September 30th, 2021

Dear Director Deese,

Over the Summer, you articulated a new strategy for a robust industrial policy, one key to reaching the full potential of American competitiveness while delivering justice, equity, and prosperity for all citizens. We are heartened by the scope of your ambitions and offer here a batch of actionable ideas to support implementation of this strategy.

In the past year, more than 300 contributors—including students, academics, activists, industry leaders, local and international government officials, and more—have helped build our nonpartisan portfolio of over 180 actionable science and technology policy proposals. Below we provide a curated set of these diversely sourced ideas for each of the industrial strategy’s core pillars:

- Pillar I: Supply-Chain Resilience
- Pillar II: Targeted Public Investment
- Pillar III: Public Procurement
- Pillar IV: Climate Resilience
- Pillar V: Equity

The contents of this document represent just a subset of our larger portfolio available publicly online. More detail for each of the ideas outlined herein is available on request, in the form of a detailed policy action memo and/or via consultation with the authors. We hope these ideas advance your vision of a modern industrial policy that benefits all Americans.
Pillar I: Supply-Chain Resilience

“This crisis and this recovery expose a long-term hollowing-out of our country’s industrial base, which happened over years and decades.”

—Brian Deese, Director of National Economic Council
June 23, 2021
Section Overview

A history of offshoring production has eroded the U.S. manufacturing base and weakened our nation’s ability to meet the medical and economic needs of all Americans, especially in times of crisis. In crafting a forward-looking strategy of innovation and resilience within our supply chains, we must learn from COVID-19 pandemic and the near past. From activating local designers and producers in times of need, to connecting R&D investments with manufacturing capabilities that rapidly scale and commercialize innovations across regions, below is a set of actionable recommendations to strengthen and improve our supply chains.

Fortifying Medical Supply Chains: Lessons to Learn from COVID-19

From March to August 2020, local designers, engineers, and manufacturers operated more than 600 prototyping and digital fabrication facilities in every state to produce over 8 million units of personal protective equipment (PPE)—all on their own initiative. This network overcame limited access to government funding for grassroots manufacturing and unclear regulatory approval for novel PPE to meet the needs of millions in their communities. Our nation’s responsiveness to disasters would increase with the creation of a federally defined, state-activated U.S. Prototyping and Manufacturing Reserve to tap into networked, community-based production capacity. The Federal Emergency Management Agency (FEMA), in partnership with the Department of Defense (DoD) and Small Business Administration (SBA), could determine tiered certification standards for participating in the reserve. A lead administrative agency would be designated to formalize, support, and coordinate the network’s actions. As distributed PPE manufacturers struggled by the dearth of standardized designs, one other rapid response measure could include creating a Digital Stockpile of Open-source Blueprints for making medical and emergency supplies and devices. This library should be manufacturing-agnostic, include designs for low-resource environments, offer plain-language instructions for users, and provide complete manufacturing requirements and testing guidance.

Even before the pandemic, our country faced national drug shortages that needlessly cost thousands of lives and nearly $500 million every year. Causes of the majority of drug shortages are still classified as “unknown” because of the secrecy of pharmaceutical supply chains. A joint initiative by the DoD, the Department of Health and Human Services (HHS), and the Food and Drug Administration (FDA) could chart a different course. With a $5 billion investment over five years, this initiative would improve medical access for vulnerable populations, stabilize drug pricing, and enable responsive, end-to-end, and on-demand drug production—production that, by year two, would cover up to half of the FDA’s list of 223 essential medicines. Initiative investments would achieve these outcomes by capitalizing on emerging innovations such as 3D printing, on-the-spot drug fabrication, and continuous flow manufacturing technologies, while securing key supply-chain components produced overseas like Key Starting Materials (KSMs) and Active Pharmaceutical Ingredients (APIs).
Revitalizing the Manufacturing Ecosystem

The decades-old mantra of “innovate here, produce there” has stymied our nation’s technological progress. As Japan, Germany, Korea, Taiwan, and China have realized the benefits of “manufacturing-led” innovation systems, our nation, lacking the capacity to produce newly developed technologies at scale, has failed to reap the maximum benefits of our unmatched investments in R&D. Instead, we have endured threatening setbacks such as a semiconductor shortage that will cost U.S. automakers $100 billion with corresponding job losses. Our nation’s trade deficit in advanced-technology goods grew from $130 billion in 2019 to $191 billion in 2020, with import levels up in almost every product category by late 2020.

The 16 Manufacturing USA Institutes were established to try to remedy these shortcomings. We therefore applaud your 100-day Supply Chain Review Report’s recommendations for new Manufacturing USA Institutes devoted to high-capacity batteries and semiconductors. However, we also appreciate the need for additional systemic changes to bolster our nation’s advanced-manufacturing ecosystem and achieve long-term competitiveness. To date, our nation has asked much of the Institutes: to develop revolutionary advanced manufacturing technologies, revive regional manufacturing ecosystems, modernize small and mid-sized manufacturers’ (SMMs) processes, and digitally upskill the workforces of entire sectors. The Institutes have made remarkable progress on each of these goals. But they need additional support. Because the government designed Manufacturing USA to end after five years, the Institutes were too thinly capitalized to fully realize their missions. In the meantime, declining workforce-development programs have diminished the supply of workers capable of using new technologies, adding more systemic barriers to upgrading manufacturing processes. SMMs have particularly struggled to accumulate the needed capital or know-how to compete in the modern era, reducing overall supply-chain efficiencies.

With these issues in mind, a more resilient supply chain depends on the restoration of American leadership in manufacturing. The following recommendations offer a roadmap for distributing the benefits of modern manufacturing to underinvested regions across the country and ensuring the longevity of our nation’s ambitious, diverse, and cutting-edge R&D ecosystem:

Action 1: Empower SMMs with digital manufacturing

A supply chain is only as strong as its weakest links. Right now, U.S. SMMs have become one of those weak links. Productivity of SMMs has consistently lagged productivity of larger firms. One reason for this is that SMMs have struggled to realize the significant productivity, innovation, and time-to-market speed gains of digital manufacturing. Continuous integration of advanced manufacturing technology into our nation’s supply chains is crucial to long-term competitiveness and resiliency. But manufacturing firms, especially SMMs, will not marshal the significant amounts of capital needed to bring in new technologies unless the efficiency and financial gains
of those technologies are fully demonstrated. To address many of these shortcomings, the U.S. Innovation and Competition Act of 2021 (USICA) authorized the Manufacturing Extension Partnership (MEP) with $2.4 billion for workforce development, training, and cybersecurity for small manufacturers. The MEP should therefore use these funds to create Regional Technology Demonstration Centers (RTDCs) where companies can see new technology prototypes in action, demonstrate and test those technologies, and train their employees to use them. These Centers should emulate Germany’s Industrie 2.0, which created over 300 “use cases” that detail how SMMs in different sectors could digitize their manufacturing processes. The MEP could develop similar use cases tailored to the United States that include guidance on recommended levels of technical workforce readiness, outline infrastructure needed for network capabilities and security, and present applications of new technologies in manufacturing (e.g., application of artificial intelligence to support predictive maintenance, quality inspection, and production scheduling).

