

## FY 2023 Regional Technology and Innovation Hub Program Phase 2

### Overarching Narrative: Maine's Forest Bioproducts Advanced Manufacturing Technology Hub

**Executive summary:** Decarbonizing and detoxifying consumer and industrial products is the next frontier in the fight against climate change. Wood derivatives are the most promising climate solutions to displace fossil fuel-based materials in many manufactured goods, with significant market opportunities in displacing petroleum-based conventional building products, plastic packaging, and harmful synthetic additives. Maine's *Forest Bioproducts Advanced Manufacturing Technology Hub* is home to generations of talent, innovation, infrastructure, and capital that together offer a powerful engine for propelling U.S. technological leadership in the 21<sup>st</sup> century circular economy: *extracting biological building blocks from forests, manipulating them for use, and manufacturing environmentally sustainable products from those components*. This core technology area is at the intersection of two KTFAs: (4) Robotics, automation, and advanced manufacturing, and (10) advanced materials science. The region is concentrated along Maine's Route 95/295 innovation corridor between Portland (Portland-S. Portland MSA) and Orono (Bangor MSA). This corridor also includes the Lewiston-Auburn MSA and the Augusta-Waterville MSA, where key manufacturing assets are located, and is closely linked in the north and west to mill communities and expansive forests in Somerset and Aroostook Cos., with further ties to heritage manufacturing sites in rural Maine and northern New England, providing extensive infrastructure for future bioproducts industry growth. See the final section for a succinct synopsis of the consortium's vision for regional economic development.

**Challenges our consortium seeks to solve:** Fossil fuel-based feedstocks are used in [96% of manufactured goods](#), with enormous implications for carbon emissions. The Biden Administration's "[Bold Goals for U.S. Biotechnology and Biomanufacturing](#)" and "[Strategy for Plastics Innovation](#)" call for the scale up of renewable alternatives for products ranging from plastics and paints to asphalt and other construction materials, with domestically produced bioproducts critical for the U.S. to achieve net-zero emissions by 2050 and mitigate the well-documented security risks associated with a warming planet.

However, innovative value-added wood-derived product technologies have been largely overlooked by federal investments, with the overwhelming share of federal bioproducts funding focused on producing commodity fuels, bioplastics, and chemicals from agriculture crops. Wood is an untapped opportunity with significant carbon, unit economics, and performance advantages in many cases. The technology currently exists to provide drop-in wood-derived replacements for molded plastic production, alternatives to carbon intensive building products, and alternatives to petrochemical additives in consumer products. It is only a question of solving problems of scale and economy to make them widely commercially viable, specifically:

- *Technology trapped in the "Valley of Death":* Some of the most promising forest bioproducts technologies are trapped at the R&D or boutique production phase. Achieving full industrial scale manufacturing requires technical investment in equipment, process standardization, and testing that is risky for a private company acting alone – especially as decades of low margins in paper, pulp, and wood product sectors have resulted in [R&D spending that is 1/3 that of the broader manufacturing industry](#).
- *Breadth of market opportunities for forest bioproducts technology:* The range and scale of new products needed to achieve the full potential of wood fiber and cellulose technologies is beyond what can be created by relatively few existing American firms in the industry. Plastic replacements, building products, and new biobased additives simply cover too many distinct markets and products where a large diversity of innovation and business models is needed. Rapidly growing the reach of these products will require new market entrants, as a source of both technological innovation and new capital.
- *Requirements for global scale workforce and production capabilities:* Ensuring that forest bioproducts stemming from innovation in the U.S. are then produced in the U.S. requires more workers with advanced

forestry and manufacturing skills at all levels, as well as enhancing manufacturing productivity and sustainability with cutting edge technology, data and AI capabilities, and worker collaborations.

- *Perceived consumer adoption risks:* Ready take-up of new products is limited by market knowledge gaps and perceived adoption risks about innovative wood products' carbon benefits, code compliance, supply chain reliability, drop-in fit within existing production lines, and performance capabilities. Credible messages from a mix of commercial, research, community, and government partners will be critical for continuing to educate consumers and shape market sentiment – far more so than the message of any one company with a product for sale.

Successfully addressing these barriers will bring a cascade of new forest bioproduct types to mass market scale over the next decade. First are those products that already have a clear, economical technology-market match but may need additional market development and production expansion: molded fiber packaging, wood fiber insulation, and coal feedstock replacements in chemical processes. Second are those that need additional development in the economies of industrial scale: cellulose-based automotive interior components, pelletized nanocellulose for plastic feedstock replacement, bioproducts for cement strengthening, more advanced wood composite building materials, and second-order chemical feedstocks from biochar. Third are those that need additional refinement for product applications: barrier coatings, agricultural sprays, texturing materials, specialized petrochemical replacements, and so on.

