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Introduction

Thank you, Chairwoman Murkowski, Ranking Member Manchin and members of the Committee for inviting me to discuss how we can all work together to drive innovation in a way that allows the U.S. economy and its citizens to capitalize on America's energy opportunity.

My name is Deborah Wince-Smith and I am the President and CEO of the Council on Competitiveness (Council). The Council is a non-partisan membership organization of 150 CEOs, university presidents, labor leaders and national laboratory directors founded in 1986 to develop the impactful policies and actions that will boost U.S. productivity, drive inclusive prosperity for every American and ensure the success of U.S. goods and services in the global marketplace.

The Council is led by a tremendous Board of Directors including our chairman, Dr. Mehmood Khan, the vice chairman and chief scientific officer of global research and development at PepsiCo, Inc., our industry vice chair, Mr. Brian Moynihan, the chairman of the board and Chief Executive Officer for Bank of America, our university vice chair Michael Crow, the president of Arizona State University, and our Chair Emeritus, Mr. Sam Allen, the CEO of Deere and Co.

This hearing comes at an important, possibly historic time for U.S. innovation.

Given the profound impact of science and technology on U.S. prosperity, standards of living, national security, modern society and geopolitical standing, every American should be concerned with the nation's ability to lead in science, technology and innovation.

With global competition accelerating and revolutionary technological advances unfolding, a dynamic cycle of creation, growth, disruption, decline and destruction will continue into the future as economies at home and abroad adapt to the changing landscape. There will be opportunities for new businesses, industries and jobs, but there will also be challenges for some people and communities as industries shift, labor markets are disrupted and jobs change.

We are witnessing the unfolding and rapid advancement of some of the greatest revolutions in science and technology in history: a new phase of the digital revolution

characterized by vast deployment of sensors, the Internet of Things, artificial intelligence (AI) and the big data tsunami; biotechnology and gene-editing; nanotechnology; and autonomous systems. Each of these technologies has numerous applications that cut across industry sectors, society and human activities. Each is revolutionary, each is game-changing in its own right. But they are now colliding and converging on the global economy and society simultaneously, with profound implications for U.S. economic and national security. These technologies are disrupting industries across the globe and altering the patterns of society and many dimensions of everyday life.

Looking specifically at the energy sector, it's clear we are moving toward a low carbon world. For countries and companies, the ability to leverage technological change for economic impact is fundamental to their competitiveness and economic success. In this "Sputnik Moment," the Council on Council on Competitiveness believes the United States must make much greater and more strategic use of science and technology, and that innovation must rise on the national economic agenda.

The Council has a long history in shaping America's policy agenda in a way that fosters innovation and competitiveness.

The Council on Competitiveness in the Energy Space

In pursuing the Council's mission, our distinctive, multi-stakeholder membership has consistently agreed on a key principle: energy is everything.

In 2006, the Council released its landmark private sector report, *Innovate America* that helped spur legislative action leading to the passage of the bipartisan America COMPETES Act two years later. *Innovate America* connected the dots between research and development, STEM education and 21st century infrastructure as the underpinnings to U.S. innovation leadership. The report also called out manufacturing and energy—access to energy, the sustainable production of energy and the deployment of a wide-range of energy resources to reinvigorate America's industrial base—as critical, "over-the-horizon" issues the nation would have to confront to ensure long-term national competitiveness.

But even as we began making the case in 2007 and 2008 that energy security, innovation and sustainability were the cornerstones of future competitiveness, the nation's—and the world's—energy landscape was changing radically.

By 2007, America's growing dependence on imports to meet energy needs had become a major factor in the trade deficit, accounting for over 45 percent of the total figure. Dependence on foreign oil translated into an outflow of $439 billion dollars annually, posing a serious challenge to U.S. national and economic security. At the same time, private sector and many state leaders were beginning to embrace the imperative for sustainability and looking for ways to transition to a low-carbon world.

To explore further this changing paradigm, the Council developed and leveraged a strong partnership with the Department of Energy that has spanned multiple

administrations, both Republican and Democratic, to launch in 2007 the Energy Security, Innovation and Sustainability Initiative. This strategic partnership recognized the critical linkages among security, innovation and sustainability and their profound impact on future U.S. productivity, standard of living and global market access. We forged consensus on an agenda for change that sought to underpin a smooth and timely energy systems transition and to ignite a brilliant new era of energy innovation, market success, job creation and productivity. A key overarching recommendation cited for the U.S. to develop and utilize all sources of energy sustainably and to level the playing field on subsidies and incentives.

