigating some of the most serious risks from climate change both at home and abroad. Assisting developing countries in their climate adaptation efforts is critical to helping the poorest and most vulnerable nations prepare for, and build resilience to, the impacts of climate change. These efforts would not only help preserve stability and security in fragile regions that are of strategic importance to the United States, but also help open these regions to U.S. businesses and investment.

More broadly, GCCI funding enables the United States to provide international leadership through the Department of State, the U.S. Agency for International Development,

and the Department of the Treasury to support our developing-country partners in their efforts to meet their emissions reduction commitments, including by expanding clean and efficient energy use, reducing deforestation and forest degradation, conserving the world's remaining tropical rainforests, and phasing down the production and consumption of substances with high global warming potential, such as such as hydrofluorocarbons. GCCI funding would help support U.S. commitments made in the context of the Paris Agreement and put the United States on a pathway to doubling U.S. grant-based support for international climate adaptation activities by 2020. Federal agencies will also systematically integrate climate-resilience considerations into international development investments so that U.S. investments overseas remain sustainable and durable and support the poorest and most vulnerable communities in their efforts to cope with the adverse impacts of extreme weather events and climate change.

## INVESTING IN RESEARCH AND DEVELOPMENT

Because of the critical role that R&D plays in expanding the frontiers of human knowledge, tackling the Nation's biggest challenges, and driving the economy forward, the Administration has consistently prioritized robust R&D investments since the start of the Administration.

The Budget sustains the Administration's consistent prioritization of R&D with an investment of \$152 billion for R&D overall through both discretionary and mandatory funding proposals. This reflects a four percent increase from 2016 and targets resources to the creation of transformative knowledge and technologies that can benefit society and create the businesses and jobs of the future. Specifically, the Budget prioritizes basic research, the type of R&D that is the most likely to have spillover impacts to multiple endeavors and in which the private sector typically under-invests. It also includes \$7.7 billion in discretionary funding

for clean energy R&D in 2017, the first step toward the Mission Innovation doubling goal.

Of the overall \$152 billion investment in R&D, \$4 billion is mandatory funding because the discretionary levels set by the Bipartisan Budget Act are not sufficient for the Nation to take full advantage of the opportunities for R&D investments to create jobs and grow the economy.

### *Revitalizing American Manufacturing*

After a decade of decline, American manufacturing has added 878,000 new jobs since February 2010, new factories are once again opening their doors, and global investment in the U.S. manufacturing sector is increasing. The Budget proposes \$2.0 billion in coordinated, cutting-edge manufacturing R&D, while also expanding industry-driven workforce training and providing additional resources through the

Manufacturing Extension Partnership to help America's small manufacturers access the technology and expertise they need to expand. This would help turn America's increased manufacturing competitiveness into a lasting advantage through smart, strategic investments that build on our strengths. Most importantly, the Budget makes new investments to grow a national network of innovative R&D hubs to help keep U.S. manufacturing in the lead on technology.

This network, the National Network for Manufacturing Innovation, plays an important part in this revitalization of American manufacturing. In his 2012 State of the Union Address, the President called for the creation of a network of manufacturing institutes to boost advanced manufacturing, foster American innovation, and attract well-paying jobs that would strengthen the middle class. Later that year, an interagency team led by the Department of Defense launched the first pilot institute. Proving that revitalizing American manufacturing is a topic we can all agree on, the Congress supported this initiative in a bipartisan fashion by passing the Revitalize American Manufacturing and Innovation Act in December 2014, which authorizes manufacturing innovation institutes to come together into a shared network and codifies authority for the Department of Commerce to coordinate this multi-agency initiative.

To date, the Administration has already awarded seven institutes. Those institutes represent more than \$500 million in Federal resources matched by more than \$1 billion of non-Federal resources, all focused on securing U.S. leadership in the emerging technologies that make America's industry more competitive today and ensure continued groundbreaking innovation tomorrow. The Budget builds on the seven institutes awarded, two more institutes with competitions already underway, and four more institutes funded in 2016 by proposing five additional manufacturing institutes in 2017 in the Departments of Commerce, Defense, and Energy. In total, the Budget proposes more than \$250 million in discretionary resources to create and sustain manufacturing innovation institutes.

Each of these new institutes would bring together companies, universities, community colleges, and Government to co-invest in the development of world-leading manufacturing technologies and capabilities that U.S.-based manufacturers can apply in production. For example, the Digital Manufacturing and Design Innovation Institute in Chicago has attracted more than 140 partners and, in its first six months alone, hosted over 2,000 visitors to its smart factory demonstration facility, modeling state-of-the-art techniques for integrating digital technologies into a factory production line. Collectively, the institutes are attracting a swelling membership from across Fortune 500 companies, leading research universities, regional non-profits, and small businesses with over 800 members to-date. They have launched 147 R&D projects to accelerate transformative manufacturing technologies into production, demonstrating the significant momentum underway.