**Core technology, our region, and national and economic security:** The U.S. economy currently turns on fossil fuel-based products that are incompatible with the Biden Administration's carbon emission targets and resilient, domestic supply chains. [Plastics](#), [building materials like iron, steel, and cement](#), and [petrochemicals](#) – the specific markets our Tech Hub is targeting – together represent roughly 20% of global CO2 emissions. Ending dependence on conventional plastics and carbon-intensive building materials is imperative if the U.S. is to reduce reliance on imports and avert a climate crisis. In plastic supply chains, for example, the U.S. imports [over \\$30 billion in feedstocks from China annually](#) (not including imports of downstream products made *with* plastic), and while the U.S. has large upstream plastic production of its own, its [geographic concentration has proven vulnerable to extreme weather impacts](#). As the world seeks bio-based climate solutions, there is also significant risk that firms in Asia and Europe are better poised to capture these future markets. For example, through investments from a five-year bioeconomy plan and regulations including a phased-in ban on single-use plastics, [one analysis estimated that by 2025 Chinese producers of biodegradable polymers could account for two thirds of global output](#).

Advanced forest-derived bioproducts offer powerful opportunities for Made in America solutions to displace plastics, sequester carbon in buildings, and replace harmful synthetics. Much of the technology to separate wood biomass into its component parts was pioneered in Maine's paper industries and remains the foundation of next generation industries. Through chemical and mechanical means, wood's component parts can be isolated and extracted into versatile biomaterials – such as nanocellulose, nature's "super polymer" – suitable for many uses. When incorporated into conventional products, these natural, biodegradable materials offer increased performance (such as improved strength), replacement of toxic additives (such as formaldehyde and PFAS), and carbon sequestration. These materials are also wholly displacing conventional products with environmentally sustainable alternatives, such as wood fiber insulation instead of fiberglass, molded fiber packaging for consumer products instead of single-use plastics, and 3D-printed structural applications replacing traditional construction. The same technology is also used in the region to commercialize products from non-wood sources, such as kelp.

Helmed by the Maine Technology Institute (MTI), the Tech Hub will leverage advanced materials and manufacturing industry, workforce, and research capabilities concentrated along Maine's I- 95/295 corridor between Portland (Portland-S. Portland MSA) and Orono (Bangor MSA). This corridor also includes the

Lewiston-Auburn MSA and the Augusta-Waterville MSA, where key manufacturing assets are located, and is closely linked in the north and west to mill communities and expansive forests in Somerset and Aroostook Cos., with further ties to heritage manufacturing sites in rural Maine and northern New England, providing extensive infrastructure for future bioproducts industry growth.

The region is strongly positioned to reach global competitiveness over the next decade, with world-class assets propelling each of five steps in the value chain:



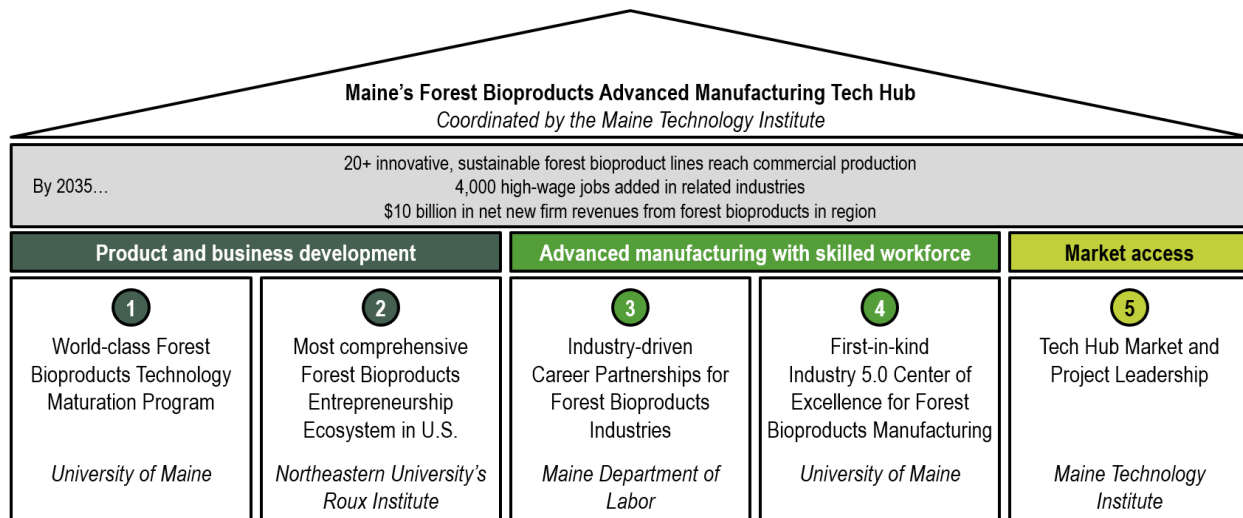
- *Sustainable feedstock source:* Woody biomass from forest residuals is [the most abundant and promising raw material for biobased manufacturing](#). Using residuals rather than virgin cellulose reduces competition for farmland, eliminates waste, and sequesters carbon while adding value to each harvested log. Maine is home to the largest contiguous privately-owned working forest in the U.S. (16.3m acres), providing 13 million tons of sustainably harvested timber and biomass to the state's [\\$8.5b forest economy and employing more than 30,000 people](#) every year. From these vast forests, the region's harvesters, sawmills, and pulp mills stand ready to supply the world with sustainably managed wood feedstock.
- *Use-inspired research and development:* The Tech Hub is anchored by a pair of world-class industrial research institutions – Northeastern University (NU)'s Roux Institute in Portland, ME and the University of Maine in Orono, ME (UMaine). UMaine is one of industry's go-to institutions for technical assistance on biomaterials and bioproduct commercialization. The university has the highest number of nanocellulose researchers in the country, boasts internationally recognized forest bioproduct testing and research facilities, and is the world's largest public supplier of cellulose nanofiber (CNF) – a common form of nanocellulose. Since 2012, 950+ companies in 50 countries have sought out samples of cellulose nanomaterials from UMaine and the university has partnered on 15 commercial scale demonstration projects across the U.S, Europe, and Brazil. Portland's Roux Institute is a new campus of NU with cutting-edge R&D facilities that support new materials development, characterization, and prototyping capabilities with nationally-recognized engineering faculty in advanced material systems development, Industry 5.0 for advanced manufacturing and supply chain systems, and sustainability engineering. Together, UMaine and NU had research expenditures in excess of \$400 million in 2022.
- *Product and business development:* The region is home to a vibrant network of organizations that support entrepreneurs and has established tools for leveraging private and public funds. [Maine ranks in the top 10 states for new entrepreneurship](#) and [registered a record 14,000 new businesses in the last year](#). Since 1999, lead applicant MTI has deployed over \$365 million in nearly 3,800 innovation, commercialization, and ecosystem projects, generating over \$2.2 billion in private sector matching investment. MTI frequently collaborates with the Maine Venture Fund (MVF), Coastal Enterprises Inc. (CEI), the Finance Authority of Maine (FAME), StartupMaine, and other consortium members to support innovation at both new and established forest biomanufacturing companies.
- *Advanced manufacturing with a skilled workforce:* Manufacturing jobs and facilities have been expanding, with the manufacturing sector's GDP growth rate 2X the national average since 2016. Today, the sector constitutes ~10% of Maine's GDP and employment and is seeing new investment—the region's forest products sector saw over [\\$1 billion in manufacturing facility buildout commence in 2022](#). Maine Manufacturing Extension Partnership (MEP) helped clients invest more than \$100 million towards modernizing facilities, equipment, and processes in 2022. TechPlace, in the middle of the region, includes a shared bio-production lab and a composites layup facility, and is home to dozens of firms in bioproducts sectors with common equipment, talent, and supply chain needs. The Maine Community

College System offers degree and training programs across the region and, through a new free community college initiative, is reaching more students than ever.

- **Market access:** The Tech Hub features global brands and engineering firms who are buyers of new solutions for packing products and constructing buildings. An expanded Domestic Trade pilot program at Maine DECD is helping companies reach new customers with promotional support, market data, and business counseling services. Maine’s first-in-the-nation extended producer responsibility (EPR) law incentivizes the region’s brands to lead the U.S.’s transition away from single-use plastics. And with tackling climate change atop her policy agenda, Maine Governor Mills has continued to position her administration to lead by example in integrating advanced wood products into state facilities.