Then, the landscape shifted again as the United States began a more earnest exploration toward low-carbon natural gas, coupled with the rapid expansion of renewable energy. Facing this new energy reality, the Council began in 2013 an effort to look at the economic opportunity at the intersection of energy and manufacturing. The American Energy & Manufacturing Competitiveness (AEMC) Partnership was a four-year partnership between the Council and the Department of Energy Office of Energy Efficiency and Renewable Energy to identify public-private partnerships and other actions that could enable America to build on this distinctive time in its energy history to dramatically increase its energy, manufacturing and economic competitiveness.

There have been many tangible outcomes from the AEMC Partnership's research agenda, four national summits and nearly 10 regional dialogues across the country. These outcomes include but are not limited to:

- Bolstering America's manufacturing competitiveness intelligence through the creation of the nation's first-ever "Clean Energy Manufacturing Analysis Center."
- Rebuilding America's shared manufacturing innovation infrastructure with nearly $1 billion invested publicly and privately during the AEMC's 4-year trajectory, including:
    - Five Department of Energy related National Network of Manufacturing Innovation Institutes;
    - Two new Manufacturing Development Facilities; and
    - A new Energy Materials Network.
- Unleashing national laboratories to advance manufacturing innovation by:
    - Proposing and helping to develop new, High Performance Computing for Energy, Manufacturing and Materials programs at the Department of Energy; and
    - Defining and launching a new Technologist in Residence Program for the national laboratory infrastructure.

A key part of this effort was a closely-related initiative undertaken with Secretary Moniz, who I'm honored to be joined by today on this panel, to create a policy and action roadmap to drive energy productivity across nine key industry sectors. *Accelerate Energy Productivity 2030*, created a viable plan to double U.S. energy productivity from 2010 levels by 2030.

In continuation of this effort to improve industrial energy use, the Council last year partnered with Third Way and the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) to release *Industry Matters.* The report laid out a number of clear, achievable pathways to saving energy, increasing competitiveness and cutting carbon in U.S. industry, including wider use of industry best practices, increased deployment of existing technologies and accelerated innovation of new technology solutions.

The most recent milestone in the Council's journey to drive competitiveness and prosperity was the October 2018 release of a policy agenda designed to turbocharge America's manufacturing capabilities, improve America's competitiveness and unleash a new wave of productivity, prosperity and resilience for all Americans. *Accelerate* included the critical findings and recommendations of the Energy and Manufacturing Competitiveness Partnership (EMCP)—a three-year effort led by a C-suite Steering Committee which brought together more than 300 experts and practitioners across nine dialogues to assess the economic opportunity at the nexus of energy and manufacturing.

Accelerate looked critically at the cross-section between energy and manufacturing, identifying challenges, opportunities and policy recommendations that impact America's prosperity, productivity and security.

America's Energy Opportunity

The EMCP posited that America finds itself facing a new, promising frontier shaped by two powerful transformations working in tandem. The first is a generational re-emergence of advanced and highly productive manufacturing capacity in the United States. This revolution in production is being driven by a number of technological developments. Virtual design through modeling and simulation using advanced computing, for example, will accelerate innovation and product development, while dramatically reducing costs and risks and allowing America to maintain its competitive edge in high performance computing capabilities. And 5G capabilities will revolutionize autonomy and connectivity, bringing the concepts of smart cities, driverless vehicles and smart factories to life.

The second major transformation occurring in the United States is an increasing abundance of innovative, sustainable, affordable and domestically-sourced energy. Coupled with increases in energy productivity and efficiency, this transition from scarcity to abundance has allowed for the decoupling of energy use from economic growth. In fact, since 2008, primary energy usage in the United States has shrunk 1.7 percent, even as GDP has accelerated by 15.3 percent. The ability to capitalize on these transformational shifts will be paramount for American competitiveness now and in the decades to come.

At the same time, though, the United States faces a number of challenges to its global leadership and its ability to capitalize on the energy opportunity. Much like roads, rail and power plants were essential for the Industrial Age, infrastructure that supports

knowledge creation and technology development is vital for the 21st century economy and U.S. success in innovation-based global competition. But, across the system, core scientific and technological capabilities are potentially at risk due to deficient and degrading infrastructure.