Another barrier preventing SMMs from adopting digital manufacturing is a reliable supply of workers trained in the new skills required to utilize new technologies. The RTDCs could function as hubs for regional workforce development, in partnership with the Institutes as well as local economic-development agencies, area community colleges, and technical high schools. The Institutes should receive additional core funding to develop skill roadmaps in their respective focus areas and to identify best practices in workforce education, such as certifications for advanced manufacturing fields or an online manufacturing education “commons”. Implementing these roadmaps and best practices through the RTDCs would increase the supply of workers capable of adopting digital manufacturing.

A third barrier is cybersecurity. Every day, malicious software and compromised “Internet of Things” (IoT) sensors pose more threats to supply-chain integrity. Yet SMMs lack the financial and technical resources to protect themselves. The Supply Chain Cybersecurity Initiative (SCCI) is taking an innovative and proactive approach to cybersecurity by using “wargaming” techniques to continuously model supply-chain networks and their dynamic threat environments. The MEP should leverage this approach for the manufacturing supply chain, partnering with the Cybersecurity and Infrastructure Security Agency (CISA) on a pilot project that tests the capacity of a wargaming approach to improve security across SMM networks.

A fourth barrier is obtaining sufficient funding for manufacturing technologies, which are capital intensive, especially in the energy sector. Over the last few decades, national banking models have virtually eliminated the local banking relationships that used to sustain small manufacturers. Re-imagining financing support for SMMs is a crucial investment in our supply chain, underscored in this Listening Session with Startups in Critical Industries. The administration should therefore explore a range of options for financing advanced manufacturing equipment and technologies: a more robust tax credit for manufacturing competitiveness or advanced manufacturing equipment investments; a U.S. Treasury “Made in America” bonds program reminiscent of 1940’s Series E
war bonds that enables citizens to support key industries they believe in (e.g., climate-tech, microelectronics, bioeconomy etc.) with low-cost patient capital; or a banking function, perhaps building on the U.S. EXIM Bank’s existing authority or through incentivized private lenders. The Industrial Finance Corporation Act of 2021 is an important long-term opportunity to coordinate financial support for SMM’s, while turning the government a profit on taxpayer dollars. A more immediate, novel approach may be for the U.S. Treasury to encourage states to use portions of the American Rescue Plan Act’s $10 billion allocation to the State Small Business Credit Initiative (SSBCI) to support SMMs with low-interest loans and seed funding, generating a local abundance of solutions for priority sectors. Regardless of the path forward, decision-makers should explore the range of comparable programs that exist in peer and competitor nations and U.S. states, such as Germany’s local community-controlled banks, the United Kingdom’s Business Bank and Patient Capital Program, and Massachusetts and Indiana’s state manufacturing capital equipment assistance programs.

**Action 2. Strategically Govern the Manufacturing USA Network**

For nearly a decade, the Institutes have operated within silos instead of functioning as a network, thereby foregoing the cost- and knowledge-sharing that could dramatically scale manufacturing processes. Enhanced collaboration between the Institutes would unlock new capabilities within the American manufacturing industry, but it will require a strategic approach that revisits foundational features of the Manufacturing USA network. This section provides an overview of a few of these critical changes, including how the Institutes are funded, how their specialties can be coordinated among one another, and how R&D agencies can better harmonize early-stage development with the Institutes’ later-stage deployment. The scale of coordination required for a revitalized advanced manufacturing strategy requires White House leadership.

Renewal of contracts for individual Institutes should be performance-based and rooted in transparent and fair evaluation processes. The DoD has commissioned the National Academies to design evaluation standards and metrics for adjudicating funding decisions. The Department of Energy (DOE) should exercise their authority for rigorous merit review of existing and new Institutes. Criteria for contract renewal could, for example, (1) assess the long-term continuing need for a given Institute in the context of emerging agency priorities; (2) evaluate the strengths and weakness of alternatives to the Institute (e.g., Federally Funded Research and Development Centers (FFRDCs), National Labs, or contractors); (3) examine the performance of the Institute in meeting agency priorities for technology, supply-chain, production, and workforce development; and (4) review trends in the annual operations and performance of the Institute.

The Institutes must also collaborate more closely with one another. Each Institute is currently organized around a particular technology area. But modern manufacturing firms need packages of technologies—additive manufacturing and robotics and digital production—to remain competitive. Achieving efficient technological integration will require work to ensure
interoperability as well as iterative testing and demonstration of new technology packages. **National Institute of Standards and Technology’s (NIST) Office of Advanced Manufacturing (OAM) should convene Institute-sponsoring agencies and an executive panel of Institute directors** to establish a new Manufacturing USA program element devoted to combining Institute technology advances and distributing packages of combined technologies to firms. One related instantiation of this would be to create a **Dual-institute Center for current Good Manufacturing Practice (CcGMP)** between the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) and BioFabUS to ensure the latest biomanufacturing technologies are sufficiently de-risked and commercialized.

Relatedly, harnessing the economic benefits of investments in R&D for AI, high-performance computing, and other manufacturing-related technology areas requires the work of R&D agencies to be connected to follow-on work at the Institutes. Unfortunately, this is not the case today. R&D agencies focus on early-stage research while Institutes separately focus on later-stage development. The National Science Foundation’s (NSF) Directorate for Technology, Innovation, and Partnerships is an important start for coordinating the nation’s R&D ecosystem. However, the **White House Office of Science and Technology Policy (OSTP) should develop common technology-development roadmaps for R&D agencies, Institutes, and Manufacturing USA industry members to follow.**

We as a nation must also address the dearth of data tracking manufacturing performance, especially data tracking production advances made by competitor nations. It took our country’s leadership years to understand how Japan’s quality production system enabled that country’s firms to capture automotive and consumer electronics markets in the 1970s and 1980s. Yet we did not learn from our mistake: we still know very little, for instance, about the regional scale-ups system in China. **NIST, with support from the International Trade Administration (ITA) and other information agencies within the Department of Commerce, should create a new manufacturing traded sector analysis unit** (ITIF, 2021) to evaluate the state of U.S. manufacturing competitiveness. This should include analyses of key U.S. producers and suppliers, global market competitors, and global production trends, as well as development of measures for tracking manufacturing performance.

