THE CHIPS AND SCIENCE ACT

Title VI: Miscellaneous Science and Technology Provisions

Subtitle B: National Science and Technology Strategy

The Federal R&D enterprise is spread across more than a dozen Federal agencies. The Office of Science and Technology Policy (OSTP) is charged with coordinating across all of those agencies and advising the President on cross-cutting S&T issues. Congress has tasked OSTP with developing cross-agency strategies on specific topics, such as artificial intelligence and climate change science. However, there is no existing requirement or practice of developing a comprehensive outlook and strategy for Federal investments in science and technology. Given the importance of the U.S. R&D enterprise, it is critical that we approach it strategically and holistically. By developing a cross-cutting strategy for Science & Technology, as is already done for national defense, homeland security, and energy, the U.S. can address emerging challenges and set priorities.

H.R. 3858 directs OSTP to complete a comprehensive quadrennial review that will provide an overview of the nation's innovation landscape and provide policymakers, industry, researchers, and other stakeholders with unbiased data and analysis to identify the future needs, barriers, and opportunities for U.S. science and technology.

It also directs OSTP to take this analysis and develop a national science and technology strategy to provide recommendations for maintaining global leadership in science and technology.

- This bipartisan bill passed favorably out of Committee in July 2021
- It is critical for policymakers, industry, researchers, and other stakeholders to have unbiased data and analysis to identify the future needs, barriers, and opportunities for U.S. science and technology.
- We must develop a national science and technology strategy to maintaining global leadership in science and technology.

THE CHIPS AND SCIENCE ACT

Subtitle C: Regional Innovation

The Regional Innovation Act of 2021 authorizes the Department of Commerce to create a regional innovation and technology hub program to be implemented throughout the next five years. This legislation would boost both U.S. competitiveness and shared prosperity from our advanced technology industries.

The Regional Innovation and Technology Hub Program will designate and support regional innovation centers across the country. The program will use a merit-based competitive process to bring together consortia consisting of local and state governments, universities, industry, labor organizations, and other groups to promote innovation and shared prosperity in a region. Each consortium will develop a regional plan to leverage their community, regional industry, and the unique capacity of their area with a vision to build and scale an Innovation and Technology Hub. Grants and cooperative agreements offered under the program can either be used to create regional innovation strategies or to implement those strategies. Implementation funds can be used for workforce, entrepreneurship, and technology development, as well as infrastructure-related activities to develop regions into innovation economies. This effort will support regional economic development and resilience, including in small cities and rural areas, and promote increased geographic diversity of innovation across the United States.

This program will also address access to quality STEM education, opportunity, and investment in economically disadvantaged communities, and sustaining regional partnership development in review of proposals. This effort supports a holistic investment in regional economies that will sustain technology and innovation hubs.

While the Department of Commerce program will have broad remit to bolster support for all types of innovation industries, this program will focus on boosting regional clean energy innovation capacity to meet our changing energy needs.

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Subtitle E: Coastal and Ocean Acidification Research and Innovation

The Coastal and Ocean Acidification Research and Innovation subtitle will:

- **Strengthen investments in ocean and coastal acidification research and monitoring in the context of other environmental stressors.** The provision reauthorizes the Federal Ocean Acidification Research and Monitoring Act funding for NOAA and the NSF through FY27. Authorization has lapsed since FY12.
- **Recognize the effects of ocean acidification on estuaries and integrate research, monitoring, and adaptation strategies for coastal acidification throughout the provision.** The provision expands the definition of ocean acidification to include estuaries and includes a definition of coastal acidification to recognize mechanisms that cause changes in coastal chemistry.
- **Increase our understanding of the socioeconomic effects of ocean acidification and coastal acidification.** The provision expands the Interagency Working Group's strategic research plan to also address socioeconomic effects of ocean and coastal acidification and assess adaptation and mitigation strategies.
- **Establish an Advisory Board to increase coordination among stakeholders.** The Advisory Board, comprised of members with a regional balance representing the shellfish, lobster, and crab industry, finfish industry, seafood processors, recreational fishing, academia, nongovernmental organizations, state, local, and Tribal governments, and regional coastal acidification networks, will advise the Interagency Working Group on ocean acidification and coastal acidification research and monitoring activities.
- **Establish an ocean acidification prize competition.** Federal agencies that are a part of the Interagency Working Group in this provision can carry out a prize competition related to ocean and coastal acidification. Any prize competitions shall stimulate innovation to advance research and response to ocean and coastal acidification.
- **Designate NOAA as the lead federal agency responsible for coordinating the federal response to ocean acidification and coastal acidification.** The provision directs NOAA to facilitate coordination of the monitoring and research efforts among federal agencies, manage the Ocean Acidification Information Exchange, and maintain an ocean acidification data archive system.
- **Provides for the long-term stewardship and standardization of data.** The provision directs NOAA to support an ocean acidification data archive system that collects and provides access to data from federally funded research, research from State and local agencies, data voluntarily submitted by Tribes or Tribal governments, academic and citizen scientists, and industry organizations on ocean acidification and coastal acidification. The system will incorporate existing global or national data assets currently maintained in Federal agencies and ensure that all data meets standards to support public findability, accessibility, interoperability, and reusability of such data.

