COMMITTEE ON
SCIENCE, SPACE
AND TECHNOLOGY
CHAIRMAN FRANK LUCAS

FULL COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HEARING CHARTER

"Chips on the Table: A one year review of the CHIPS and Science Act"

Tuesday, September 19, 2023
10:00 a.m.
2318 Rayburn House Office Building

Purpose: On September 19, 2023, the Committee on Science, Space, and Technology will hold a full committee hearing titled "Chips on the Table: A one year review of the CHIPS and Science Act." The purpose of this hearing is to evaluate progress made by the Department of Commerce in implementing the semiconductor incentive, manufacturing, and research and development provisions of the CHIPS and Science Act. The success of this multi-billion-dollar investment in America's long-term economic and national security is critical to insulating the United States from unforeseen market volatility and adversarial nations. This hearing will inform current and future oversight and legislative efforts of the Science, Space, and Technology Committee.

Witnesses

- **The Honorable Gina M. Raimondo,** Secretary of Commerce, U.S. Department of Commerce

Overarching Questions

- Are CHIPS and Science programs being implemented quickly, effectively, and efficiently?
- Why is it important for the U.S. to maintain its competitive scientific advantage over adversarial nations, and how will the CHIPS and Science Act ensure U.S. leadership?
- What impediments or challenges to implementation have been identified, and what can Congress do to address those issues?
- What taxpayer protections are being implemented to safeguard investments in semiconductors and cutting-edge science?
- Will CHIPS and Science programs meet Congressional intent with regards to economic and national security?
- How is the Department working to ensure private enterprise, international partners, and the broader scientific community buy in to CHIPS and Science programs?
- Will the American workforce be ready to meet the labor demands of the CHIPS and Science act?

Background

Semiconductors, also called "chips," are tiny electronic devices (based primarily on silicon or germanium) composed of billions of components that can process, store, sense, and move data or signals. There are a number of types of semiconductor chips—including logic, memory, analog, optoelectronics, sensors, and discretes—each performing different functions and requiring specialized design and manufacturing processes. Semiconductors are a fundamental component of all electronic devices, enabling nearly everything in our modern lives – from communications, healthcare, transportation to military systems.

The United States has a long history of innovation in microelectronics. U.S. government investments in research led to the invention of early computers and transistors in the 1940s, as well as the first integrated circuit in the 1950s. Developments in semiconductor technology during the past 50 years have made electronic devices smaller, faster, and more reliable. First described by Gordon Moore, then R&D manager for Fairchild Semiconductor in 1965, Moore's law predicted that the number of transistors that can be cost-effectively included on an integrated circuit will double every 18 months to two years. This theory has held for decades, and today's microchips contain tens of billions of transistors, but are reaching their physical limits. As demand for chip complexity increases with new applications such as artificial intelligence (AI), 5G, and quantum computing, industry will need new fundamental breakthroughs in microelectronics.

Semiconductor production includes three segments: (1) design, (2) manufacturing/fabrication, and (3) assembly, testing, and packaging (ATP). In some cases, these steps are all performed by a single company, called an integrated device manufacturer (IDM). Other semiconductor companies, called fabless firms, only do design in-house. Fabless firms purchase fabrication services from a semiconductor factory and ATP services from an outsourced semiconductor assembly and test company. Additionally, the semiconductor production process requires several types of inputs, including materials, manufacturing equipment, software, and intellectual property, some of which is produced only outside of the United States. It should be noted that only a small number of fabs produce the most state-of-the-art semiconductors, and none of those are located in the United States.