Finally, the lack of intra-Institute and interagency coordination—coupled with the importance of forward-looking market-competition analysis—underscore the need for dedicated White House leadership in designing a more comprehensive advanced-manufacturing strategy for the nation. **Consistent with pending legislation, the administration should create an Advanced Manufacturing Office (AMO) within the National Economic Council** equipped with adequate staff and budget to coordinate the numerous manufacturing-related programs within the Manufacturing USA network and across the federal agencies. One possible priority area for the AMO would be to explore new intellectual property (IP) frameworks to generate regional
economic benefits and better incentivize partnerships with academia and industry. The IP frameworks of the Fraunhofer Institutes provide a model that the AMO could build on.

**Action 3. Prioritize Institute Focus on Heterogeneous Semiconductor and Biotechnology Manufacturing**

Semiconductor and biotechnology manufacturing are two of the most important industries of the future, with broad economic ramifications across health care, clean energy, military systems and much more. Global chip revenues have doubled in importance over the last three decades, increasing from 0.25% to 0.5% of global GDP and 1.2% of U.S. GDP. The bioeconomy contributes an estimated 5.1% of GDP, a number that is also expected to dramatically increase in the near future. To ensure the United States maintains leadership in both of these sectors, the administration should:

- **Establish a new Institute devoted to the cutting edge of semiconductor manufacturing.** From breakthroughs in sensor technology to memory and storage capabilities, innovation in computing will depend on harnessing *heterogeneous computing*: the harmonization of specialized chips with different computing paradigms into larger systems. Accordingly, part of the $52 billion in proposed USICA funding for semiconductor manufacturing should establish an *Institute for Scalable Heterogeneous Computing* to provide a centralized coordinating function between early-stage agency research and manufacturing capacities. While progress made by large American firms on semiconductor manufacturing is promising, positive results are often proprietary to the firm in question and do not necessarily improve the broader innovation ecosystem for SMMs. A new Institute would ensure help capture the full scope of the broader R&D ecosystem by integrating, scaling, and standardizing the efforts of large private enterprises, SMMs, and DoD and DOE research on post-Moore computing (e.g., STARnet, Ncore, JUMP, E2CDA, ERI). This Institute would explore energy-efficient ways to integrate and package specialized chips, develop software to handle novel computing paradigms, assist with the development of physical design and verification tools for quality control, and help down-select computing technologies most likely to scale up from end to end.

- **Better coordinate work on the bioeconomy across existing Institutes, federal programs, and non-governmental partners.** Further progress in engineered biology requires a new class of manufacturing techniques and specialized workers. To reduce U.S. dependence on petroleum-based products, the OSTP and the National Security Council (NSC) should launch a four-year, $15 billion *National Bioeconomy Manufacturing and Innovation Initiative*. The joint initiative would first establish a National Bioeconomy Coordination Office within the White House to work with federal agencies on bioeconomy priorities. The initiative would then facilitate investments in cutting-edge R&D on genome
editing, DNA sequencing, and non-destructive measurement techniques to enhance our nation’s ability to control and manipulate biology. Additional R&D investments could catalyze the creation of foundational and publicly available tools for biological engineering, including standardized measurement techniques, design software, data-analysis pipelines, a national network of low-cost sequencing facilities and data repositories. The initiative would also spread innovation regionally through coordinating existing agency bioeconomy efforts and creating bioinnovation hubs, graduate and postgraduate training opportunities, and biomanufacturing training and reskilling programs.

There is a pressing need for large-scale, forward-looking investments in our nation’s manufacturing capacity. For too long we have offshored the benefits of American innovation. During COVID-19, local producers took it upon themselves to manufacture PPE and other needed goods. In the future, these networks should be activated and supported by the government. Similarly, we are just now beginning to appreciate the full strategic importance of providing SMMs with demonstration facilities, workforce training, and cybersecurity assistance. Unlocking our nation’s full advanced manufacturing potential will require support for SMM modernization. Finally, the broader advanced manufacturing ecosystem must be improved, a process that should be informed by a thorough understanding of our global manufacturing competitiveness. American can no longer afford to miss opportunities for Institutes to productively partner with R&D agencies and among themselves. The White House can and must facilitate the seamless integration of these moving parts into a cohesive national strategy for advanced manufacturing.
Pillar II: Targeted Public Investment

“Markets on their own will not make investments in technologies and in infrastructure that benefit an entire industry.”

—Brian Deese, Director of National Economic Council
June 23, 2021
**Section Overview**

Over the last few decades, industry has supported the lion’s share of American R&D and commercialization efforts, from world-leading electric vehicles and smartphones to novel artificial intelligence (AI) applications. But in this era of complex and intense global competition, a new approach is needed. Contrasting the U.S. approach is our rivalry partner, China, which employs multiple public and private levers to quickly mobilize capital around national priorities. While there are certainly drawbacks to China’s development strategy (expanded on below under Pillar III), their centralized model poses significant threats to U.S. competitiveness that must be addressed. China has already captured nearly 80% of the market for solar-panel manufacturing, and is now directing intensive support to development of next-gen semiconductors, information and communications equipment, new materials and energy sources, advances in biomedicine, aeronautic capabilities, and advanced-manufacturing technologies.

We have long been playing on the wrong field. Appreciating that an open, cross-border flow of information makes it easier to copy new discoveries, China has prioritized applied research to gain advantages in tech deployability and economic returns at global scale. America, meanwhile, has maintained its focus on basic pioneering research, despite clear evidence pointing to the bidirectional relationship between applied and fundamental research. The solar industry, for instance, has achieved price reductions through innovations in manufacturing rather than innovations in panel technology. The upshot is that it is high time for our nation to rethink how we invent. Fortunately, we are taking steps in the right direction. USICA’s support for advanced-manufacturing and regional technology hubs; NSF’s budget request for an Entrepreneurial Fellowships program and announcement of the Technology, Innovation, and Partnerships Directorate; the Economic Development Administration’s $1 billion “Build Back Better Regional Challenge,” the advent of new R&D model ideas like Advanced Research Projects Agencies (ARPAs) applied to labor, education, and health—all of these actions recognize the imperative of progress through production. Meanwhile, nascent models of R&D offer exciting opportunities to translate our country’s world-leading basic-research capabilities into scalable and regional economic activity.

Below are a set of recommendations for building on these efforts through targeted public investment into new technologies. These recommendations will harness new R&D models to achieve discrete goals in strategic sectors, ensure that American R&D outputs generate equitable economic growth, and unlock the innovative potential of every American.

**Harnessing New R&D Models**

DARPA, the first Advanced Research Projects Agency, was launched in 1958, achieving breakthroughs such as GPS-enabled precision strike capabilities, the invention of stealth technologies, and creation of the internet. In record time, DARPA met the moment of the Cold
War. Today, peer and rival competition demands a similar imagination of our nation’s R&D ecosystem. Our new approach should follow an “embedded autonomy” structure wherein the government describes outcome-oriented goals and measures progress while mission-driven organizations take disruptive risks for paradigm-shifting innovation.