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Subtitle G: Quantum Networking and Communications

While the United States leads the world in many aspects of quantum information science research and development, challenges remain to ensuring the U.S. remains competitive in this field. Quantum networking and communications is the area of quantum technology development for which the U.S. is most at risk of ceding its leadership. In addition to funding research in this area, the U.S. will need to prepare students for careers in quantum information science to meet the increasing demand for quantum workers.

The Quantum Network Infrastructure and Workforce Development Act builds upon the National Quantum Initiative Act to support quantum workforce development and strengthen Federal research efforts in quantum networking and communications technology. The legislation:

- Builds upon existing interagency initiatives to bolster quantum networking and communications research and standardization, including support for securing sensitive networks through post-quantum classical encryption.
- Requires a National Academies study of the educational challenges associated with creating a diverse, flexible, and sustainable quantum workforce.
- Promotes the integration of the principles of quantum mechanics and quantum initiative science into K-12 and higher education curricula, including through resources and training for K-12 educators.
- Establishes a quantum education pilot program to promote quantum information science workforce development across the nation.

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Subtitle I: Partnerships for Energy Security and Innovation

Representative Melanie Stansbury (D-NM) introduced **H.R. 4863, the Partnerships for Energy Security and Innovation Act** on July 30, 2021 on behalf of herself and Representative Young Kim (R-CA), Chairwoman Eddie Bernice Johnson (D-TX), Ranking Member Frank Lucas (R-OK), Representative Teresa Leger Fernandez (D-NM), and Representative Anthony Gonzalez (R-OH).

This subtitle directs the Secretary of Energy to establish a nonprofit corporation entitled the "Foundation for Energy Security and Innovation" (the Foundation). The purpose of the Foundation is to serve as a mechanism for fostering public-private partnerships that reinforces and advances the mission of the Department by:

- Supplementing Department-supported R&D with private sector funding;
- Facilitating the commercialization of energy technologies;
- Contributing to energy workforce development; and
- Enabling information exchange and the sharing of best practices between the Department and its external collaborators.

In realizing the purpose outlined above, the Foundation is authorized to carry out studies, competitions, projects, fellowships, and grants that support research, development, demonstration, or commercialization of energy and other Department-supported technologies. Funding would be awarded based on the technical and commercialization merits of the proposed project, and funded entities would be subject to a cost-share requirement. The subtitle authorizes the Foundation to work with the Department to leverage the technical capabilities and expertise of the National Laboratories to augment technology commercialization activities. The Foundation would also be able to support training and education programs relevant to its stated purpose, maturation funding to move a technology from the prototype stage to commercialization, and other stakeholder engagement activities. The Foundation would be required to provide support to and coordinate with National Laboratory-Associated Foundations.

The Foundation would be charged with meeting several oversight requirements, including the submission of a strategic plan and annual reports to relevant Congressional Committees. In addition, the Foundation would be subject to an evaluation by the Comptroller General of the United States and annual financial audits.

This introduced bill served as a counterpart to an amendment that passed as part of the Senate's *United States Innovation and Competition Act of 2021*. While H.R. 4863 was nearly identical to the Senate text, the conference version includes House language that would mandate the establishment of an intellectual property policy, foster efforts to broaden participation in energy technology R&D among historically underrepresented communities and regions, and strengthen guardrails between the Foundation and the Department's Office of Technology Transitions.

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Subtitle J: Energizing Technology Transfer

Rep. Ross (D-NC) introduced **H.R. 4606, the Energizing Technology Transfer Act** on July 21st on behalf of herself and Rep. Meijer (R-MI).