For example, the Department of Energy (DOE) has a vast portfolio of world-leading scientific infrastructure and production assets developed over the past 75 years, including 17 national laboratories. With a replacement plant value of more than $130 billion, the land, facilities and other assets that comprise this infrastructure represent some of America's premier assets for science, technology, innovation and security. This infrastructure must be maintained and upgraded.

Industrial consumption and a heavy reliance on shale gas has created growing pressure on the extraction infrastructure, driving the demand for alternative, clean sources of energy from renewables to nuclear. Yet, America's regulatory infrastructure is failing to keep pace with innovation as outdated policies often double the construction time of nuclear plants and offer investors only long-term returns on wind and solar investments.

As the United States continually advances and modernizes its energy systems, efficiency is sometimes prioritized over security, making grid and nuclear plant monitoring a significant concern. And, with nearly 90 percent of America's energy grid operated by private companies, the vulnerability of the grid to cyberattacks and operational disruption is a significant threat to productivity and livelihoods. Failure to comply with rules put in place to secure the electric grid—as in the recent case of Duke Energy, which is facing a record $10 million fine for numerous violations of regulations aimed at preventing physical and cyber-attacks—poses a serious risk to the security and reliability of America's electric grid.

In addition to these infrastructure and security concerns, the financial challenges across the spectrum from start-up to scale up are posing a serious threat to U.S. leadership in technological innovation—something first identified by the Council's 2011 report, *Make*, and highlighted by examples of companies such as A123, a high-flying U.S. battery start-up now owned by the Chinese. The U.S. must ensure access to long-term patient capital through mechanisms such as a clean energy bank that lies outside of the traditional venture model, which is ill-equipped to address the scale and scope of major energy projects. Added to that, America's lead in venture capital is shrinking, further diminishing its role as a driver of technology and innovation globally. In 1992, U.S. investors led 97 percent of the $2 billion in venture finance, and accounted for about three-quarters just a decade ago. However, in 2017, U.S. investors led 44 percent of a record $154 billion in venture finance, with Asian investors accounting for 40 percent. And federal investment in basic research and the absence of a coordinated, defined research agenda to guide insufficiently-funded research and development are limiting the potential for advancement in key sectors.

Underpinning these obstacles is a growing skills gap exacerbated by shifting workforce demographics. With the pace of innovation accelerating rapidly, the pressure to create a workforce with the skills needed to take on the jobs of the future is constantly mounting.

Automation—robots, machines, devices, sensors and software—is increasingly capable of doing routine tasks that have comprised millions of American jobs. About five million jobs in manufacturing were lost from 2001-2010, making room for new, higher-skill manufacturing jobs to take their places in a labor market that rewards well-educated workers who can perform non-routine work and complex tasks. But the reskilling of workers will be essential to meeting the ever-changing needs of the U.S. and the global marketplaces.

While all this is happening at home in the United States, global competition is ramping up as countries around the world realize the advantages of investing in a strong innovation ecosystem. While traditional U.S. competitors such as Germany, Japan, France and the U.K. continue to be strong R&D performers working at the leading edge of technology, many emerging economies seek to follow the path of the world's innovators and transform into knowledge-based economies whose economic growth is driven technology and innovation. Most notable for its rapidly strengthening position, China poses an especially formidable and growing strategic competitive challenge, having more than doubled its investment in R&D since 2010 and positioning itself to outpace the United States by the end of this decade. And leadership in clean energy is clearly a priority as evidenced by their efforts in areas such as solar.

As nations begin to recognize the advantages of investing in a strong innovation ecosystem, the United States must re-prioritize science and technology to remain a global leader.

Fostering U.S. Leadership in Energy Innovation

In response to these challenges, the Council developed, and put forth in *Accelerate*, a "call to action" to turbocharge the U.S. manufacturing renaissance in an era of energy abundance. *Accelerate* presents a road map for decision-makers and calls upon stakeholders across the economy to engage and leverage the seminal opportunity the current landscape has created and catalyze a new wave of productivity and prosperity.

