

Investing in Bioindustrial Manufacturing Infrastructure and Minnesota's Future

Bioindustrial Manufacturing:

The use of living organisms, cells, tissues, enzymes, or cell-free systems to produce materials and products for non-pharmaceutical applications, thus replacing petroleum-derived chemicals for both economic and environmental benefit. The resulting high-value products are manufactured using agricultural feedstocks, byproducts, and waste streams.

Request for the State of Minnesota:

- \$300 million in federal funds have been appropriated by Congress to establish a nationwide network of pilot-scale bioindustrial manufacturing facilities. BioMADE, a Department of Defense Manufacturing Innovation Institute, will direct their investment to states interested in investing in a collaborative partnership to drive America's bioeconomy.
- **BioMADE is prepared to invest \$100 million in Minnesota and is seeking a commitment from the State of Minnesota for \$100 million in matching funds.** This combined level of funding will enable the construction and operation of the nation's first federal/state/private bioindustrial manufacturing pilot innovation facility, biorefinery, and commercial campus, establishing Minnesota as the national leader in biomanufacturing innovation, commercialization, and workforce development.

Proposal for the State of Minnesota:

To establish Minnesota as the leader in the expanding biomanufacturing economy by hosting the nation's first federal/state/private pilot-scale Bioindustrial Manufacturing Innovation and Production campus.

- Utilize Minnesota's abundance of agricultural feedstock (such as corn stover, sugar beets, or woody biomass) and research capacity.
- Overcome the existing gap between limited lab output and commercial-scale production.
- Facilitate the launch of co-located small and medium size manufacturers.
- Provide U.S. capacity to compete against existing facilities in Europe, Asia, and Mexico.
- Opportunity for Minnesota to define and lead the nation's domestic, distributed, and resilient network for biomanufactured chemicals within a secure domestic supply chain.

Minnesota Siting Requirements:

- 7-15 acre footprint for industrial pilot-scale biomanufacturing facility within a 300-1,000 acre rural/ex-urban campus to accommodate commercial expansion for 4 to 8 manufacturers.
- Wastewater treatment; significant water and electricity needs; low/no carbon emissions.
- Excellent transportation access: rail and highway; one hour in proximity to MSP.
- Access to a workforce pipeline for upskilling, career transition, and development.

Making Minnesota the National Leader:

- **July 2020:** All ten Democratic and Republican members of Minnesota’s congressional delegation signed a letter to the Secretary of Defense urging BioMADE to be located in Minnesota stating, *“the BioMADE team will deliver innovative solutions to the critical national security challenge while driving growth for our companies, expanding the capabilities of our research institutions, and creating economic opportunity for our region’s residents.”*
- **October 2020:** BioMADE was established with an \$87 million investment by the Department of Defense as a Manufacturing Innovation Institute and part of the Manufacturing USA Network to be headquartered in Minnesota.
- **February 2021:** BioMADE announces its first suite of funded research projects, including projects with Minnesota-based General Probiotics and Cargill.
- **April 2021:** BioMADE was joined by U.S. Secretary of Agriculture Tom Vilsack and a congressional representative in official launch.
- **June 2022:** BioMADE hosted its first in-person Member Meeting in St. Paul, bringing 200+ bioindustrial manufacturing leaders from industry and academia as well as federal government leaders together in the Twin Cities.
- **September 2022:** BioMADE played an active role in the White House Summit on Biotechnology & Biomanufacturing following President Biden’s issuance of Executive Order 14081, Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy – making biomanufacturing a national priority.
- **September 2022:** BioMADE announces additional funded research projects, including with Minnesota-based Valerian Materials and the University of Minnesota.
- **October 2022:** U.S. Rep. Betty McCollum hosted Ms. Heidi Shyu, Under Secretary of Defense for Research and Engineering and the Pentagon’s Chief Technology Officer, in St. Paul for National Manufacturing Day. The event, which also featured BioMADE and Cargill, brought together Minnesota leaders from business, innovation, higher education, and national security.
- **December 2022:** Congress appropriated \$300 million (P.L. 117-328) in funding to BioMADE to invest in a national network of bioindustrial manufacturing facilities.
- **February 2023:** BioMADE is prepared to invest \$100 million in Minnesota. It is seeking \$100 million in matching funds from the State of Minnesota to launch the nation’s first federal/state/private pilot-scale Bioindustrial Manufacturing Innovation and Production campus, making Minnesota the leader in the U.S. bioeconomy.

Investing in Bioindustrial Manufacturing Infrastructure and Minnesota's Future

Summary: The U.S. faces a foundational gap in its ability to scale up bioindustrial manufacturing¹ from laboratory R&D to commercial production. Without addressing this gap, the nation will be unable to meet the goals set out by the Biden Administration's Executive Order for Biotechnology and Biomanufacturing which is meant to incentivize the expansion of *domestic, flexible*² industrial biomanufacturing capacity, and to address identified industrial supply chain vulnerabilities.³

At its core, the gap is the *intermediate* step between the lab and commercial market. Closing the gap *requires the establishment of pilot-scale biomanufacturing infrastructure* to validate a technology or product. This gap defies private investment from major manufacturers who will not see the return on investment on such capital assets. To realize the promise of industrial biomanufacturing, Congress has funded a multi-year effort to catalyze the creation of pilot-scale infrastructure.

The foundational leaders of the new bioindustrial economy are now being set, and Minnesota is being given the opportunity to lead through co-investment in this unique program and to leverage an equal amount of federal monies. When successful, the State's investment will catalyze an ecosystem of *commercial-scale* bioindustrial manufacturing on campuses where companies will co-locate, creating jobs and launching new manufacturing opportunities.