This subtitle authorizes a series of activities related to clean energy technology commercialization nationally and at the national laboratories, as well as reforms for DOE management and administration of demonstration projects and prize competitions, among other activities.

Part 1 of the subtitle authorizes a series of programs to enhance commercialization of clean energy technologies across the nation. This includes authorization of: $15 million annually for 5 years for a national clean energy technology incubator program; $1 million annually for 5 years for university prize competitions, and $3 million annually for 5 years for coordination of technology transfer programs and activities.

Part 2 of the subtitle would authorize programs to support the commercialization of technologies developed at the national laboratories and facilitate partnerships with the national laboratories. This includes authorizing a total of $3.7 million annually for 3 years for a Lab Partnering Service Pilot Program. It would also authorize: $25 million annually for five years for a program to bring entrepreneurial researchers into the national laboratories; $25 million annually for five years for a program to provide small businesses with greater access to national laboratory facilities and expertise; and entrepreneurial leave and consulting opportunities for national lab employees.

Part 3 of the subtitle authorizes programs to modernize activities at DOE pertaining to its management and funding of technology development, demonstration, and commercialization. This includes authorization of: $20 million for each of fiscal years 2023 through 2027 to carry out the authorized activities of DOE's Office of Technology Transitions; substantial oversight mechanisms for demonstration projects stewarded by the Department; extension of a cost-share waiver program for universities and non-profits by 2-years; special hiring authority; and consolidated and updated reporting requirements.

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Subtitle K: Micro Act

Representative Paul Tonko (D-NY) introduced **H.R. 6291, the Microelectronics Research for Energy Innovation Act (Micro Act)** on December 14, 2021 on behalf of himself and Representative Jake Ellzey (R-TX).

The Micro Act subtitle directs the Secretary of Energy to carry out a crosscutting initiative in microelectronics research, development, and demonstration (RD&D). This includes research activities aimed at driving progress in the scientific areas underpinning microelectronics, as well as a mechanism for supporting large-scale efforts focused on addressing specific challenges.

The impetus for this legislation lays in the need to authorize the Department of Energy's (DOE) role in the broader microelectronics RD&D enterprise. DOE's unique technical expertise and user facilities, as well as the external research community that engages regularly with the Department, render it well-positioned to accelerate transformational research in microelectronics that are essential to meeting future mission needs and bolstering the competitiveness of the domestic microelectronics industry. Research supported under the new initiative would leverage the Department's assets to focus on a broad array of topics including materials science, plasma sciences, fabrication, device architecture, energy efficient computing, and grid optimization, among many others. The subtitle also includes language intended to ensure funding awarded through this program aligns with the explicit scope of the legislation and does not duplicate microelectronics research activities funded elsewhere.

The subtitle also authorizes the establishment of up to four Microelectronics Science Research Centers (MSRCs). These large-scale centers would conduct mission-driven research to address foundational challenges in the design, development, and fabrication of microelectronics. The MSRCs would be multi-institutional endeavors involving National Laboratories, universities, and private sector partners, and will seek to advance high-impact research, facilitate technology transfer, and generate new intellectual property. They would also contribute to the future microelectronics workforce through student engagement, technical training programs, and public outreach.

The Micro Act complements the *Creating Helpful Incentives to Produce Semiconductors Act* (CHIPS Act). The CHIPS Act, which was enacted into law in late 2020, includes authorization of a new National Semiconductor Technology Center (NSTC) focused on research and prototyping of advanced semiconductor concepts in partnership with the private sector. The MSRCs mentioned above would accelerate early-stage research that could then feed into the NSTC, which would focus on more downstream technology development. The Micro Act includes language directing DOE to ensure that the MSRCs and the broader research program are coordinated with the NSTC and other research activities authorized in CHIPS, as well as other microelectronics research activities occurring both within and outside of the Federal Government, to prevent duplication of activities.

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Subtitle L: National Nuclear University Research Infrastructure Reinvestment

Rep. Gonzalez (R-OH) introduced the National Nuclear University Research Infrastructure Reinvestment Act of 2021 on July 29th. Original co-sponsors include Reps. Casten (D-IL), Meijer (R-MI), and Foster (D-IL). Chairwoman Johnson is also a co-sponsor of the bill.

The subtitle improves Department of Energy's nuclear energy university programs by ensuring adequate support for upgrades and revitalization of existing nuclear science and engineering infrastructure. This provision builds off of language and activities authorized in the Energy Act of 2020. The provision authorizes $55 million annually for five years for these activities.