An embedded-autonomy approach to space commercialization, for example, would coordinate government-funded, academic, and private-sector research on new capabilities to manufacture, assemble, and service spacecraft in space. With an investment of $100 million per year, the National Aeronautics and Space administration (NASA) and DoD could create a public-private consortium known as the Advanced Space Architectures Program (ASAP). ASAP would mitigate existing research redundancies and unlock new strategic capabilities, from constructing large structures otherwise impossible to launch from Earth to converting low-cost launch vehicles into persistent platforms or fuel depots.

At the cutting edge of embedded autonomy are the ARPA programs, like DARPA, ARPA-Energy (ARPA-E), the Intelligence Advanced Research Projects Agency (IARPA), and most recently the ARPA-Health. Characterized by clear and mission-driven direction, flexible hiring authorities, and deeply experienced personnel who can navigate bureaucratic red tape, ARPA programs have shattered technical and institutional barriers to develop groundbreaking capabilities. Agencies should embrace ARPA-like models to harness force multipliers of advanced computing, AI, and synthetic biology. An ARPA-Labor, for example, could catalyze high-impact R&D focused on creating powerful, scalable approaches to pressing workforce issues including unemployment and market disruption. Broadly speaking, some of the key elements to successfully beginning an ARPA program can be found in our “How to ARPA” roadmap, developed by former DARPA Director Arati Prabhakar.

An exciting and even newer model of embedded-autonomy programs are Focused Research Organizations (FROs), which provide an agile mechanism to support fundamental research into moonshot ideas and scalable execution in strategic sectors. Just as DeepMind Strike Teams overcame decades of stagnant industry and academic efforts to “solve” protein folding prediction, FROs would operate as fast-moving, tight-knit, and goal-oriented entities that focus on new technologies, systems, or processes that can reduce cost or increase speed and reliability of subsequent work. Unlike conventional academic institutions, FROs would enable a nimble approach to strategic competition. By incentivizing collaboration among cross-disciplinary teams of scientists, professional engineers, and developers, FROs aim to achieve discrete goals over a five-year-or-less timescale for different strategic sectors. For example, an FRO might focus on developing neuro-immune therapeutics that can vaccinate individuals against PTSD, or cracking the bioelectric code to regenerate lost or wounded limbs, or designing scalable and efficient desalination systems for drinkable water everywhere. The FRO concept aligns with a recommendation from the NSF Workshop on a National Networks of Research Institutes (NNRI)
to embrace a “CEO-led” model for new agency R&D efforts. A test vehicle for exploring FROs can be found in NSF’s recent budget request for Regional Innovation Accelerators, which are focused on use-inspired, solutions-oriented research in key challenge areas of climate change, quantum information science, AI, and biotechnology.

Investing in the Invention Ecosystem

ARPA and FRO models can direct federally funded R&D towards application-oriented end products with massive real-world benefits. But the broader system of innovation is in dire need of public support. Since public-sector R&D began declining in the 1970s, the rate of scientific discovery per dollar spent and multifactor productivity growth based on new ideas have both stagnated. Our schools, higher education institutions, and national labs have been producing two pools of stranded assets: nascent technology concepts and world-class scientific talent.

One reason for this is that researchers within the broader American scientific enterprise also need support in shepherding inventions from the lab to the marketplace. Currently, scientist entrepreneurs who fail to secure startup funding must rely on academic research grants that prioritize established researchers and incremental progress over exploring and commercializing novel concepts. Another reason is that, for every scientist denied the opportunity to commercialize their idea, there are countless others who have been denied meaningful access to the American scientific enterprise in the first place. With children born to the richest 1% of American society ten times more likely to be inventors than those born to the bottom 50%, it is dismayingly to contemplate the thousands upon thousands of “Lost Einsteins” our nation has failed to recognize. A moral imperative alone should motivate us to close the access gap for women, minorities, and children from low-income families—but success on this front would also quadruple innovation in the United States.

In our report for the Lemelson Foundation on “The Invention Ecosystem: A Pathway to Economic Resilience and Inclusive Prosperity,” we argue that this challenge will require a comprehensive approach that conceives of the problem along two dimensions. The first is the innovation pathway, which empowers inventors and entrepreneurs to create value from their ideas in the form of products and businesses. The second is the inventor pathway, which should seek to inspire and prepare students to address crucial challenges and thrive in the innovation economy. Below we highlight build on the recommendations outlined in the report with several ideas to invest in our nation’s “Invention Ecosystem”:

Action 1: Creating an Innovation Pathway for Scientists and Critical Industries

- Empowering our nation’s scientific-entrepreneurial talent could unleash a new wave of scientific commercialization. Over 40,000 new science and engineering Ph.D. students graduate each year, many of whom are full of innovative ideas but lack the entrepreneurial knowledge needed for succeeding in the marketplace. Using the prestigious American
Association for the Advancement of Science (AAAS) Science and Technology Policy Fellowships as a template, a National Fellowship for Entrepreneurial Scientists and Engineers could be the first federal program geared specifically for transitioning early-stage research to commercial enterprise. These paid, two-year fellowships would provide scientists and engineers time to become familiar with commercialization processes, immersive entrepreneurial training, and connections to experts across government, industry, and finance. We therefore strongly applaud the NSF FY22 budget request for “Entrepreneurial Fellowships”.

- Even those working in strategically critical sectors are struggling to find funding given venture-capital firms’ nearly unshakable affinity for software startups. One example is “DeepTech,” where companies build science-based products and services in fields with transformational potential, including AI, quantum computing, and bioinformatics. Progress in DeepTech sectors is required to address some of the administration’s most pressing policy priorities. By funding venture-capital firms that invest in DeepTech, the federal government can support early-stage companies and assuage the risk-based doubts of private investors.

Action 2: Take a Solutions-Based R&D Approach to the Inventor Pathway

- More than 30% of American K-12 students remain below basic competency levels in math and science, and less than 5% ever reach Advanced levels. Shortcomings in our nation’s educational system when it comes to science, technology, engineering, and math (STEM) are disproportionately felt by communities on the margins. Yet we are doing far less to understand the scope and nature of these shortcomings—and to identify the most promising remedies—than we should. While federal agencies like the U.S. Department of Agriculture (USDA) enjoy multi-billion dollar research budgets, the Department of Education’s (ED) R&D budget has declined from a mere $342 million to an even paltrier $313 million over the past decade. We need a serious course-correction. One avenue is to double the R&D capacity at the Institute of Education Sciences (IES). With this increased capacity, the IES could support an ARPA-like Transformative Research Program (TRP) to revolutionize our nation’s educational landscape by developing breakthrough solutions at scale in partnership with industry, universities, and other organizations on high-risk, high-reward projects. These could include automating feedback on students’ math and writing homework through natural language processing, improving kindergarten readiness gap by rapidly assessing emerging reading gaps and dyslexia, or utilizing AI-based digital tutors to fill language and skill-learning gaps with responsive teaching methods.