Across its recommendations, *Accelerate* emphasizes the following key themes and specific recommendations:

1. The United States cannot compete globally without **establishing the next-generation physical, regulatory and financial infrastructure needed to support the nation's advanced energy and manufacturing enterprise.**

By shifting focus toward innovation, nuclear plants have been able to increase operating capacity from 60 percent to more than 90 percent in the last 30 years. Yet, a recent study by the Nuclear Energy Institute found that oil, gas, hydro, solar, wind and biomass received more than 90 percent of all economic incentives—tax policies, regulation, research and development, market activity, government services and disbursements—provided to the energy industry since 1950. By leveling the regulatory playing field, the United States can capitalize on the tremendous potential of nuclear energy—including advanced small modular reactors—to be a critical piece of a lower carbon energy

portfolio. Policymakers must also work to catalyze innovation in the utility sector by allowing utilities to recoup a percentage of investments in R&D through rate increases.

More broadly, the federal government must ensure states and other entities have the flexibility to propose and implement innovative regulatory models and explore new technologies needed to support the advanced energy and manufacturing enterprise. This means encouraging state and local governments to continue experimenting with new regulatory frameworks to test and evaluate the viability of disruptive technologies from autonomous vehicles to next-generation nuclear power.

With regard to physical infrastructure, we must break the cycle of incremental infrastructure improvements to spur creative and forward-looking approaches to the movement of goods, services and people. This means modernizing the electric grid and facilitating the interoperation of smart grid technologies in tandem with ensuring their cyber resilience.

2**. Federal investment in basic research at a minimum of 1 percent of GDP** is essential to American competitiveness.

While the nation still leads the world in research and development spending, it now trails ten European and Asian countries in R&D spending per unit GDP. Since the early 1960s, federal support for R&D has declined from nearly 2 percent of GDP to 0.8 percent. R&D funding from the private sector has steadily increased over that same time frame, but the private sector, with shorter time horizons, places far less emphasis on basic research than the federal government. That pattern has grown stronger in recent decades. Between 2010 and 2016, U.S. basic research as a percent of GDP declined by 8 percent. Increasing investment in basic research is essential to building and maintaining a world-class innovation-based economy.

3. Ensuring **U.S. leadership in critical technologies** is not only an issue of competitiveness but an issue of national security.

Computing, big data and autonomous systems are converging in the field of AI. AI will be among the most disruptive technologies of the 21st century. It has been estimated that AI could contribute $15.7 trillion to global GDP by 2030. The nation that leads in AI—in its development, application and deployment—will lead a massive global transformation of the economy, society, national security and how we live our lives.

In order to remain competitive, the United States must also continue the quest to develop a capable exascale ecosystem with the ability to advance scientific discovery and strengthen national security. And leadership in quantum information science and our ability to apply this technology to grand challenges will be essential to improving America’s industrial base, creating jobs and ensuring economic and national security.

5G technology will offer higher speeds and lower latency making it one of the fastest, most robust technologies to date. 5G will enable more resilient critical infrastructure, technologies like state-of-the-art radar systems and cutting-edge communications on land and in space. It will unlock the door to innovations not yet conceived of. To

maintain America's competitive edge, we must accelerate our development and deployment of 5G.

Energy storage will be essential if the United States hopes to reliably provide the energy needed to power the technological landscape of today and tomorrow. Fossil fuels persist as an attractive fuel source due to their storage capacity at a volume 20 times higher than batteries and the increasing support of shale gas extraction infrastructure. Yet, the coal and gas-supported grid is foreseeably unreliable due to environmental instabilities and increasingly unattractive as international pressure to reduce our carbon footprint mounts. More funding for research and development of advanced materials can foster major technological breakthroughs in efficient fuel extraction, storage and deployment of sustainable energy solutions. Efforts such as the Joint Center for Energy Storage Research at Argonne National Laboratory are critical for identifying materials with the potential to revolutionize energy storage. Breakthroughs in this area will be necessary to fully reach the potential of electric cars and other modes of transportation.

We must capture the value of investments in research by supporting and accelerating the development of these and other advanced technologies in the United States. This will require increasing federal and state support for regional technology test beds, such as the Manufacturing USA institutes and Cyclotron Road at Lawrence Berkeley National Laboratory that incentivize technology transfer and partnerships between national laboratories, universities and businesses.

4. **Catalyzing the power and potential of the American worker** to thrive in an advanced manufacturing economy must be a fundamental priority as workforce demographics shift and the skills gap persists.

We need a workforce capable of succeeding in the hyper-connected, cross-disciplinary, advanced technology-based economy of the next decade. A number of steps are necessary to mitigating the challenge, including: growing the number and diversity of the STEM-educated workforce, establishing greater opportunities for experiential learning (e.g. co-ops and apprenticeships) and reforming rules to retain more skilled immigrants. Other critical steps include encouraging greater lifelong learning opportunities and re-establishing vocational education classes in K-12 that build a base for skilled trades.