This subtitle also directs the Secretary of Energy to carry out a subprogram to establish not more than four new research reactors, along with nuclear science and engineering facilities, to address research demand and infrastructure gaps. This subprogram supports nuclear energy workforce development by establishing or enhancing nuclear science and engineering capabilities at traditionally underrepresented institutions including historically Black colleges and universities, Tribal colleges or universities, minority-serving institutions, EPSCoR universities, and junior or community colleges. The provision authorizes a total of $390M over five years for these activities.

The subtitle also adds nontechnical nuclear research to the scope of the Department of Energy's University Nuclear Leadership Program, and increases authorization of appropriations for the program by $15M annually through 2025.

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Subtitle M: Steel Upgrading Partnerships and Emissions Reduction

Rep. Gonzalez (R-OH) introduced the "Steel Upgrading Partnerships and Emissions Reduction Act", or "SUPER Act of 2021", on July 21st on behalf of himself and Rep. Lamb (D-PA).

This provision directs the Secretary of Energy to establish a program of research, development, demonstration, and commercial application of advanced tools, technologies, and methods for low-emissions steel manufacturing in order to increase the competitiveness of U.S. industry and achieve significant reductions in emissions from both advanced and commercially available steelmaking processes.

The subtitle directs the Secretary, in carrying out this program, to focus on a range of key technology areas, including heat generation, carbon capture, smart manufacturing, resource efficiency, alternative materials, and high performance computing, and to leverage the research infrastructure of the Department as practicable. It requires the Secretary to carry out this work in coordination with relevant programs of the Department, other federal agencies including NIST, and with relevant programs and activities authorized in the Energy Act of 2020.

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Subtitle N: Applied Laboratories Infrastructure Restoration and Modernization

This subtitle authorizes $800 million in total funding for deferred maintenance, critical infrastructure needs, and modernization activities across seven National Laboratories for each of fiscal years 2023 through 2027. Various mechanisms and approaches may be used for carrying out these activities, including alternative financing arrangements that can significantly accelerate the completion and reduce the total cost of infrastructure projects by making funding more readily available up front.

Specific priorities include upgrades to research laboratories, administrative and support buildings, utilities, roads, power plants, and other critical infrastructure. In addition, this subtitle authorizes projects that would enable National Laboratory user facilities and computing capabilities to meet the specialized requirements of existing and emerging science missions, and to maintain safe, efficient, reliable, and environmentally responsible operations. The latter includes pilot projects to demonstrate net-zero emissions with resilient operations.

The subtitle specifies that the Department of Energy's seven applied laboratories are the intended recipients of this funding. This includes the National Renewable Energy Laboratory, National Energy Technology Laboratory, Idaho National Laboratory, Savannah River National Laboratory, Sandia National Laboratories, Los Alamos National Laboratory, and Lawrence Livermore National Laboratory. Infrastructure construction, restoration, and modernization projects for the National Laboratories stewarded by the Department's Office of Science are authorized in Title I.

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Subtitle O: Department of Energy Research, Development, and Demonstration Activities

This section authorizes $11,200,852,898 for research, development, and demonstration (RD&D) activities aligned with the 10 technology areas in the applied energy offices. This section authorizes appropriations for building technologies, sustainable transportation, advanced manufacturing, industrial emissions reduction technology, advanced materials, and renewable power (RD&D) within the Office of Energy Efficiency and Renewable Energy.

It also authorizes appropriations for grid modernization RD&D within the Office of Electricity. This section authorizes appropriations for advanced materials RD&D within the Office of Nuclear Energy. It also authorizes appropriations for RD&D carried out by the Office of Environmental Management, including relating to artificial intelligence and information technologies. This section also authorizes appropriations for clean industrial technologies, alternative fuels, and carbon removal RD&D within the Office of Fossil Energy and Carbon Management. In addition, it authorizes appropriations for the Advanced Research Projects Agency—Energy.

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Subtitle P: Fission for the Future

This provision directs the Secretary to establish a program to provide Federal financial assistance to eligible entities to support the research, development, and demonstration of advanced nuclear reactors. It also directs the Secretary to use a competitive, merit-based review process.

In carrying out this program, the Secretary shall prioritize projects that would be located in communities that have retired or retiring fossil fuel electric generation facilities, as well as projects that would support nonelectric applications, such as heating, hydrogen production, or industrial processes.

The provision authorizes $800,000,000 to be appropriated to the Secretary to carry out the program for the fiscal years 2023-2027.