State of Play: It is estimated that biomanufacturing will create \$4 trillion in economic activity in the coming decade. Europe and Asia recognized the economic and national security potential of biomanufacturing a decade ago. Europe's development and progress advancing the sector is outpacing the U.S. Currently, in the U.S., 40% of the refineries creating nearly all critical chemical building blocks is consolidated in just three (3) companies.⁴ The vast majority of chemical and material products that are used today trace back to petroleum-sourced refined chemicals at a handful of billion-dollar chemical refineries⁵, which in turn are transported around the world to manufacture end-products (e.g., next-gen coatings, plastics). These products are not even the principal economic driver of the refineries; fuel markets drive refinery output and commodity chemicals are simply a *byproduct* of fuel production.⁶ There is a more innovative, more sustainable, and more advantageous pathway.

Today, American biotechnology companies and university researchers are able to engineer biology to demonstrate the potential for impactful applications. However, the nation's ability to transition these bio-based solutions to manufactured products on the market is hampered by a

¹ "Bioindustrial manufacturing" means the use of living organisms, cells, tissues, enzymes, or cell-free systems to produce materials and products for non-pharmaceutical applications.

² Biomanufacturing – in contrast to petrochemical manufacturing – is more modular, and thus, the manufacturing opportunities/benefits more distributed. <https://www.schmidtfutures.com/wp-content/uploads/2022/04/Bioeconomy-Task-Force-Strategy-4.14.22.pdf>, <https://www.whitehouse.gov/briefing-room/presidential-actions/2022/09/12/executive-order-on-advancing-biotechnology-and-biomanufacturing-innovation-for-a-sustainable-safe-and-secure-american-bioeconomy>

³ <https://www.federalregister.gov/documents/2022/09/15/2022-20167/advancing-biotechnology-and-biomanufacturing-innovation-for-a-sustainable-safe-and-secure-american>

⁴ <https://www2.deloitte.com/xe/en/insights/industry/oil-and-gas/building-resilience-petrochemical-market.html>

⁵ <https://www.afpm.org/system/files/attachments/AFPM-Capacity-Report-2019.pdf>

⁶ <https://www.nap.edu/catalog/19001/industrialization-of-biology-a-roadmap-to-accelerate-the-advanced-manufacturing>

gap between the lab and commercial-scale production; *that foundational gap is the pilot phase.*⁷ Industrial biomanufacturing opens the door to a domestic, distributed, resilient network for chemical manufacturing, bringing jobs and opportunities to local communities, reducing the transportation footprint, and securing a domestic supply chain.

The challenge today is one of de-risking the economic model and product development to address this gap. By establishing a network of pilot-scale biomanufacturing facilities via public-private partnership, *as a service to small and medium manufacturers*, the U.S. would address this private sector investment shortfall. Because a purpose-built pilot production facility cost is substantial, and profit margins are low, the return on investment for private industry simply does not exist. This pilot phase gap – providing quantifiable TRL/MRL⁸ proof across a large enough range of products, at sufficient scale – holds back innovation, domestic sourcing, and job creation, and is driven in large measure by the lack of access to pilot infrastructure to do the work in a speedy and cost-efficient way. Today, companies are *forced* to utilize facilities in, Europe, Mexico, and Asia to get through the “pilot” phase of development as pilot assets for bioindustrial products are all but nonexistent in the U.S.⁹

Congress provided \$300 million as a down payment for a national network of pilot facilities within the *Consolidated Appropriations Act, 2023* (P.L. 117-328) passed in December 2022. The federal government and BioMADE are now seeking partnerships with state, local, and private sector groups to establish the pilot facilities and related infrastructure.

The Role of Minnesota: BioMADE is prepared to invest \$100 million in Minnesota and is seeking a commitment from the State of Minnesota for \$100 million in matching funds. This co-investment will enable the development of the nation’s first bioindustrial manufacturing campus. The centerpiece of the Minnesota campus will be the U.S. Government/BioMADE state-of-the-art bioindustrial manufacturing pilot plant which will attract industry, inspire innovation, and create a talent pipeline. The Minnesota project will launch a national network of 12-15 pilot plants over the coming years at a gross cost of ~\$1.5B for the initiative. ***The investment by the State of Minnesota, at this time, would cement its lead in this burgeoning sector of the economy, provide for additional markets for its feedstocks (e.g., corn stover, sugar beets, and woody biomass), and develop a bridge between the urban innovation cores and the rural heartland.***

Minnesota's Return on Investment: In addition to securing a national leadership role in this new manufacturing vertical, Minnesota can anticipate its co-investment spawning full-scale bioindustrial manufacturing operations that are co-located with the pilot facility residing on the same campus. With pilot scale-up development and workforce training taking place "over the fence" upon this campus, Minnesota will see the necessary private investment for a full-scale manufacturing operation. Beyond the hundreds of millions of dollars in CAPEX and dozens of jobs in rural areas that pilot facilities will immediately provide, Minnesota can reasonably expect billions of dollars of economic activity and thousands of employment opportunities with a robust innovation ecosystem that grows and drives America’s new bioeconomy.

⁷ <https://crsreports.congress.gov/product/pdf/R/R46881>; <https://www.schmidtfutures.com/wp-content/uploads/2022/04/Bioeconomy-Task-Force-Strategy-4.14.22.pdf>

⁸ <https://academic.oup.com/jimb/article/49/5/kuac022/6712705>

⁹ <https://biopilots4u.eu/database>