- Relatedly, a large source of educational inequities stems from poor data on how students learn and what strategies and technologies for improving learning are best. An initial investment of $50 million could fix this gap for the long term by augmenting the Statewide
Longitudinal Data System (SLDS) with industry-grade, cloud-based technologies and interoperable data platforms capable of tracking—on a sustained basis—outcomes from K–12 educational investments. For more immediate assessments that inform follow-on R&D, a Learning Observatory at IES could be created to track and publish near-live data on how students are progressing under a given program or learning technique. Finally, to acquire, process, and harness this data and more, core funding should be provided to improve IES’ data science capabilities. A $25 million allocation could be directed at HBCUs and MSIs to build a cadre of skilled academic researchers who are “bilingual” across data-science and domain-specific challenges in education.

Every American has the potential to become the next Einstein. We should make smart, targeted investments to make sure that potential isn’t wasted. Finding novel R&D solutions to educational challenges will help us identify and solve learning gaps along the pathway to becoming an inventor. Similarly, from ARPA to FRO models, the United States has unparalleled capacity to innovate with a strategic blend of basic and applied research. However, more work is needed to bring this innovation to the market—and spread the benefits of innovation to every corner of America.
Pillar III: Public Procurement

“The federal government is the largest buyer in the world ... we need to think about how to leverage this purchasing power strategically to shape markets.”

—Brian Deese, Director of National Economic Council
June 23, 2021
**Section Overview**

Our nation’s hands-off approach to market innovation assumed the government would lead the funding, development, or support of tomorrow’s most critical technologies. But now, with private-sector R&D investments substantially outpacing government R&D spending, there is little guarantee of the United States achieving essential capabilities in nationally important technological areas, let alone at scale. Governments have grappled with this strategic uncertainty through varying degrees of hands-on involvement. China, for example, sends clear priority signals and targeted resources to its R&D ecosystem. In the defense context, China’s military-civil fusion (MCF) endeavor allocates nearly $70 billion to address the persistent disconnect between military-procurement and R&D ecosystems. But the “scientific” top-down direction of China’s national innovation ecosystem has proven difficult to actualize. MCF fund managers have drawn criticism for alleged “turmoil and greed”. It is also too early to assess the efficacy of China’s approach. Massive government investment may simply be wasted attracting entrants into overstimulated markets.

Fortunately, America need not direct the orchestra. Our nation understands that intensively guiding markets can be counterproductive—and that the most innovative technologies and products are often found on the experimental “edges” of industry, where individuals can take disruptive risks. A renewed commitment to innovation will require investing in emerging technologies and experimenting with new ways of activating industry to meet government needs. The administration can use both market-shaping mechanisms (MSMs) and regulatory guidance to stimulate richer, more creative, and productively competitive markets in key technology sectors.

**Market-Shaping Mechanisms**

Supply-side incentives, such as direct R&D funding, industry tax credits for R&D, and Small Business Innovation Research (SBIR) grants can and have steered innovation. However, the administration can complement these efforts with a suite of underutilized procurement strategies known as “demand-pull” or market-shaping mechanisms (MSMs). MSMs position the government as a buyer to correct market failures, spur entirely new industries, and/or generate spillover effects to boost other sectors. Half of projects supported by SBIR grants fail to reach commercialization because market demand is too small. MSMs help to create the demand. Over time, federal agencies using MSMs could create a “marketplace of outcomes”—a marketplace wherein agencies issue clear and succinct descriptions of problems to be solved and outcomes to be achieved; private-sector teams work to solve those problems, and investors back the teams most likely to be successful. While a range of MSMs are available—including volume guarantees, advanced purchase agreements, advanced market commitments, milestone payments, and prizes or challenge-based acquisitions—we focus on the latter three below.
In an **advanced market commitment (AMC)**, the government places an open call to the private sector to purchase a certain quantity of a specified technology. Rather than picking winners and losers, AMCs communicate to the R&D ecosystem by setting a desired target amount or technology and then letting companies freely compete to win the AMC. AMCs for a pneumococcal vaccine resulted in the **immunization of 150 million children and saved the lives of 700,000 people**. AMCs also enabled Operation Warp Speed to negotiate agreements with multiple companies to purchase millions of doses of COVID-19 vaccines should they meet FDA approval. But AMCs are not a silver bullet. To work efficiently, AMCs must have a target end goal (e.g., a number of vaccines to be produced) and be used when there is a range of competitors available and strong rationale for government involvement (e.g., when there is an obvious market failure or nationally strategic need). Examples of sectors where AMCs could be useful include:

- **Microelectronics.** Robust domestic manufacturing capabilities are of the utmost strategic importance, but it is currently much cheaper to outsource fabrication of microelectronics because of the economies of scale that established semiconductor manufacturing companies have. An AMC could set technical specifications on desired microelectronic chips, thereby providing the direction and incentives needed to bolster U.S. commercial fabrication facilities.

- **Biomanufacturing.** Certain biomolecules are critical to the biotechnology supply chain but are costly and risky to purchase. A Biomedical Advanced Research and Development Authority (BARDA) AMC could be launched to organize large-scale procurement of critical biomolecules for low-cost use in key sectors of the bioeconomy.

- **Quantum computing.** Quantum computing is a national security priority, but it is also a nascent, unproven technology without a well-developed market or a near-term commercial use-case. An AMC delineating clear milestones based on NIST’s quantum-computing benchmarks would drive commercialization of certain QIS systems.

- **Autonomy and robotics.** The United States lags China, Japan, and South Korea in the deployment of robotic systems. An AMC could be launched to direct software and hardware efforts towards government priorities by providing specifications for needed autonomous systems.

- **Additive manufacturing.** Additive manufacturing is crucial to U.S. competitiveness, yet companies cite costs of additive-manufacturing equipment as the top challenge for adoption. DoD could launch an AMC identifying equipment specifications for advanced additive manufacturing among a variety of use cases in order to bring down prices.

- **Energy storage.** DOE’s Energy Storage Grand Challenge Roadmap aims to domestically manufacture energy storage technologies for all of U.S. market demand by 2030, with specific target goals already listed (e.g., $80/kWh manufactured cost for a battery pack to power a 300-mile-range electric vehicle by the year 2030). An AMC aligned with this
roadmap could advance progress by harnessing market competition to cut operational and manufacturing costs.