The Tech Hub’s unique combination of assets will help it retain innovation and manufacturing in these areas as markets develop. The advantages of sustainable forest feedstock, R&D expertise, and manufacturing capacity provide a strong base for traditional industry and innovation clustering effects given the need for rapid iteration on product and production line design. Moreover, achieving decarbonization targets will require locating supply chains close to their end users for both environmental and economic reasons. The Tech Hub is especially well positioned to serve markets in the Northeastern U.S. and will be a hub of innovation for industry growth across the U.S. to serve markets around the globe.

**Private sector participation:** The Tech Hub’s implementation strategy involves investments in 5 projects that form a regional ecosystem of commercialization-enabling resources. Together, they propel a dense cluster of innovators, founders, talent, manufacturers, and markets competitive with any region in the world:



To advance technology and build the businesses bringing that technology to market, we will expand technological maturation capabilities available to innovators and launch the country’s most comprehensive forest bioproducts entrepreneurship program. To ensure the region has the workforce and industrial capabilities to produce at global scale, we will strengthen the region’s talent pool through industry-driven career partnerships and establish a first-in-kind Industry 5.0 Center of Excellence for forest bioproducts manufacturing. And we will bridge forest bioproducts innovations with the commercialization resources and partnerships necessary to bring those ideas to market at a globally competitive scale.

Each of these investments is in support of accelerating market access by the private sector, as reflected by the commitments to participate in the Tech Hub and undertake aligned economic activities. Together, private sector commitments are valued at over \$352 million and include:

- *Forest Bioproducts Technology Maturation Program (Component Project 1):* Consumer brands like global

veterinary health giant IDEXX and international bottled water firm BlueTriton will collaborate with the Tech Hub to generate low-carbon, waste-free packaging for their products. Industrial innovators like SHoP Architects/Assembly OSM and Arcadia Alliance will partner with the Tech Hub to bring to market 3D-printed buildings and boats constructed from wood materials that displace hundreds of tons of CO<sub>2</sub>. The Tech Hub is also discussing partnerships with two global footwear brands seeking to use forest biomaterials to make their shoes lighter weight and more durable, while reducing their carbon footprint.

- *Forest Bioproducts Entrepreneurship Ecosystem (CP2)*: Investors with assets totaling more than \$4.25 billion have committed to accelerate the progress of the next generation of forest bioproduct startups, as diverse as agriculture coating firm CapaTec to medical device company Xylogen.
- *Career Partnerships for Forest Bioproducts Industries (CP3)*: As manufacturers in the region expand, firms like sustainable carbon maker Highland Solutions, wood product innovator Hancock Lumber, and others will rely on the Tech Hub to help attract hundreds of workers needed to fill new, good-paying jobs in disadvantaged rural communities.
- *Industry 5.0 Center of Excellence for Forest Bioproducts Manufacturing (CP4)*: Growing manufacturing firms like Tanbark and TimberHP, and members represented by the Manufacturers Association of Maine will collaborate with the Tech Hub to aggressively scale up their production capabilities and add good jobs by integrating digital, robotics, sustainability, and worker-first advanced manufacturing techniques, while advanced engineering firm Progress Engineering and global processing solutions giant Valmet will drive manufacturing innovations.
- *Maine Tech Hub Market and Project Leadership (CP5)*: Firms like green paper coating pioneer Folia Materials will use discounted access to life cycle analyses to expand their customer base by documenting the environmental impacts of their products. Wood-fiber giant Sappi will leverage the Tech Hub to discover technology solutions available for license. Engineers Thornton Tomasetti and members of the Northeast Bio-Based Materials Collective will join Tech Hub events to promote forest bioproducts as market-ready construction solutions. And 60+ companies will benefit from innovation vouchers and competitive grants that help them cross the valley of death between a good idea and successful product.

Represented by Maine's Forest Products Council and Professional Logging Contractors NE, the region's landowners, loggers, truckers, paper mills, tree farmers, foresters, and lumber processors are committed to ensuring that the region can supply the world with millions of tons of sustainable wood feedstock.

Eligible firms<sup>1</sup> will access Tech Hub resources through MTI's central intake process and complete an initial needs assessment that benchmarks commercialization maturity so that growth can be later measured. This process is modeled on MTI's current intake and evaluation process, which is fast, effective, and familiar.

**Commitments from outside private sector:** The Tech Hub represents a unique public-private partnership supported with broad and significant commitments from government, community organizations, education institutions, and other partners. Their commitments are valued at over \$277 million and include:

- The *Maine Technology Institute* is committing to coordinate the Tech Hub, employ the Regional Innovation Officer, deliver the Tech Hub's market leadership programs, and make complementary financial and technical assistance awards valued at \$10 million.

