Testimony of Spencer Nelson
Managing Director of Research and New Initiatives, ClearPath Action
U.S. House of Representatives Committee on Science, Space, and Technology
Unleashing American Power: The Development of Next-Generation Energy Infrastructure

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Good afternoon Chairman Williams, Ranking Member Bowman, and other Members of the Committee. My name is Spencer Nelson. I am the Managing Director of Research and New Initiatives at ClearPath Action, a 501(c)(4) organization that advocates for clean energy innovation, modernized permitting and regulatory reform, American manufacturing competitiveness, and unlocking America's natural resources.

Thank you for the opportunity to testify today and for holding today's hearing on these important draft bills on grid security, hydrogen, and pipelines, all of which are critical components of a cleaner and more secure American energy system. Energy innovation has been a fundamental driver of continued economic growth in the United States, along with improvements to the reliability, security, and affordability of our energy systems. Our country must continue to promote policies that support innovation in this critical space.

The House Science, Space, and Technology Committee has historically been in the driver's seat in propelling new clean energy technologies forward through investments in American ingenuity and research.

Today I will cover three key themes:

- Historical success — Investments in energy innovation that have led to lower energy costs;
- Today's landscape — Energy security in the U.S. will require more research and development for grid resilience, hydrogen energy and pipelines; and
- Future opportunities — Industrial decarbonization and carbon dioxide removal policies that could be priorities in the 118th Congress.

Innovation leads to lower energy costs

The United States is leading a global energy revolution, and this Committee has historically advanced policies to pursue the next frontier of energy innovation. American ingenuity has driven down the costs of natural gas, solar, wind, and battery storage over the last decade. These technologies each contribute to reducing emissions while providing affordable and reliable energy to the American consumer. Importantly, none of them would be as cost-effective today if it were not for investments made by the United States over the last 50 years.

The shale gas boom in America is a perfect example of successful public-private sector cooperation in energy innovation.

In the 1980s, Texas entrepreneur George Mitchell figured out how to break up shale rocks to release the natural gas stuck inside. This process, called hydraulic fracturing, initially got off the ground with support from DOE, which cost-shared R&D and demonstrations in the 1970s and 1990s, as well as tax credits from the 1980s to early 2000s.

These DOE projects included demos of hydraulic fracturing, horizontal drilling, 3-D seismic imaging, diamond-headed drill-bits, and, ultimately, combined-cycle natural gas turbines. All of these innovations combined now produce lower cost natural gas, providing affordable and reliable power for the U.S. grid. Both that early-stage investment and the unconventional oil production tax credit, together more than $10B, expired as the technology matured.

Now we have a $100 billion annual shale gas market in America — not a bad return on DOE's initial investment.

The Department of Energy is running that playbook again, launching six new "Energy Earth Shots," with clear cost and performance goals to accelerate clean energy solutions. For example, in July of 2021, the Department announced the "Long Duration Storage Shot," an initiative to reduce the cost of grid-scale energy storage by 90 percent for systems that deliver 10+ hours of duration within the decade. That specific goal may sound familiar – it mimics the authorization proposed by this Committee when it enacted the Better Energy Storage Technologies Act (BEST) in the 116th Congress.

Collectively, the deployment of innovation-driven natural gas, solar, wind, and energy efficiency has led to a 40 percent reduction in power sector emissions in the U.S. in the last 15 years while our GDP has grown more than 60 percent.

Continued government investment in research and development of technological solutions is essential for decoupling emissions from economic prosperity. While the costs of mitigation have come down in the areas mentioned above, the rate of cost reduction is slowing. In order to meet emissions reduction goals, the world needs many more technological solutions by 2050 that are still too expensive to be commercially cost-effective. Technological innovation is a clear opportunity for bipartisanship where government investment is warranted. The U.S. is uniquely positioned to lead global action by creating jobs in new industries, reasserting America's global technology and resources leadership over Russia and China, and driving down global emissions.

Energy Act of 2020

As you know, given the instrumental role this Committee played in its enactment, one of the biggest advancements in clean energy and climate policy in over a decade is the monumental Energy Act of 2020. This law modernized and refocused DOE's research and development programs on the most pressing technology challenges — scaling up clean energy technologies like advanced nuclear, long-duration energy storage, carbon capture, and enhanced geothermal. Crucially, across all these technologies, DOE is now empowered to launch the most aggressive commercial-scale technology demonstration program in U.S. history.