**Milestone-based payments** reward innovators for intermediate progress towards a specific goal. The best recent example of this is NASA’s partnership with SpaceX. Structured as a series of payments once development milestones were met for the Falcon9 rocket delivery of cargo and astronauts in space, the SpaceX partnership reduced U.S. dependence on Russian rockets to send resources and people to the International Space Station (ISS). For an investment of roughly $400 million, NASA gained access to a capability that would have cost them $1.7 billion to $4 billion using a “business as usual” approach. The SpaceX partnership has also propelled our nation to a leadership position in commercial launch services. The United States had 0% of the global commercial-launch market in 2010, but SpaceX had captured 65% of that market by 2018. This idea could be expanded but would require regulatory fixes. The Federal Acquisition Regulation (FAR) specifies that the executive branch only has authority to use contract financing when it is in the public interest (no financing is the first preference). The DoD’s **Performance Based Payments (PBP)** Guide similarly defines PBPs as *not* an incentive arrangement—though it may be acceptable to provide industry with an accelerated PBP payment schedule for innovative solutions. In general, milestone payments could shape markets, but policies need to clearly specify when and how such payments can be used and oversight mechanisms need to be established.

**Government prizes or challenge-based acquisitions** allow agencies to select solutions based on demonstrated capabilities as opposed to written proposals. While prize competitions are geared towards the demonstration of an ability, challenge-based acquisitions are a relatively new concept where the “prize” is the guaranteed government or industry purchase of the winning solution. The lines may also blur between the initiatives as the process matures. For example, one **Ansari XPrize competition** awarded a $10 million prize to a privately funded reliable, reusable spaceship able to carry three people into space (100 km above the Earth’s surface) two times within two weeks. Nearly 30 teams competed in the competition, investing a total of $100 million into finding a solution. The prize competition turned into an acquisition when the winner was licensed by Virgin Galactic—and the solution has become part of the commercial space-flight industry today. With every federal agency possessing the authority to support competitions of up to $50 million, challenge-based acquisitions could shape a variety of sectors if federal agencies were required to transition, or buy, a certain percentage of winning solutions. The acquisition itself would then de-risk follow-on development by sending a clear signal to industry of administration priorities.

These rewards and acquisition efforts could also creatively be used to shape global markets by setting the ethical baseline for the administration’s priorities. Consider the surveillance-technology industry. With advances in AI, video analytics, internet spyware, and more, crushing dissent is arguably easier now than ever before. In the last few years alone, demand for new-age surveillance technologies has skyrocketed, posing serious threats to the future of democracy and human rights.
President Biden has remarked on the dangers of the modern authoritarian, and surveillance technologies are the most important tools in their arsenal. Moreover, the market for surveillance technology is highly unregulated. There is little to no oversight of the misuse of surveillance technologies exported from China, Israel, the United Kingdom, the United States and elsewhere. The Israeli-based NSO group, for example, has supplied Saudi Arabia, Kazakhstan, and many other authoritarian customers with powerful surveillance software, including information on heads of state, government ministers, activists, journalists, and human rights defenders. But a surveillance technology prize competition, supported by DARPA’s Measuring the Information Control Environment, could induce a paradigm shift in the global export market for surveillance technology. This effort would call upon U.S. surveillance vendors to develop real-time software and hardware controls to monitor technology misuse and lock operations when and where needed. Along with award money, the “prize” could include a special class of export license authority. Eventually, the nascent features would become prerequisites for acquisition and conditions for export, setting the basis for multilateral agreements that hold companies accountable for the use of their technology.

Regulatory Guidance

Unclear regulatory guidance often inhibits innovation—or results in innovation that imposes serious social costs. The development of AI applications underscores this point. Without requirements for engineering or adjacent teams to evaluate the ramifications and biases of their technologies, ethical considerations within most AI firms have taken a backseat. The existing laissez-faire approach to AI is precisely the opposite of what is needed. AI applications are dynamically responsive to new training data and user feedback; hence even initially verified algorithms may not be immune to the emergence of underlying or new forms of bias that reduce the fidelity of procured systems post-acquisition. With the U.S. government poised to become the largest single customer of AI, we have a strategic and ethical imperative to shape the AI market. Creating a National Framework for AI Procurement could ensure the performance, security and ethicality of publicly acquired AI tools, and could encourage adoption of similar standards by state and local governments. In addition, the Office of Federal Procurement Policy (OFPP) and OSTP could coordinate the range of ongoing interagency AI vetting efforts to ensure consistent evaluation criteria. At a minimum, evaluation of an AI application should include an analysis of the model architecture, use cases, data types, and developer team profiles prior to acquisition.

Another approach would be to target specific applications of AI, such as its use in surveillance in the United States. These digital-surveillance techniques pose severe implications for equity, justice, and liberty. And yet the industry is widely described as the “wild west”, free of accountability or transparency. At a minimum, the OFPP should amend the Federal Acquisition Regulation to require that federally procured surveillance technologies receive approval under NIST’s face-recognition vendor test. A more fundamental, holistic, and long-term approach would be to create a Digital Surveillance Oversight Committee (DSOC) to certify all surveillance
technologies prior to acquisition, based on meaningful involvement from historically surveilled communities, law-enforcement officials, and retired industry experts. This would create a class of approved and unapproved surveillance technologies, establishing *de facto* standards for state and local government entities acquiring these technologies.

China’s market-oriented, government-guided model appreciates the strategic importance of communicating national priorities to the R&D ecosystem. Such communication is equally important in our own country, where industry supports the bulk of innovation, but need not be as prescriptive. Playing to our strengths in this competitive environment will require embracing previously underutilized market shaping techniques. Advanced market commitments, milestone-based payments, prizes or challenge-based acquisitions, and regulatory guidance can communicate foundational national priorities while simultaneously incentivizing industry to compete to achieve them.
Pillar IV: Climate Resilience

“We need an industrial base that is resilient to the increasing reality of a climate-affected world. That requires a fundamental shift in how we produce and how we power the economy.”

—Brian Deese, Director of National Economic Council
June 23, 2021
Section Overview

Nowhere are market failures more stark or urgent than in the climate innovation ecosystem. The tried-and-true playbooks—lean teams, rapid prototyping, agile development—of direct-to-consumer companies or software startups are poorly suited to climate-tech startups, which to succeed must often integrate into existing value chains dominated by incumbents rather than trying to disrupt those value chains. Moreover, successful development and launch of climate tech requires significant up-front capital and risk. These obstacles discourage investors from pursuing climate innovation. The resulting dearth of success stories creates a vicious cycle that drives investors even further away from the climate space, despite significant potential to generate both profit and societal benefit.