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<sup>1</sup> Eligibility is focused on accelerating an ecosystem that supports commercialization of products where the following is true:

- The primary enabling chemistry, materials, or technology derives from wood, forest residuals, or related feedstock.
- The commercialization gap is primarily technical, manufacturing process, talent, market readiness, or business maturity.
- There are plausible market opportunities of significant scale with potential to leapfrog global competitors.
- There are likely environmental, health, or performance advantages over traditional materials or products.
- The opportunity creates economic impact in the Tech Hub or closely linked region.

- Three premier higher education institutions – *University of Maine*, *Northeastern University (through its Roux Institute)*, and the *Maine Community College System* – are committing world-class innovation expertise, cutting edge bioproducts equipment and infrastructure, industry-shaped training programs, and research-driven IP to build talent pipelines and help private sector firms rapidly accelerate product commercialization and operational growth.
- *Maine Governor Janet Mills*, along with the state’s *Department of Labor* and *Department of Economic and Community Development* are committing to facilitate industry-driven career partnerships for the forest bioproducts sector, deploy \$2 million to help forest supply chain businesses make capital investments, identify opportunities to integrate forest bioproducts into state facilities, cultivate opportunities for immigrants in the forest bioproducts economy, and take other steps that bring to bear the considerable resources of the State of Maine.
- A diverse group of community organizations and labor organizations are committing to helping design and deliver inclusive workforce and entrepreneurship programming, help tackle barriers to work, and support connections with local communities throughout the Tech Hub and linked region.
- The *Maine International Trade Center* and the *Finance Authority of Maine*, both quasi-state agencies, are committing to support global market development and access to financing – critical activities to enable firms to overcome barriers to international sales and to access the capital necessary to grow operations to a global scale. The *Maine Venture Fund* is committing to investing at least \$1 million in forest bioproducts startups emerging from Tech Hub’s programming.
- *Maine Development Foundation (MDF)* is committing to facilitating collaboration with Maine’s forest sector economic roadmap coalition (FOR/Maine) on regional policy, market development, supply chain engagement, and community revitalization. Five of Maine’s most economically distressed rural mill communities stand eager to market their industrial infrastructure assets to growing manufacturers.
- National labs, research centers, manufacturing institutes, and philanthropic organizations including *Oak Ridge National Laboratory*, *Forest Products Lab*, *RAPID Manufacturing Institute*, and *P3 Nano* are committing to collaboration with the Tech Hub to expand access to commercialization resources.
- The *Northern Forest Center*, on behalf of the *Coalition of Northern Forest Innovation and Research (CONFIR) NSF Type-I Regional Innovation Engine*, is committing to collaborate with the Tech Hub towards developing a forest products innovation pipeline that stretches across northern New England.
- Organizations including *NSF*, the nonprofit leader in testing, standards, and certification, Maine industrial incubator *TechPlace*, and *New England Forestry Foundation* have committed to offering discounted or no-cost services and trainings to firms referred through the Tech Hub.

**Tech Hub sustainability:** We will use EDA funds to build and validate a long-term, self-sustaining business model that expands the Tech Hub’s impact at a rate that supports the market revenue goals necessary for the Tech Hub to reach global competitiveness within 10 years. As a result, we project growing the consortium’s reach to 3X its initial scale under the EDA grant. This target corresponds to a business model that requires between \$25-45 million annually, with variation hinging on expansion, sunseting, or other adjustments of programs as we prove out what works (and what may not).

Our plan includes supporting growth of the backbone Tech Hub Market and Product Leadership functions at MTI through annual dues from industry participants; earned revenue from fees, commissions, and sales of market intelligence products based on a Forest Bioproducts IP Catalog we will build; and sponsorships from events and partnerships. The Bioproducts Technology Maturation program and Industry 5.0 Center of Excellence will largely be transitioned to fee-for-service and sponsored research with industry. In the Bioproducts Technology Maturation Program, we will pilot whether a “shared pain point” multi-client project model creates a revenue flywheel that supports ever-larger technology maturity projects. We will also use

the grant period to produce trainings and toolkits on Industry 5.0 best practices for forest bioproduct manufacturing from which sales can spread the Tech Hub's insights nationwide. The Entrepreneurship Ecosystem project will transition to a blended revenue model anchored on corporate partnerships, enabled by opportunities to further cluster founders around specific new technology, product applications, or market opportunities. Many of the development activities of the Careers Partnerships for Bioproducts Industries will be integrated existing government, philanthropic, and industry-driven funding streams.