5. **Securing U.S. energy critical infrastructure and next generation innovation is more important now than ever.** For this reason, the Council in 2018 launched a three-dialogue series on increasing the resilience of the nation's critical infrastructure, intellectual property and industrial operations against cyberattack. The final report, *Secure: Ensuring Resilience and Prosperity in a Digital Economy* puts forth a **National Agenda for Cybersecurity** with the power to secure and strengthen America's resilience to the growing cyber threat while ensuring the nation remains competitive, productive and prosperous.

Of the 16 critical infrastructure identified by the Department of Homeland Security, the energy sector is disproportionately targeted by cyberattacks. At the same time,

protecting our energy infrastructure from cyber threats is fundamental to U.S. economic and homeland security because of its crucial intersection with other critical infrastructures—from power and manufacturing to transportation and healthcare—that rely on energy to operate.

Building cybersecurity protections into new technology, requiring that all new technology applied to the electric grid meet widely-accepted security standards to build cyber resilience and protecting intellectual property on new energy innovations will be essential as the potential cost of cyberattacks escalates and the reliability of networks is increasingly called into question.

Another important measure in protecting America's critical technologies is requiring, under the new authorities of the Foreign Investment Risk Review Modernization Act (FIRRMA) in the National Defense Authorization Act for Fiscal Year 2019, that the Committee on Foreign Investment in the United States (CFIUS) conduct full reviews and regulatory approval for any foreign investment or ownership interest from hostile nations in American advanced startups, joint ventures or acquisitions. This applies not only to cybersecurity and energy but across the spectrum of technological innovation. These measures are necessary as countries like China target the U.S. start-up ecosystem in an effort to gain a competitive advantage.

Notwithstanding a currently robust economy, U.S. leadership in technology and long-term competitiveness are under threat. But the potential to succeed in the global economy is greater than ever before. This potential demands the urgent attention of our nation's leaders and a focused examination of our capabilities, investments and policies related to science, technology development and innovation. As the global landscape changes, the status quo is no longer sufficient if the United States hopes to maintain its leadership and capitalize on its bright energy future. A comprehensive strategy such as that put forward in *Accelerate* and similar reports by my colleagues on the panel will be essential if the U.S. hopes to achieve its full potential.

Conclusion

The United States is at a critical moment in time in national innovation systems research and action. New, transformational models driven by the democratization and self-organization of innovation are emerging and taking root across the nation. But, at the same time, U.S. leadership is under threat. The United States faces now what are perhaps existential challenges to its global leadership in innovation. America's role in technology advancement is diminishing globally—now accounting for only one-quarter of global research & development, down from two-thirds in 1960. Competitors are increasing their capacity for innovation. And rapid technological change and disruption have impacted the workforce and communities.

With these challenges in mind, the Council recently launched a **National Commission on Innovation & Competitiveness Frontiers** to double down on all efforts to optimize the nation for this new, unfolding innovation reality. Over the coming three years, the

Commission will assemble top minds from industry, academia, labor and the national laboratories to:

- Sharpen national, regional and local leaders' understanding of a dramatically changing innovation ecosystem, and provide them a prioritized policy recommendation Roadmap for the coming decade;
- Harness changes in the global innovation ecosystem and implement the Commission's recommendations to accelerate and sustain annual productivity growth at levels between 3.5 and 4 percent, and push U.S. living standards (GDP per capita) to the top of global rankings by the end of the decade; and
- Address, propose and potentially launch private, public and public-private solutions to specific national and global grand challenges—as defined by the Commission's work.

The Commission will build on the Council's intellectual capital in this space developed over the past thirty years. Organized around three critical competitiveness pillars—capitalizing on emergent and converging technologies; optimizing the environment for innovation systems; and exploring the future of production, sustainable resource consumption and the future of work—the Commission will acknowledge and respond to the urgency of the challenge at hand, understand and describe this new reality and position the nation to prosper and thrive with a clear set of recommendations that will enhance and expand the nation's innovation capacities at the heart of competitiveness.

More than any country in history, the United States has been the greatest driver and beneficiary of technology, innovation and a vibrant entrepreneurial spirit. We stand ready to work with you to set in place the policies needed to ignite a new era of competitive and sustainable growth and productivity.

Thank you.