However, in the last several months, the Administration has taken a series of actions that deserve celebration. We’d like to recognize and build on three key efforts to support the climate innovation ecosystem:

- The President’s plan to drive American leadership forward on clean cars and trucks will support domestic manufacturers and elevate American innovation and ingenuity worldwide. To further support the President’s related goal of tackling the climate crisis, we propose creating a nationwide network of zero-emission fueling stations to help transition the commercial truck and bus industries to cleaner fuels.

- The Administration’s new plan to promote the use of clean and sustainable fuels in the American aviation industry will go a long way toward mitigating harmful emissions — but why stop there? The United States could launch a comprehensive electrification of the entire aviation ecosystem to eliminate emissions and create jobs.

- The President’s pledge to expand and modernize the nation’s electrical grid demonstrates his ongoing commitment to supporting clean energy generation projects. We can further enhance his plan by coordinating federal and state entities to reduce electric grid regulatory barriers and creating a joint DOE-DoD Grid Resilience Innovation Demonstration (GRID) Network to rapidly deploy innovative and secure grid technologies.

Still, due to the expected pace of technological progress, some have recently suggested that the administration will fail to meet its grid-decarbonization and other goals within established timeframes. To ensure our nation overcomes the most monumental challenge of our time, the administration must act to remedy these market failures with financing and regulatory solutions that accelerate the deployment of key energy technologies.
Financing Solutions

A jolt to the clean grid initiative—and the broader climate effort—would be to finance clean energy innovation through a National Climate Bank. Consistent with pending legislation, the National Climate Bank would create 5.4 million jobs with $500 billion of private and public investment in clean energy and climate-related technologies prioritized to frontline and environmental-justice communities. A less widely-covered approach would be for the administration to support a legislative update to the Federal Thrift Savings Plan (TSP) to allow federal workers to redirect retirement funds away from fossil-fuel investments and towards the clean energy sector. Operationally, this would create a Climate Choice Index Fund in the TSP, potentially allocating billions of dollars to help address the climate crisis over generations. The administration could build momentum by requesting the Government Accountability Office (GAO) to examine the risk to federal workers’ retirement assets from extensive fossil fuel stock investments in the TSP. Alternatively, the administration could encourage the Federal Retirement Thrift Investment Board to act without Congress to provide federal workers an option to invest in individual “green” stocks by creating an option via mutual fund window.

Regulatory Solutions

A new policy regime is needed to bolster our nation’s capacity to rapidly and equitably generate and deploy climate technologies. However, one existing effort includes the Carbon Dioxide Removal (CDR) task force. With authority under the Energy Act of 2020, the CDR task force has a mandate to investigate the full extent of CO₂ removal and policy vehicles needed for net zero emissions by 2050. The administration should bolster the aims of the CDR task force by recommending an investigation into three more items:

- **Net-negative carbon removal targets:** The task force should estimate the amount of CO₂ the United States must remove to limit average global warming to 1.5°C (a target that will require net negative emissions) and estimate what year this goal could feasibly be achieved.

- **A public carbon removal service:** Just as waste disposal and sewage infrastructure are public services paid for by those that generate waste, industries should pay for the service of having their past and current CO₂ emissions removed and stored securely. The CDR task force should explore the build of a public carbon removal service, In parallel and in tandem with the Energy Act’s research, development, and demonstration program and prize competitions, the CDR task force should assess the CDR technology landscape to determine which are the best options to include in the service. Revenue generated from this service could fund additional reinvestments into CDR technology, carbon storage facilities, maintenance of CDR infrastructure, environmental justice initiatives, and job creation.
• **Tethering CDR efforts to equity**: The CDR task force should identify carbon removal strategies that will mitigate social inequities. Specific recommendations for the task force might include a tax credit for investing CDR on private land, with proceeds directed towards supporting environmental justice communities, on-the-ground interviews with relevant communities, and incentivizing CDR technology design with co-benefits to the host community, like shae, habitat, and urban heat-island effects.

This new climate policy regime should be cognizant of barriers to scaling nascent energy sources. One example is next-generation geothermal technologies, which could provide enough clean energy to power the planet for over a billion years. But the market has not developed, largely due to government regulations that restrict geothermal well construction or production on federal lands—where the shallowest, most essential resources exist. As a result, entrepreneurs must endure long timelines of intensive environmental assessments and approval processes before making progress on a venture. The same risks are ostensibly true for fossil fuel wells, however, regulatory hurdles were categorically excluded from environmental review by Section 390 of the Energy Policy Act of 2005. The administration should therefore ask Congress to *catalyze the geothermal transition by making the geothermal drilling approval process on Federal lands as simple as the oil and gas approval process.*

Regardless of the technology—CDR methods, geothermal energy, and another nascent solution—policy should direct climate innovation with a regional deployment mindset. As proposed by former Secretary of Energy Ernest Moniz in 2016, a **DOE-Led Regional Clean Energy Innovation Initiative** would establish clean energy ecosystems that fuse local- and state-level economic development goals with climate development goals. This would not only accelerate the adoption of clean energy technologies but also speed the pace of innovation. The initiative would draw on each region’s resource strengths—existing workforce, research capabilities through national labs or universities, energy resources, and manufacturing facilities—while creating “State Energy Ambassadors” to disseminate the best policy ideas in and out of the state.

In just several months, the administration has made important strides for tackling the climate crisis. But addressing the systemic market failure in the climate innovation ecosystem will require even bolder public policy and investments moves. The CDR task force represents an important existing vehicle to scope ideas that will guide the direction of policy and law towards systems-level procurement of climate innovation technologies—perhaps, if unlocked, even geothermal energy solutions. But sufficient policy and financing vehicles will be required to ensure that climate innovations cross the valley from lab discovery to commercialization and with a regional consciousness that unlocks our nation’s full potential.
Pillar V: Equity

“Fifth, and finally, equity must run through everything that we do. We must learn from our historical mistakes ... By doing it differently this time, we will enhance our economic competitiveness ... this is what it is going to take to build an economy from the bottom up and the middle out.

—Brian Deese, Director of National Economic Council
June 23, 2021
Section Overview

In a February letter our team wrote to OSTP Director Dr. Eric Lander, we offered a series of science and technology policy recommendations to address our nation’s racial, gender, and wealth inequalities. We wrote then:

For too long, the advances of science and technology (S&T) have reproduced and exacerbated inequities in American society, most notably severe racial and socioeconomic disparities. The administration can do more to promote equity, diversity, and justice across all of its S&T departments and agencies...Agencies can put words into action by actively bringing new voices to the table...As President Biden pursues an ambitious clean-energy agenda, the administration must prioritize clean-energy investments for low-income households and communities of color. The administration can also move to address the lasting, adverse effects that urban-renewal transportation policies of the 1960s continue to have on marginalized neighborhoods and communities.