The Energy Act:

- Sets up a moonshot of more than 20 full commercial-scale demos by the mid-2020s;
- Established ambitious goals for America to maintain global leadership and increase key clean energy program authorizations by an average of over 50 percent over the next five years;
- Reauthorized solar and wind, critical minerals, and grid modernization programs as well as the DOE's Office of Technology Transitions, ARPA-E, and more;
- Contained important tax credit extensions for clean energy technologies, like carbon capture through 45Q and other credits for new offshore wind developments; and
- Phased out hydrofluorocarbons, a potent greenhouse gas.

Many of these new programs were fully funded in the bipartisan Infrastructure Investment and Jobs Act (IIJA) enacted in 2021 and are now being implemented by the Department of Energy. Successful implementation of these moonshot technology demonstrations is a critical task and one that is currently underway for further advancing energy innovation.

23 of the research and demonstration DOE programs funded by IIJA have moved to the stage of a funding opportunity announcement. So far, DOE has awarded over $7.2 billion dollars in 37 specific demonstration projects, with over $55 billion remaining to be awarded.

CHIPS and Science Act

The bipartisan Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022 will also bolster U.S. competitiveness, innovation, and national security.

The package directed $280 billion in investment over the next 10 years, with the majority for scientific R&D and commercialization. Approximately $53 billion is for semiconductor manufacturing, R&D, and workforce development, with another $24 billion worth of tax credits for chip production. There is $3 billion for leading-edge technology and wireless supply chain programs.

This legislation also included the Steel Upgrading Partnerships and Emissions Reduction (SUPER) Act, which was marked up by this Committee. This bill established a first-of-a-kind, low-emissions steel manufacturing research program.

CHIPS and Science also provided $15 million through FY2027 to increase DOE coordination of technology transfer programs, including connecting the private sector with other DOE programs, information sharing, and creating metrics to measure the success of clean energy technology transfer programs. CHIPS and Science also comprehensively reauthorized the DOE Office of Science, which is critical for early-stage research. Taken together, CHIPS and Science and the

Energy Act set the stage for new investments that will improve energy affordability, cleanliness, and security.

R&D policies for Grid Security, Hydrogen, and Pipelines

Today, there are three important policies we're discussing that will advance essential parts of the United States energy system, and that were not fully addressed by the Energy Act or the CHIPS and Science Act.

Grid Security Research and Development

The power system in the United States consists of more than 7,000 power plants, 150,000 miles of high-voltage power lines, and millions of low-voltage power lines and distribution transformers, which connect 145 million customers.[1] This critical system must withstand both physical and cyber-attacks. Unfortunately, the volume and severity of potential threats only continue to grow.

The United States' electric grid is the country's most important and vulnerable infrastructure system. Today, the bulk of that system is over 40 years old. As electricity demand rises, new technologies reach the market, and as bad actors across the globe become more sophisticated and connected, the security of our grid is under constant strain.

According to a report from the Congressional Research Service:

> "Cybersecurity threats can arise from a number of sources, ranging from deliberate cyberattacks by nation-states to acts of malice from disgruntled current or former employees. They also can result from terrorists, industrial spies, organized crime groups, and other groups with hacking capabilities, such as hacktivists. However, some observers have asserted that while terrorists (who seek to damage the U.S. economy) may be able to buy the technical capacity for a cyberattack on the grid from hacktivists, they would be more likely to seek an attack causing direct physical destruction."[2]

A recent example of this was the two attacks on North Carolina substations earlier this winter.[3] Regardless of where threats originate and the form that they ultimately take, it is imperative that the nation's grid operators are prepared and equipped to handle all such liabilities.

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[1]https://www.forbes.com/sites/chuckbrooks/2023/02/15/3-alarming-threats-to-the-us-energy-grid--cyber-physical-and-existential-events/?sh=2852a752101a

[2] https://crsreports.congress.gov/product/pdf/R/R46959

[3]https://www.cbsnews.com/news/north-carolina-power-substation-damaged-apparent-gunfire-weeks-after-grid-attacks/

The Grid Security Research and Development discussion draft released today addresses the nation's need for cutting-edge research and development of technologies, processes, strategies, and plans for securing our nation's energy systems from cyber and physical attacks and extreme weather events. It supports American leadership in innovating new technologies, data structures and systems, and strategic plans that improve emergency response coordination through grant-based funding at DOE.

The proposed legislation also promotes demonstration and commercial uptake of these advancements through education and workforce development through the National Science Foundation and DOE, as well as technical assistance and vulnerability testing programs administered or funded by the DOE.

Additionally, it strengthens interagency coordination on energy sector cybersecurity initiatives through an update to the Roadmap to Secure Control Systems in the Energy Sector and Multi-Year Program Plan that aims to identify areas for interdisciplinary research, technology transfer, and new areas to grow cybersecurity capabilities.