While ambitious, this path is achievable. A similar business model has powered [CPI](#) – a U.K. Catapult Network process innovation center – to grow over 20 years from a staff of 4 to nearly 700, now generating more than £75 million in annual revenue. We have designed for self-sustainability from the start with an approach that is rooted in a long track record of productive collaboration by consortium partners, including through the industry-led FOR/Maine coalition. The Maine Technology Institute's core funding from the state provides a predictable foundation for overall consortium leadership.

**Labor engagement:** Maine's labor unions are a key asset in advancing workforce development opportunities and job quality in the forest bioproducts industry. Leaders from Maine AFL-CIO and the Maine State Building & Construction Trades Council, which together represent more than 46,000 workers across 220 unions, will play a central role in the Advanced Manufacturing Careers Partnership. In this capacity, they will advise on the implementation of the Advanced Manufacturing Talent Roadmap, represent the voice of workers in strengthening job quality in the state, and facilitate career pathways by connecting workers, employers, educational institutions, and labor training centers to help establish and scale certified pre-apprenticeship and registered apprenticeship opportunities. A core function of the partnership would include proactive employer education from the Maine Department of Labor's (MDOL) Bureau of Labor Standards on best practices for advancing job quality, in line with U.S. DOL's [Good Jobs Principles](#).

**Community benefits:** The Tech Hub will foster growth in a forest supply chain tightly interconnected across the identified geography and significantly benefiting disadvantaged communities in Maine, as well as historically underserved populations including women, individuals with disabilities, people of color, rural youth, immigrants, justice-involved individuals, and the recovery community. Forty-five percent of the region's population reside in communities that, per the Biden Administration's Justice40 guidelines, are considered disadvantaged or partially disadvantaged. As new markets are unlocked, timber harvesters in Maine's most rural communities ensure a sustainable source of feedstock wood. Economic growth then flows through to many of Maine's most economically distressed mill towns – which include several consortium members – with assets that make them attractive host sites for new forest bioproducts manufacturing. Tech Hub funds will enable MDF and FOR/Maine to accelerate communities' readiness for investment and infrastructure revitalization. Our workforce programs will build a robust, diverse forest bioproducts talent pipeline through career exploration, apprenticeships, and no- and low-cost certificate and degree programs that are supported by tailored wraparound supports and partnerships with community organizations that work with underserved populations. Innovation-focused "Start Summits" hosted in communities around the region will provide entry points into the forest bioproducts startup economy for talent without current opportunities to turn their promising ideas into new businesses. Consortium members have substantial records delivering inclusive innovation programs. For example, at UMaine, nearly half of participants in the MIRTA accelerator come from groups historically underrepresented in commercialization. At the Roux Institute, 65% of companies in its startup portfolio are led by founders who identify as female, BIPOC, or LGBTQ+. And at MTI, 43% of recovery grants for innovation-economy businesses were deployed into Justice40 designated disadvantaged communities.

**Outcomes:** Through investments reflected in this strategy, the Tech Hub will achieve the following results:

Metric (cumulative milestones)	Year 3	Year 5	Year 10
Innovative, environmentally sustainable forest bioproduct lines reaching commercial production	3	8	20+
New high wage jobs in related industries in region	1,000	2,000	4,000
Net new firm revenues from forest bioproducts in region	\$1 billion	\$4 billion	\$10 billion
Supporting capital investment	\$3 billion	\$5 billion	\$10 billion
New companies achieving first customer and/or investment of at least \$500,000	20	50	100

The Tech Hub’s global competitiveness in forest bioproducts markets will contribute to broader U.S. leadership in fossil-fuel alternative supply chains. If by 2035 global markets reach 50% displacement of conventional product lines in plastic packaging, building materials, and petrochemicals, the U.S. could see net revenue growth of \$530 billion through expansion in biobased manufacturing; if two-fifths of the resulting biobased market is wood-derived, that will equate to \$210 billion in net new revenues nationally.<sup>2</sup>

The consortium will engage in high-frequency data collection and evaluation practices to assess the Tech Hub’s overarching progress toward our expected outcomes. There will be four parts to this work: a business intelligence dashboard reflecting project and consortium progress; discussions of performance improvement opportunities at Steering Committee meetings using [methods of Harvard’s Government Performance Lab](#); annual retrospective impact analysis assessing progress towards top-line goals; and integrating into each of these activities feedback from participants, communities, and impacted populations. This work will be coordinated out of the RIO’s office at MTI and is described in more depth in the Maine Tech Hub Market and Project Leadership component project narrative.