The Budget also includes a mandatory spending proposal of \$1.9 billion to build out the remaining 27 institutes to create a national network of 45 manufacturing institutes over the next 10 years that would position the United States as a global leader in advanced manufacturing technology.

### ***Advancing Biomedical Research at the National Institutes of Health (NIH)***

The Budget provides \$33.1 billion—including \$1.8 billion in new mandatory funding—to support biomedical research at NIH. This funding would allow for almost 10,000 new and competing NIH grants that will help scientists better understand the fundamental biological mechanisms that underpin health and disease to improve health and save lives. The Budget provides increased resources for the President's Precision Medicine Initiative and continues support for the Brain Research through Advancing Innovative Neuroethologies (BRAIN) initiative, launched by the President in 2013, which is helping to revolutionize our understanding of the human brain.

**Enhancing Investments in Cancer Research.** As a part of the cancer “moonshot” the President announced in the State of the Union Address, the Budget provides an increase of \$755 million to accelerate progress in preventing, diagnosing, and treating cancer. The increase is in addition to NIH’s significant investment for the cancer moonshot in 2016. The Budget’s multi-year cancer initiative, which begins in 2016, provides \$680 million to NIH and \$75 million to the Food and Drug Administration in 2017, to improve health and outcomes for patients through investments in research and infrastructure, and brings together researchers across sectors and scientific disciplines. Notably, these funds would significantly increase support for research to help realize the promise of cancer immunotherapy.

**Precision Medicine Initiative.** The Budget includes \$300 million for NIH to continue the progress of the President’s Precision Medicine Initiative, which was launched in 2016 to enable a new era of medicine for all by accelerating research into the development of treatments tailored to specific characteristics of individuals. The Budget supports efforts underway to establish a voluntary national research cohort of one million or more Americans, expand research to define cancer subtypes and identify new therapeutic targets, modernize the regulatory framework for DNA-sequence-based diagnostic tests, and improve health data sharing and interoperability so patients can access their health records for research, providers can recommend optimal treatments and researchers can use individual and population data to develop new insights and therapies. It also supports activities to engage patients, including those from historically underserved communities, and raise awareness about the promise of precision medicine for all.

**BRAIN Initiative.** The Budget includes \$195 million for NIH for the BRAIN Initiative, a bold research effort to revolutionize our understanding of the brain and to uncover new ways to treat, prevent, and cure brain disorders like Alzheimer’s, schizophrenia, autism, epilepsy, and traumatic brain injury. The initiative has grown

since its launch in 2013 to include five agencies, and dozens of major foundations, private research institutions, universities, companies, and advocacy organizations have aligned their research efforts to advance the BRAIN Initiative.

### ***Investing in Civil Space Activities***

The Budget invests in space exploration and technological advancements, providing \$19 billion, including \$763 million in mandatory funding in 2017, to NASA to further U.S. leadership in space and at home. The Budget supports exploration of the Solar System, including robotic missions to Mars and to the Sun, and funds the development and operation of a fleet of spacecraft to study our own planet, increasing our understanding of the Earth and its climate. The Budget supports innovative public-private partnerships to enable new industries and capabilities in space and to ensure that our space programs are sustainable and affordable. The Budget also makes investments in new groundbreaking technologies, such as solar-electric propulsion that would allow us to push out into the Solar System not just to visit, but to stay.

### ***Addressing Challenges in Agriculture through R&D***

Recognizing the importance of science and technology to meet challenges in agriculture, the Budget increases investment in three major areas of agricultural R&D:

- Grants through USDA’s flagship competitive peer-reviewed research program, the Agriculture and Food Research Initiative (AFRI), are funded at \$700 million, including \$325 million in mandatory funding. This is the full authorized level and double the 2016 funding level. It would enable USDA to accept many qualified research proposals that it previously would have rejected due to funding constraints. AFRI-supported research would enable USDA to respond to critical problems and challenges facing the Nation such as ensuring an abundant supply of safe water for agricultural uses, responding to climate change, understand-

ing and restoring soil health, and improving food safety and quality.

- USDA's in-house research programs through the Agricultural Research Service are funded at almost \$1.2 billion, which includes increases for current and new programs for climate change resilience and vulnerability, pollinator health, agricultural microbiomes, responding to antimicrobial resistance, as

well as research on foreign animal diseases, soil health, avian influenza, and for safe and abundant water supplies to support agricultural production.

- The Budget provides \$94.5 million for construction and renovation of key infrastructure investments based on USDA's facility modernization plan.