Global Supply Chains and Disruptions

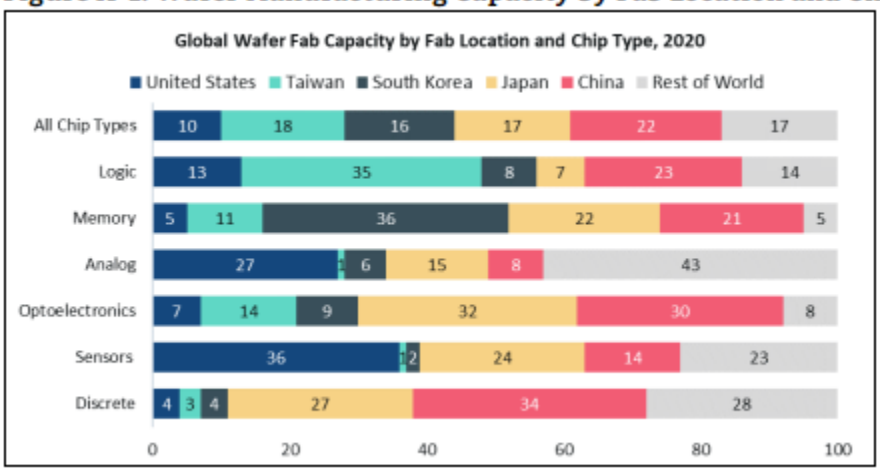
In 2020, semiconductor companies headquartered in the United States accounted for 47% of total sales worldwide,[1] and U.S. semiconductor equipment manufacturers lead the world in market share.[2] The U.S. also leads in semiconductor research and design, with the industry investing $50 billion in R&D in 2021 alone.[3] However, U.S. share of actual manufacturing output across all semiconductor types only sits at around 10% (see Figure A-1, below).

[1] Semiconductor Industry Association 2021 Factbook, 19 May 2021, available at https://www.semiconductors.org/wp-content/uploads/2021/05/2021-SIA-Factbook-May-19-FINAL.pdf

[2] Mordor Intelligence, Semiconductor Equipment Market Size & Share Analysis 0 Growth Trends & Forecasts (2023-2028), available at https://www.mordorintelligence.com/industry-reports/semiconductor-equipment-market

[3] Ryan C. Berg, Christopher Hernandez-Roy, Juliana Rubio, Rubi Bledsoe, and Henry Ziemer, Can North America Become a Semiconductor Powerhouse?, available at https://www.csis.org/analysis/can-north-america-become-semiconductor-powerhouse#:~:text=The%20United%20States%20continues%20to,Act%20further%20accelerating%20this%20trend.

Figure A-1. Wafer Manufacturing Capacity by Fab Location and Chip Type



Source: CRS, adapted from SEMI, *World Fab Forecast*, November 2020.

The COVID-19 pandemic and ensuing economic and social disruptions highlighted U.S. economic vulnerability to global events, but the shortage of semiconductors captured much of the attention of the nation. Because semiconductors are integral components in almost all industrial activity and fundamental to several emerging technologies, their performance and price affected multiple sectors and the broader U.S. economy, raising a number of strategic concerns for Congress, including:

- *The threat of a decline in the U.S. leadership in advanced semiconductor R&D and manufacturing and the potential rise of China's industrial and technological competitiveness.*[4]
  - These concerns relate to the extent to which U.S. industry has fallen behind industry in Taiwan and South Korea in advanced chip manufacturing capabilities[5], due in part to a movement of U.S. semiconductor firms to a fabless business model and the outsourcing of chip production to overseas foundries.[6]
  - For example, Taiwan Semiconductor Manufacturing Company (TSMC) is the world's largest contract chipmaker and produces around 90 percent of the world's leading-edge semiconductors that are used for AI and quantum computing applications.[7]
  - These concerns were also informed by a series of acquisitions by Chinese companies of semiconductor firms in the United States and in allied countries since 2014 that appeared to give China strategic capabilities.[8]

[4] Saif M. Khan, Alexander Mann, and Dahlia Peterson, The Semiconductor Supply Chain: Assessing National Competitiveness, January 2021, available at https://doi.org/10.51593/20190016