Finally, this bill supports the competitive development of new testing facilities for Critical Energy Sector Infrastructure that will enable "scalable physical and cyber performance testing" that will be constructed and reviewed periodically by the DOE, Department of Defense, and Department of Homeland Security.

Clean Hydrogen Research and Development

New frontiers in energy innovation are quickly emerging. One crucial technology area is clean hydrogen. Under the right circumstances, clean hydrogen produced from renewables, nuclear, or fossil energy with CCS can play a key role in reducing industrial, transportation, and power sector emissions while strengthening our energy security. The Intergovernmental Panel on Climate Change (IPCC) agrees – in its 2022 report's modeling projections, all future low-carbon energy scenarios included a significant role for hydrogen.

Between funding for clean hydrogen hubs provided to the DOE in the IIJA and recent tax credits, a number of new, clean-hydrogen production facilities are being deployed. Earlier this month, as the result of a 2022 DOE award, Constellation's Nine Mile Point nuclear power plant, located in upstate NY in Rep. Tenney's district, started producing clean hydrogen on-site to replace its usual deliveries, and Constellation is prepared to expand production.[4] Additionally, late last year, Air Products announced the Louisiana Clean Energy Complex, a $4.5 billion clean hydrogen production project, which will permanently sequester over five million tons of carbon dioxide every year.[5] Investing in hydrogen technology today will present immense domestic and international opportunities.

[4]https://world-nuclear-news.org/Articles/Nine-Mile-Point-starts-supplying-hydrogen#:~:text=The%20Nine%20Mile%20Point%20Hydrogen,kilograms%20of%20hydrogen%20per%20day.
[5] https://www.airproducts.com/campaigns/la-blue-hydrogen-project

The DOE's hydrogen program was last fully authorized in the Energy Policy Act of 2005. Since then, DOE has modernized the program internally, including the launch of the H2@Scale initiative in 2018 during the Trump Administration, which focused efforts toward commercialization.[6] In 2021, the DOE announced the Hydrogen Shot goal, which calls for 1 kilogram of hydrogen to cost $1 within a decade.[7] DOE hydrogen programs were partially reauthorized in IIJA, but the provisions never went through regular order, and more can be done to improve statutory programs.

The Clean Hydrogen and Fuel Cell Research discussion draft would fully authorize hydrogen R&D programs for the first time in 15 years. The bill enables cost reduction by supporting the highest-value decarbonization pathways for hydrogen technologies. It also calls for a Hydrogen Innovation Center in the Office of Science to deploy analytical tools to predict the behavior of fundamental technology to reduce the cost of hands-on research activities. Additionally, the bill calls for research and development to reduce the amount of water necessary to produce hydrogen.

Next Generation Pipeline Research and Development

Pipelines are an essential part of the U.S. economy, transporting over $45 billion of gross domestic product in the United States in 2021.[8] The transportation of diverse products via pipelines not only avoids carbon dioxide emissions associated with trains or tanker trucks – that is a 42 percent decrease compared to rail – but studies have shown that pipelines have a much better safety record than these alternative forms of transportation.[9,10] There is a need for new R&D initiatives to ensure that both current and future pipelines are flexible, safe, and have minimal environmental impacts.

The Next Generation Pipelines Research and Development Draft is designed to improve public-private partnerships and increase federal RD&D related to the next generation of pipelines. It also develops a competitive DOE demonstration program to improve existing and future pipelines. The bill is robust, especially in terms of technology focus. It would fund RD&D on diverse fuels that could be transported by pipelines, including existing and future pipelines, and collaborate with the Department of Transportation (DOT) and the National institute of Standards and Technology (NIST).

The bill establishes:

1. A competitive DOE demonstration initiative for new technologies to enhance natural gas pipelines and associated infrastructure. The technology focus is broad, ranging from

[6] https://www.energy.gov/eere/fuelcells/h2scale
[7] https://www.energy.gov/eere/fuelcells/hydrogen-shot.
[8] FRED Economic Data
[9] Manhattan Institute's 2013 Issue Brief - Pipelines are Safest for Transportation of Oil and Gas and Fraser Research Bulletin's 2015 - Safety in the Transportation of Oil and Gas: Pipelines or Rail?.
[10] https://liquidenergypipelines.org/305561/Page/Show?ClassCode=Page&Slug=fact-sheets-and-infographics#WNP

advanced leak detection and mitigation tools/technologies to technologies that help repurpose existing pipelines.
2. A joint research and development program between DOE, DOT, and NIST to conduct basic research.
3. A National Pipeline Modernization Center, which will focus on commercializing cost-effective technologies and processes.