Today, we reaffirm these sentiments, applaud your commitment to incorporating equity considerations into the heart of U.S. industrial policy, and have integrated several equity-focused actions into each of the above pillars. Below, we offer several additional proposals for an industrial policy of inclusive R&D, entrepreneurship, and infrastructure.

Regionally Inclusive Innovation

The administration could launch a national Place-Based Public-Private Partnerships for Innovation (P4I) Initiative to grow a network of American innovation zones (IZs) in deindustrialized and underserved communities. The IZs would weave together place-based investments with educational, research, entrepreneurship, and financial support to advance inclusive economic development. The P4I initiative would be led by an OSTP-convened interagency committee overseeing over $1 billion in annual investment over a 10-year period. This large-scale investment would create a network of IZs, generate a diverse and prepared labor force for sustainable innovation, and expand R&D programs to build innovation capacities via tax credits, grants, and more. Place-based innovation could also take place via a strategic, bottom-up national-challenge grant system funding “Regional Centers for Shared Prosperity” in order to accelerate startup creation, develop the next generation of talent, and provide alternative capitalization models. Initially funding the program to award six regional challenge grants of $25 million each is expected to yield at least a 3:1 return in private-dollar investments (for a total of $500 million) and create at least 21,000 jobs in underserved areas of the country.
Entrepreneurship for All

Regionally inclusive innovation would depend on a thriving small-business ecosystem to diversify offerings and distribute economic profits equally. However, minority entrepreneurs routinely face systemic barriers such as limited access to capital or isolation from key dealmaker networks. To create an inclusive entrepreneurial ecosystem, the administration should create the E-Corps, a four-year pilot of 1,000 small-business incubators backed by federal grants, training, and placement programs. With grant support from the Small Business Administration (SBA) Office of Investment and Innovation, the E-Corps would provide early-stage and minority-led small technology businesses with the networks, resources, and tools needed to better access outside capital and scale up businesses. SBA’s Office of Investment and Innovation could also support inclusive entrepreneurship through a public-private partnership for business-to-business (B2B) data sharing. Using temporary “data grants” in the form of fiduciary data pooling, API access, online directories, and federated data and learning, this data-sharing effort would level the playing field between startups and established, data-rich companies. The partnership would ensure that data providers would retain ownership over data assets while delegating operational responsibility to the government. Relatedly, the administration could also increase early exposure to relevant inventor role models and entrepreneurship programs for young people, by structuring SBIR programs toward first-time applicants, with an emphasis on women and minorities.

However, America’s greatest asset may be its ability to attract and retain the world’s most talented individuals. Half of our nation’s billion-dollar startups were founded by immigrants. But maintaining this high-skilled immigration pipeline has never been easy. In addition to overcoming a host of obstacles in their home countries, foreign-born entrepreneurs must endure a long, convoluted, and highly politicized immigration process in the United States. Unlike many other countries competing in the global battle for talent, the United States has no operationally active immigration pathway for attracting talented startup entrepreneurs. Therefore, the administration, U.S. Citizenship and Immigration Services (USCIS) and U.S. Customs and Border Protection (CBP) should reimplement, publicize, and issue guidance for the to implement the International Entrepreneurship Rule (IER) (Innovation Frontier Project, 2021).

Equity-powering Infrastructure

An innovation ecosystem and workforce are only as strong as the physical infrastructure that supports it. For too long, underserved communities across the country have felt the impacts of aging roads, buildings, and water systems, creating a wide-range of consequences that have disproportionately affected minority populations. These disparities have only exacerbated the ever increasing gaps in wealth and opportunity that exist between American workers, making it essential that our nation’s new industrial policy includes robust, equitable, and comprehensive investments in 21st-century infrastructure to create a level playing field and unleash stronger economic growth.
To start, the Administration can invest in *next-generation technologies that efficiently and effectively eradicate lead contamination in water lines*. Anywhere from 6 to 10 million residential lead service lines remain in use and are responsible for disastrous public health impacts that often impact low-income communities. These consequences are well-documented and devastating, with over *400,000 Americans* dying from lead poisoning each year and over *half of American children* under the age of six having detectable levels of lead in their blood. But lead is an instantiation of a broader issue with the American water ecosystem, which remains catastrophically out of date. In fact, the U.S. water sector—some 50,000 community systems and 16,000 sanitary sewer systems—only receives 4% of its funding from the federal government, *far below standard* for other critical infrastructure (e.g. highways at 25%, mass transit and rail at 23%, and aviation at 45%). Meanwhile, nearly *75% of federal funding* for the water sector supports primarily legacy water operations and maintenance systems, which, without any modernization, will require $1 trillion over the next two decades to sustain.

This is a life- and livelihood-costing market failure in need of a dedicated initiative to locate and promote the commercialization of key technologies, like the Federal High Administration’s *Every Day Counts* initiative. With the Department of Commerce as part of the new *Water Subcabinet*, there is an opportunity to launch a strategic national directive to support the innovation and manufacturing of water technologies. Through an expanded Manufacturing Extension Partnership, the administration could *create a joint Environmental Protection Agency (EPA)-NIST collaboration to identify, down-select, demonstrate, and commercialize the promising technologies*. While water policy would still primarily remain under the authority of the EPA, NIST could support the effort by evaluating key technology areas in AI, predictive analysis, advanced sensors, intelligent networks, cloud based data storage, and consumer focused communications and treatment products. By finally ensuring that the water we drink and the air we breathe are lead-free and sustainably equipped with the latest infrastructure, the U.S. will take a necessary first step towards supporting the diverse workforces of both today and tomorrow.

We must also invest in bringing modern digital infrastructure to the communities who need it most. The digital world is here to stay, but millions of Americans lack the high-speed, affordable internet necessary to learn or work from their own homes. To tackle this challenge, the American Jobs Plan (AJP) allocates $65 billion in spending—a large portion of which will flow through the National Telecommunications and Information Administration (NTIA) to states. To ensure that incumbent service providers are not *de facto* recipients of this funding, the *NTIA should evaluate a range of novel approaches to expanding affordable broadband services and inform state broadband offices of their recommendations*. More broadly, instituting new measures that make it easier for all Americans to understand where broadband is currently offered and at what price and speed will also *promote transparency and competition in the broadband market.*
Combined, these necessary, targeted investments in physical and digital infrastructure will lay the foundation needed to build an economy from the bottom up and the middle out.

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As you have emphasized in public remarks, our country needs a robust industrial strategy that reflects the demands of the twenty-first century. We believe that the ideas shared in this document can help achieve this ambitious task. The proposals highlighted above not only reflect lessons learned from past efforts: they also represent the voices of a diverse S&T community that is eager to step up and support you and your team. The Day One Project—and everyone involved in it—is devoted to helping America build back better than ever before.

Sincerely,

The Day One Project Team