[5] Alex Williams and Hassan Khan, A Brief History of Semiconductors: How the US Cut Costs and Lost the Leading Edge, 20 March 2021, available at https://employamerica.medium.com/a-brief-history-of-semiconductors-how-the-us-cut-costs-and-lost-the-leading-edge-c21b96707cd2

[6] Mark Granahan, Fabless Isn't Fab: Why the U.S. Must Prioritize Domestic Microchip Manufacturing, 25 August 2021, available at https://www.electronicdesign.com/markets/automation/article/21172694/ideal-semiconductor-fabless-isnt-fab-why-the-us-must-prioritize-domestic-microchip-manufacturing

[7] David Sacks, Will China's Reliance on Taiwanese Chips Prevent a War?, 6 July 2023, available at https://www.cfr.org/blog/will-chinas-reliance-taiwanese-chips-prevent-war#:~:text=Taiwan%20Semiconductor%20Manufacturing%20Company%20(TSMC)%20is%20the%20world's%20largest%20contract,AI)%20and%20quantum%20computing%20applications.

[8] Executive Office of the President, Ensuring Long-Term U.S. Leadership in Semiconductors, January 2017, available at https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_ensuring_long-

- State-led efforts by the government of the People's Republic of China (PRC) to develop a native, vertically-integrated semiconductor industry are unprecedented in scope and scale,[9] and if successful, they could significantly shift global semiconductor production and related design and research capabilities to China, undermining U.S. and other foreign firms' leading positions.[10]

- *Inadequate domestic manufacturing capability to meet U.S. national security and economic needs.*
  - Only a small share of global chip manufacturing capacity is currently located in the U.S. (about 10% in 2020, down from 36% in 1990)[11], and none of the most advanced chips manufacturing capacity is in the U.S.
  - U.S. national defense systems are reliant on semiconductors – both state-of-the-art and legacy/mature chips – for a wide range of applications.[12]
  - Concerns about the sustainability and adequacy of the current fab and foundry ecosystem generated interest in alternatives, including access to a broader range of commercial, state-of-the-art design and fabrication capabilities.

- *U.S. reliance on global supply chains and production concentrated in East Asia.*
  - Semiconductor production is currently concentrated in East Asia where there are growing vulnerabilities of supply chains to trade disputes, military conflicts, or even IP theft. Taiwanese companies hold a 68 percent market share in the manufacture of semiconductors.
  - In recent years, China has increased its military investments and intensified its rhetoric with regard to its ambitions to re-unify Taiwan, including by the use of force if necessary, bolstering these concerns.

- *Domestic workforce required to re-shore semiconductor manufacturing capacity.*
  - According to the Semiconductor Industry Association, the U.S. faces a shortage of 67,000 skilled laborers essential to the industry and to fulfill the vision of the CHIPS program.[13]

- *High costs of manufacturing in the U.S.*
  - NIST's Strategy for the CHIPS for America Fund identified that the high cost of building and operating manufacturing infrastructure will be a challenge for the program.[14]
  - By some estimates, it will take 25% longer and cost around 50% more to produce semiconductors in the U.S. instead of Asia.[15]

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term_us_leadership_in_semiconductors.pdf

[9] Christopher Thomas, A new world under construction: China and semiconductors, 1 November 2015, available at https://www.mckinsey.com/featured-insights/asia-pacific/a-new-world-under-construction-china-and-semiconductors;

[10] Karen Sutter, China's New Semiconductor Policies: Issues for Congress, 20 April 2021, available at https://www.crs.gov/Reports/R46767?source=search

[11] Semiconductor Industry Association, 2021 State of the U.S. Semiconductor Industry, available at https://www.semiconductors.org/wp-content/uploads/2021/09/2021-SIA-State-of-the-Industry-Report.pdf

[12] Eric Lee, How Taiwan Underwrites the US Defense Industrial Complex, 9 November 2021, available at https://thediplomat.com/2021/11/how-taiwan-underwrites-the-us-defense-industrial-complex/