**Housing:** Since 2019, more than \$1 billion in public and private capital has been invested in Maine, supporting the construction of more than 600 new homes, with more than 3,000 homes in the development pipeline. In the Tech Hub region, 94% of these units are reserved for affordability. MaineHousing offers a variety of state-funded rental relief programs to prevent the displacement of lower-income residents, with an additional \$35 million allocated by Governor Mills for the 2024-2025 biennium. Her budget contains another \$35 million to leverage Low-Income Housing Tax Credits and would add an additional \$15 million through the proposed supplemental budget if passed. In 2022, Governor Mills signed into law major zoning reforms that removed regulatory barriers to increased construction and promotes denser development.

**Activities since Phase 1 designation:** Since receiving Phase 1 designation, the consortium has:

- Developed this five-year, \$72 million implementation strategy.
- Added 40 new members, more than doubling our consortium’s size, to broaden reach and impact.
- Secured unencumbered, committed, and unrestricted non-federal match of \$7,201,058 with \$5,534,117.00 from Northeastern University, \$984,850.66 from UMaine, and \$682,090.62 from MTI.
- Secured investment and policy commitments valued at nearly \$630 million, with private sector commitments accounting for more than half of that value. These commitments will leverage our requested federal funding almost 10:1. These commitments equate to more than \$616,000 per 1,000 residents in our region.
- Convened strategy sessions that engaged 31 industry representatives and community participants on our technology, commercialization, and equity strategies.
- Engaged Rebel Global Security to review the consortium’s security capabilities and improve the Tech Hub’s risk mitigation preparedness.

<sup>2</sup> Consortium and Camoin Associates analysis of IBIS World, Grand View Research, Global Market Insights, and Lightcast data.



- Developed a website as a platform for engaging the public, communities, and broader industry in the Tech Hub work.

**Documentation of consortium membership roles and letters of support:** For documentation of member commitments to execute each Tech Hub component project, please see enclosed letters from University of Maine, Northeastern University, Maine Department of Labor, and Maine Technology Institute. For other letters of support and commitment, please see enclosed letters.

**A succinct synopsis of the consortium’s vision for regional economic development, the initiatives and partners needed to achieve that vision, and the outcomes expected from achieving that vision.**

Our consortium partners share a vision that Maine’s *Forest Bioproducts Advanced Manufacturing Technology Hub* will be the nationwide region of choice for firms developing, manufacturing, and selling innovative, climate-forward products derived from forests and other natural sources.

*Consortium members and additional partners:* Led by the Maine Technology Institute, the consortium brings together representatives from **state government** (Maine Governor’s Office, Maine Department of Economic and Community Development, Maine Department of Education, Maine Department of Labor; **higher education** (Northeastern University’s Roux Institute, University of Maine); **industry** (Arcadia Alliance, Blue Highway Growth, BlueTriton/Poland Spring, CapaTec, Energy Impact Partners, Flexible Capital Fund, Folia Materials, Hancock Lumber, Highland Solutions, IDEXX, LaCasse & Weston, Louisiana Pacific, Maine Angels, Maine Forest Products Council, Maine Venture Fund, Manufacturers Association of Maine, Material Impact, Northeast Bio-based Materials Collective, OMX Ventures, P3 Nano Program, Professional Logging Contractors of Maine, Progress Engineering, Safer Made, Sappi, SHoP Architects, Tanbark, Thornton Thomasetti, TimberHP, Two Lanterns Venture Fund, Valmet, Valo Ventures, Xylogen); **economic development** (Ashland Area Economic Development Council, Coastal Enterprises, Entrepreneurship 4 All, Finance Authority of Maine, FocusMaine, FOR/Maine, Greater Portland Immigrant Welcome Center, StartUp Maine, Maine Development Foundation, Maine International Trade Center, New England Forestry Foundation, Our Katahdin, Sunrise County Economic Council, Tech Place); and **labor and workforce training organizations** (AFL-CIO Maine, Boots to Roots, Harold Alfond Foundation Center for the Advancement of Maine’s Workforce, Maine Community College System, Maine State Building and Construction Trades, Maine TREE Foundation, New Ventures Maine, Portland Adult Ed’s New Mainers Resource Center, Rural Aspirations). The Consortium **also includes** Maine MEP, the Northern Forest Center representing CONFIR, an NSF Type-1 Regional Innovation Engine grantee, Oak Ridge National Laboratory, NSF International, the towns of Jay, Lincoln, and Old Town, and RAPID Manufacturing Institute.