Altogether, these three bills accelerate energy innovation and recognize the important role of public-private partnerships to meet our challenging future energy and security needs.

Other Critical Topics for the 118th Congress

In addition to the three bills discussed, there are two areas where this Committee could consider additional legislation: one, innovations for heavy industrial processes like cement, concrete, and chemicals; and two, expanding the technologies available for carbon dioxide removal.

Industrial Sector Policy Opportunities

In 2020, emissions from industrial facilities were roughly as high as those from power plants, or 24 percent of all U.S. emissions.[11] For the very first time, industrial emissions were neck and neck with the power sector, and by 2030, industrial facilities could be the top source of U.S. emissions, exceeding those from power plants and vehicles.[12] Similar to the successful policies that have led to the power sector emissions reductions, there are opportunities for the industrial sector to make great strides in reducing emissions. If done right, these federal policies could be a win-win, increasing American manufacturing competitiveness and creating jobs here at home while positioning the United States to lead as one of the most carbon-efficient producers in the world.

To accomplish this, first and foremost the industrial sector needs more RD&D. There are already some recently enacted policies to build from, like the Clean Industrial Technology Act and the SUPER Act. When fully implemented, the SUPER Act will strengthen the competitiveness of American manufacturing by developing technologies to reduce emissions of conventional steelmaking, which will result in U.S. companies furthering their competitive advantage as other allies start prioritizing low-carbon steel.

Similar legislation could be adopted for the cement and concrete subsector. Globally, cement production makes up about eight percent of global carbon dioxide emissions — if the cement

[11] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions
[12] If there is a large expansion of carbon capture technology, it is possible that transportation remains the largest source of emissions in 2030.

industry were a country, it would be the third-largest emitter in the world.[13,14] Today's commercially available methods of manufacturing these building materials inherently produce carbon dioxide emissions, making decarbonization difficult without further technological innovation.

Since cement naturally releases carbon dioxide during the production process, its emissions cannot be eliminated through renewable energy. Carbon capture and new technologies will be required, and this Committee could consider developing new legislation on the topic. Legislation for this subsector could aim to expand RD&D in low-emissions approaches to manufacture cement and concrete and foster public-private partnerships to deploy competitive approaches.

Similar to how the U.S. scaled up natural gas and solar power, we can apply our talents to commercialize innovative technologies that will reduce industrial sector emissions, supporting a cleaner environment and stronger economy.

Carbon Dioxide Removal Policy Opportunities

Even with these exciting innovations, nearly all climate projections rely on some degree of carbon dioxide removal (CDR) to accelerate emissions reductions and offset residual emissions, like those from difficult-to-decarbonize sectors. In the long term, there will likely need to be removal of emissions already in the atmosphere to bring total emissions to net-negative. Globally, carbon removal could be more than 10 gigatons of carbon dioxide per year by 2050, with an additional removal capacity of up to 20 gigatons per year by 2100.[15]

There's more that can be done to expand on the great carbon removal efforts in the Energy Act of 2020. One bill that would do so is the Carbon Removal and Emissions Storage Technologies (CREST) Act, introduced last Congress by Representatives John Curtis (R-UT) and Scott Peters (D-CA). The CREST Act expands the scope of DOE's carbon removal and storage technology program to research and evaluate the feasibility of a diverse portfolio of CDR and storage pathways beyond its current strong focus on direct air capture technologies. The CREST Act includes both an expansion of R&D into new areas, as well as a competitive pilot reverse auction purchasing program to accelerate carbon removal market commercialization. It would increase the supply of promising CDR solutions necessary to greatly increase carbon removal from the atmosphere that can either be stored permanently underground or sequestered in products.

Conclusion

[13] https://static.clearpath.org/2022/03/cement-report-feb-2021-22.pdf
[14] https://www.economist.com/science-and-technology/how-cement-may-yet-help-slow-global-warming/21806083
[15] https://www.wri.org/initiatives/carbon-removal

This Committee has been at the forefront of Congressional efforts that have established America's leadership on clean energy innovation. You have an incredible record of bipartisanship, most recently marked by the enactment of the Energy Act of 2020 and the CHIPS and Science Act.

ClearPath Action greatly appreciates what this Committee has accomplished. We look forward to supporting your efforts in the months ahead, including these specific bills, and legislation in new areas such as industrial emissions reduction and carbon dioxide removal.

Thank you again for this opportunity, and I look forward to the discussion.