13 Semiconductor Industry Association, America Faces Significant Shortage of Tech Workers in Semiconductor Industry and Throughout U.S. Economy, 25 July 2023, available at https://www.semiconductors.org/america-faces-significant-shortage-of-tech-workers-in-semiconductor-industry-and-throughout-u-s-economy/

[14] https://www.nist.gov/chips/implementation-strategy

[15] Bloomberg Editors, $52 Billion Chipmaking Plan Is Racing Toward Failure, 28 March 2023, available at https://www.washingtonpost.com/business/2023/03/28/chips-act-funding-isn-t-what-us-semiconductor-manufacturers-need/fa80c040-cd62-11ed-8907-156f0390d081_story.html

Congressional Action on CHIPS

CHIPS for America Act: In December 2020 Congress enacted the "Creating Helpful Incentives to Produce Semiconductors for America Act," or the "CHIPS for America Act."[16] The act authorized the activities now being stood up at the Department of Commerce, including an incentive program for building and equipping semiconductor facilities in the United States, as well as R&D activities to support U.S. leadership in semiconductor technology. At the time, funding was not appropriated to carry out these activities.

CHIPS and Science Act of 2022: Division A of the CHIPS and Science Act of 2022[17] provided mandatory funding for the CHIPS for America provisions enacted in 2020. In total, the act provided $52.7 billion in mandatory funds provided through four funds:

1. **The CHIPS for America Fund**, $50.0 billion for FY2023-FY2027 to the Department of Commerce for:
   - $39 billion for implementation of the incentives program specified in Section 9902 of the CHIPS for America Act. Of the funding available for FY2022, $2 billion is specified for the production of mature semiconductor technologies and up to $6 billion is available for the cost of direct loans and loan guarantees;
   - $11 billion for FY2023 through FY2026 for R&D and workforce development programs, including for the National Semiconductor Technology Center, the National Advanced Packaging Manufacturing Program (NAPMP), NIST microelectronics-related metrology R&D, and establishment of up to three semiconductor manufacturing technology-focused Manufacturing USA institutes.

2. **The CHIPS for America Defense Fund**: $2 billion for the Department of Defense for "establishing and operating a Microelectronics Commons, a national network for onshore, university-based prototyping, lab-to-fab transition of semiconductor technologies and semiconductor workforce training."[18]

3. **The CHIPS for America International Technology Security and Innovation Fund**: $500 million, available until FY2030, to the Department of State for the purposes of coordinating with foreign government partners to support international information and communications technology security and semiconductor supply chain activities.

4. **The CHIPS for America Workforce and Education Fund**: $200 million for the FY2023-FY2027 period to the National Science Foundation (NSF) to promote growth of the semiconductor workforce through microelectronics workforce development activities.

[16] Creating Helpful Incentives to Produce Semiconductors for America Act (CHIPS for America Act), Title XCIV, The William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, H.R. 6395, 116th Congress.
[17] CHIPS and Science Act of 2022, H.R. 4346, 117th Congress.
[18] U.S. Senate Committee on Commerce, Science, and Transportation, CHIPS and Science Act of 2022 Section-by-Section Summary, available at https://www.commerce.senate.gov/services/files/1201E1CA-73CB-44BB-ADEB-E69634DA9BB9

Department of Commerce's CHIPS For America Program

The Department of Commerce has established two new offices at the National Institute for Standards and Technology (NIST) to lead implementation of CHIPS programs that were authorized in the CHIPS for America Act and the CHIPS and Science Act of 2022:

1. *CHIPS Program Office (CPO)* – The CPO is a new operating unit established to implement the semiconductor incentives program and provide policy and stakeholder engagement support across CHIPS programs. The CPO, reporting directly to the Under Secretary of Commerce for Standards and Technology and working closely with the Office of the Secretary, seeks to ensure coordination of all CHIPS-related activities across the Department of Commerce. The CPO is to participate actively in White House-led coordination efforts, including the CHIPS Implementation Steering Council, to ensure a tightly connected implementation of CHIPS throughout the government and draw on the technical expertise of these agencies.

