INTERIM REPORT FOR THE

Decadal Plan for Semiconductors

The Challenge

Innovation in semiconductor technology is needed to advance information and communication technologies (ICT) critical to our economic growth and national security. Advances in semiconductor technology will be needed to manage the exponential amount of data to be moved, stored, computed, secured, and converted to end-user information. As computing systems move into the domain of AI, with cognition and reasoning, the underlying hardware performance is facing constraints by fundamental physical limits. The ICT opportunities of tomorrow are simply unachievable with current hardware technologies. A crisis is at hand, and the current paradigm must shift to create new value propositions with semiconductor technologies as the key driver.

A Call to Action: Semiconductor Technology Leadership Initiative

We're on the edge of the next industrial revolution. Maintaining and strengthening U.S. leadership in ICT during this new semiconductor era requires tripling federal funding throughout the coming decade—**an additional $3.4B investment per year** for large-scale industry-relevant semiconductor research. New public-private partnerships must be initiated to cover a wide breadth of interdependent technical areas and multi-disciplinary teams. Organized and coordinated investments with market-focused goals are needed to support essential technology development.

The Decadal Plan provides an overview of the global drivers and constraints for the future ICT industry, focusing on creative solutions and measured impact. The Decadal Plan has three key objectives:

- Identify significant trends, applications, and challenges in semiconductors that are driving ICT.
- Quantitatively assess the potential impact of the five seismic shifts on ICT.
- Identify fundamental goals to alter the current trajectory of semiconductor technology to better address coming challenges.

Five Seismic Shifts That Will Define The Future of Semiconductors and ICT

1. Fundamental breakthroughs in analog hardware are required to generate smarter world-machine interfaces that can sense, perceive, and reason. Annual investment need: $600M throughout this decade to pursue analog-to-information compression/reduction with a practical compression/reduction ratio of 10^5:1 for practical use of information more analogous to the human brain.

2. The growth of memory demands will outstrip global silicon supply, presenting opportunities for radically new memory and storage solutions. Annual investment need: $750M throughout this decade to develop emerging memories/memory fabrics with >10-100X density and energy efficiency improvement for each level of the memory hierarchy. Discover new storage systems and storage technologies with >100x storage density capability.

3. Always-available communication requires new research directions that address the imbalance of communication capacity vs. data-generation rates. Annual investment need: $700M throughout this decade for communication enabling data movement of 100-1000 zettabyte/year at the peak rate of 1Tbps@ <0.1nJ/bit. Develop intelligent and agile networks that effectively utilize bandwidth to maximize network capacity.

4. Breakthroughs in hardware research are needed to address emerging security challenges in highly interconnected systems and AI. Annual investment need: $600M throughout this decade for privacy and security hardware advances that keep pace with new technology threats and use cases (e.g., trustworthy AI systems, secure hardware platforms, and emerging postquantum and distributed cryptographic algorithms).

5. Ever-rising energy demand for computing vs. global energy production is creating new risk, and new computing paradigms offer opportunities to dramatically improve energy efficiency. Annual investment need: $750M throughout this decade to discover computing paradigms/architectures with a radically new computing trajectory demonstrating >1,000,000x improvement in energy efficiency.

Learn more about the Decadal Plan, the Semiconductor Industry Association (SIA), and Semiconductor Research Corporation (SRC) at **https://www.src.org/decadalplan/**

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