*Component projects:* The Tech Hub’s implementation strategy involves investments in 5 projects that form a regional ecosystem of commercialization-enabling resources. Together, they propel a dense cluster of innovators, founders, talent, manufacturers, and markets competitive with any region in the world. To advance technology and build the businesses bringing that technology to market, we will expand technological maturation capabilities available to innovators and launch the country’s most comprehensive forest bioproducts entrepreneurship program. To ensure the region has the workforce and industrial capabilities to produce at global scale, we will strengthen the region’s talent pool through industry-driven career partnerships and establish a first-in-kind Industry 5.0 Center of Excellence for forest bioproducts manufacturing. And we will bridge forest bioproducts innovations with the commercialization resources and partnerships necessary to bring those ideas to market at a globally competitive scale.

*Complementary commitments:* The Tech Hub’s impact will be amplified by investment and policy commitments valued at nearly \$630 million, with private sector commitments accounting for more than half

of that value. These commitments will leverage our requested federal funding almost 10:1. These commitments equate to more than \$616,000 per 1,000 residents in our region.

*Global competitiveness:* The technology currently exists to provide drop-in wood-derived replacements for molded plastic production, alternatives to carbon intensive building products, and alternatives to petrochemical additives in consumer products. It is only a question of solving problems of scale and economy to make them widely commercially viable, specifically: technology trapped in the “valley of death,” market, breadth of market opportunities for forest bioproducts technology, requirements for global scale workforce and production capabilities, and perceived consumer adoption risks. Successfully addressing these barriers through Tech Hub investments will bring a cascade of new forest bioproduct types to mass market scale over the next decade. The Tech Hub’s unique combination of assets will help it retain innovation and manufacturing in these areas as markets develop. The advantages of sustainable forest feedstock, R&D expertise, and manufacturing capacity provide a strong base for traditional industry and innovation clustering effects given the need for rapid iteration on product and production line design.

*Climate/Environment:* Decarbonizing and detoxifying consumer and industrial products is the next frontier in the fight against climate change. Fossil fuel-based feedstocks are used in [96% of manufactured goods](#), with enormous implications for carbon emissions. Federal biotech and plastic innovations strategies call for the scale up of renewable alternatives for products ranging from plastics and paints to asphalt and other construction materials, with domestically produced bioproducts critical for the U.S. to achieve net-zero emissions by 2050 and mitigate the well-documented security risks associated with a warming planet. Wood derivatives are the most promising climate solutions to displace fossil fuel-based materials in many manufactured goods, with significant market opportunities in displacing petroleum-based conventional building products, plastic packaging, and harmful synthetic additives. Using residuals rather than virgin cellulose reduces competition for farmland, eliminates waste, and sequesters carbon while adding value to each harvested log. Our Tech Hub seeks to accelerate adoption of these forest-derived climate solutions.

*Equity:* The Tech Hub will foster growth in a forest supply chain tightly interconnected across the identified geography and significantly benefiting disadvantaged communities and historically underserved populations. As new markets are unlocked, timber harvesters in Maine’s most rural communities ensure a sustainable source of feedstock wood. Economic growth then flows through to many of Maine’s most economically distressed mill towns. Tech Hub funds will enable MDF and FOR/Maine to accelerate communities’ readiness for investment and infrastructure revitalization. Our workforce programs will build a robust, diverse forest bioproducts talent pipeline through career exploration, apprenticeships, and no- and low-cost certificate and degree programs that are supported by tailored wraparound supports and partnerships with community organizations that work with underserved populations. Innovation-focused “Start Summits” hosted in communities around the region will provide entry points into the forest bioproducts startup economy for talent without other opportunities to turn promising ideas into businesses.

*Outcomes:* To achieve global competitiveness in forest bioproducts markets, the Tech Hub will over the next 10 years bring to commercial production 20+ innovative, environmentally sustainable forest bioproduct lines; add 4,000 new high wage jobs in related industries in the region; and achieve \$10 billion in net new firm revenues from forest bioproducts in region.

*Timeline:* The first 3-6 months of our implementation period will focus on ramping up operations, including hiring staff, procuring vendors, developing workplans, and marketing new Tech Hub programs. Most projects will begin program delivery within 6 months of Tech Hub launch. We will annually review results and begin post-grant transition planning activities at the beginning of year 3. Formal grant wind-down activities will occur beginning 12 months before the grant end.