2. *CHIPS Research and Development Office* – The CHIPS R&D Office will support the development of the NSTC and manage the Industrial Advisory Committee, Advanced Packaging, Manufacturing USA, and R&D activities, in collaboration with existing NIST laboratories and the NIST Office of Advanced Manufacturing. The office will oversee R&D activities to enable advances and breakthroughs in measurement science, standards, material characterization, instrumentation, testing, and manufacturing capabilities for next-generation microelectronics metrology, and to ensure U.S. competitiveness and leadership in microelectronics. It will also oversee the new Manufacturing USA institute that will pursue research in support of the virtualization and automation of maintenance of semiconductor machinery; the development of new advanced testing, assembly, and packaging capabilities; and the development and deployment of educational and skills training curricula needed to support the industry sector and to ensure the United States can build and maintain a trusted and predictable talent pipeline.

Implementation Progress

- August 9, 2022 – CHIPS and Science Act signed into law;
- September 6, 2022 – CHIPS Program hiring process begins;
- February 28, 2023 – Notice of Funding Opportunity (NOFO) for commercial facilities released;
- April 25, 2023 – NSTC vision paper released;
- June 23, 2023 – NOFO for supply chain projects announced;

NOFO #1 – Commercial Facilities: The CHIPS Program Office released the first NOFO and opened the application portal on February 28, 2023.[19] The first NOFO is reserved for applicants constructing, expanding, or modernizing facilities to produce semiconductors or provide advanced packaging capabilities. The CHIPS Program Office expects to release additional NOFOs for semiconductor materials and manufacturing equipment facilities in late spring 2023, as well as research and development facilities in the fall of 2023. All potential applicants for the first and

[19] National Institute of Standards and Technology, Notice of Funding Opportunity CHIPS Incentives Program – Commercial Fabrication Facilities, available at https://www.nist.gov/system/files/documents/2023/06/23/CHIPS-Commercial%20Fabrication%20Facilities%20NOFO%20Amendment%201.pdf

future NOFOs (e.g., chip manufacturers, equipment and material suppliers, advanced packaging firms) may submit a required Statement of Interest beginning on February 28, 2023. Other steps in the funding process include an optional pre-application (detailing project description), full application (including technical and financial feasibility of the project), due diligence (validating application information), and award issuance.

NOFO #2 – Supply Chains and Equipment Manufacturers: On June 23, 2023, the CHIPS Program Office released its second NOFO (as an amendment to the first NOFO).[20] This notice covers investments in the construction, expansion, and modernization of commercial facilities in the United States for wafer manufacturing and facilities for materials used to manufacture semiconductors and semiconductor manufacturing equipment. The Department also released its Vision for Success, which details goals for strengthening supply chain resilience, promoting U.S. technological leadership, supporting fab clusters, and establishing an ecosystem of reliable suppliers. Applicants under the second NOFO are required to comply with all rules and requirements of the first, including the notable provisions detailed above.

CHIPS Incentives Program

Sec. 9902 of the 2021 NDAA authorized the Department of Commerce to establish a grant program at the Department of Commerce to incentivize new domestic semiconductor manufacturing facilities and workforce development. The CHIPS Incentives Program aims to catalyze sustainable growth in the domestic semiconductor industry in support of U.S. economic and national security. Eligible projects include the construction, expansion, or modernization of (a) commercial facilities for the front- and back-end fabrication of leading-edge, current generation, and mature-node semiconductors; (b) commercial facilities for wafer manufacturing; and (c) commercial facilities for materials used to manufacture semiconductors and semiconductor manufacturing equipment, provided that the capital investment equals or exceeds $300 million. Funding can be provided through direct funding via grants (cooperative agreements, or other transactions), loans, or loan guarantees.

Guardrails: The CHIPS and Science Act prohibits any company that accepts a grant incentive or tax incentive from building and manufacturing advanced semiconductor CHIPS in the People's Republic of China or in other countries of concern for 10 years following the receipt of incentives. The Secretary of Commerce is required, in consultation with the Secretary of Defense and Director of National Intelligence, to consider updates to the technology threshold for prohibitions on manufacturing in countries of concern, considering consistency with export controls as well as technology advancements.

Companies that receive federal financial assistance through the CHIPS program are required to notify the DOC of planned transactions in countries of concern subject to their agreement with the Secretary. If DOC determines that the planned transaction violates the agreement, the company has an opportunity to remedy the potential violation; otherwise, DOC may recover the full amount of Federal financial assistance provided. The provision gives DOC the authority to request any records necessary to review compliance with the agreement, while ensuring such records remain confidential.

[20] Id.

The first notice of funding opportunity (NOFO) published by the Department goes into further detail on "guardrails" that must be in place to secure a financial incentive. These include:

- A guardrail to ensure that recipients of CHIPS funding do not expand manufacturing capacities below the 28 nm level technology node in China or other countries of concern for 10 years after receiving the financial award, even with their own non-CHIPS funds.

- A guardrail to prevent companies from using taxpayer funds for stock buybacks and shareholder dividends. Specifically, the act prohibits the use of these funds for the purchase of an equity security of the incentive recipient that is listed on a national securities exchange or any parent company of the incentive recipient; or to pay dividends or make other capital distributions with respect to the common stock of the incentive recipient.

Advanced Manufacturing Tax Credit: While not administered by the Department of Commerce, Section 107 of the CHIPS and Science Act creates a new tax credit, the advanced manufacturing investment credit (AMIC), to be administered by the Internal Revenue Service. The AMIC is equal to 25% of the value of qualified investments in buildings and other eligible depreciable tangible property for advanced manufacturing facilities that have a primary purpose of manufacturing semiconductors or semiconductor manufacturing equipment. The Department of Commerce expects that the AMIC will serve as an important tool to close the cost gap between investment in fabs in the United States and other countries. The law authorizes AMIC for projects that start construction between January 1, 2023, and December 31, 2026.[21] The Congressional Budget Office has estimated that industry claims for this tax credit will decrease federal revenues by $24.5 billion between FY2023 and FY2027.[22]

National Semiconductor Technology Center (NSTC)

Section 9906(c) of the 2021 NDAA directs the Secretary of Commerce, in collaboration with the Secretary of Defense, to establish a National Semiconductor Technology Center (NSTC) to conduct research and prototyping of advanced semiconductor technology to strengthen the economic competitiveness and security of the domestic supply chain. The Department of Commerce describes the NSTC as the "focal point" of the $11 billion provided in the CHIPS and Science Act of 2022 for research and development. Conceptually, according to NIST, government, industry, customers, suppliers, educational institutions, entrepreneurs, workforce representatives, and investors will converge in the NSTC to address semiconductor ecosystem challenges and opportunities.

The Department of Commerce has conducted, and continues to conduct, stakeholder engagements to inform its development of the NSTC. These efforts include requests for information (RFIs), workshops, and listening sessions. In addition, the department is considering recommendations made by the President's Council of Advisors on Science and Technology (PCAST).

[21] NIST, CHIPS for America: A Strategy for the CHIPS for America Fund, 6 September 2022, available at https://www.nist.gov/system/files/documents/2022/09/13/CHIPS-for-America-Strategy%20%28Sept%206%2C%202022%29.pdf

[22] Congressional Budget Office, Estimated Budgetary Effects of H.R. 4346, 21 July 2022, available at https://www.cbo.gov/system/files/2022-07/hr4346_chip.pdf

On April 25, 2023, the CHIPS Office at the Department of Commerce released a strategy paper for the NSTC, which, among other items, lays out the creation of a new, independent, nonprofit entity with the prerequisite expertise to serve as operator of the NSTC.[23] On April 26, 2023, the Department issued a notice in the Federal Register seeking nominations for Selection Committee members, who by virtue of their experience and expertise, could identify distinguished, purpose-driven, visionary leaders for the new independent, non-profit entity to operate the NSTC.[24] On June 20, 2023, the Department identified five individuals to serve on the Selection Committee: Janet Foutty of Deloitte Consulting LLP; John Hennessy of Stanford and Google; Jason Matheny of RAND Corporation, Don Rosenberg of UC San Diego and Anzu Partners, and Brenda Wilderson of AnitaB.org. The Department has since extended the selection committee's timeline from August 31, 2023 to September 30, 2023.

National Advanced Packaging Manufacturing Program

Authorized under Section 9906(d) of the 2021 NDAA, the National Advanced Packaging Manufacturing Program (NAPMP), is intended to strengthen semiconductor advanced test, assembly, and packaging capability in the domestic ecosystem. This effort will be led by the National Institute of Standards and Technology (NIST) and the areas targeted by the NAPMP include co-design, chiplets, heterogeneous integration, design, platforms, advanced tooling, and materials and substrates. NIST's initial approach is to identify areas of focus and services needed to build domestic capacity for key areas and to identify opportunities to strengthen alignment of key areas with facilities, partnerships, and program integration.[25]

In January 2022, the Department of Commerce issued a Request for Information on the NAPMP and other R&D activities authorized by Congress. According to the Department of Commerce, RFI respondents recommended the NAPMP "serve as a critical resource to develop advanced packaging and related R&D, as part of a larger effort to strengthen the resiliency of the semiconductor supply chain."

Further Reading:

CRS:

1. Frequently Asked Questions: CHIPS Act of 2022 Provisions and Implementation
2. Federal Research and Development (R&D) Funding: FY2024
3. China's New Semiconductor Policies: Issues for Congress
4. "Made in China 2025" Industrial Policies: Issues for Congress
5. Semiconductors and the CHIPS Act: The Global Context

[23] National Institute of Standards and Technology, A Vision and Strategy for the National Semiconductor Technology Center, 25 April 2023, available at https://www.nist.gov/chips/vision-and-strategy-national-semiconductor-technology-center

[24] National Institute of Standards and Technology, Federal Notice – National Semiconductor Technology Center Selection Committee, 22 August 2023, available at https://www.federalregister.gov/documents/2023/08/22/2023-17991/national-semiconductor-technology-center-selection-committee

[25] National Institute of Standards and Technology, CHIPS R&D Update, 8 December 2022, available at https://www.nist.gov/system/files/documents/2022/12/15/1.%202022-12-08_RD_Deck_final.pdf

Department of Commerce:

6. Notice of Funding Opportunity: CHIPS Incentives Program – Commercial Fabrication Facilities
7. Vision for Success: Facilities for Semiconductor Materials and Manufacturing Equipment
8. A Vision and Strategy for the National Semiconductor Technology Center
9. Vision for Success: Commercial Fabrication Facilities

Other:

10. CSIS - Implementing the CHIPS Act: Sematech's Lessons for the National Semiconductor Technology Center
11. CSIS - The CHIPS and Science Act Guardrails' Implications for the U.S. Trade Agenda
12. CSIS - Implementing CHIPS: The NEPA Permitting Challenge
13. Atlantic Council - United States–China semiconductor standoff: A supply chain under stress
14. Brookings - Technology competition between nations: Views from industry leaders
15. Brookings - Improving workforce development and STEM education to preserve America's innovation edge
16. Heritage Foundation - Time To Wean Ourselves From Chinese Semiconductors
17. RAND Corporation - Securing the Microelectronics Supply Chain