



Driving Decarbonization: A Look Book of Climate Tech in Maryland

Produced in partnership by





Download the latest version of Driving Decarbonization: A Look Book of Climate Tech in Maryland at <https://bit.ly/MDClimateTechBook>.

Dear Friends,

Welcome to the Maryland Climate Tech Look Book. This dynamic guide highlights the exciting companies and organizations that help Maryland achieve its climate goals and become a center for climate tech ventures. Since this sector and the network of companies and organizations are constantly changing, this resource will be continually updated, with the latest version available online at www.mdeia.org.

The Maryland Climate Tech Look Book is produced by the Maryland Energy Innovation Accelerator (MEIA), a Maryland Clean Energy Center (MCEC) program (1). The Look Book is focused on early-stage technology commercialization in partnership with Maryland-based Universities and labs to support the state's clean energy and climate goals. MEIA supports ventures in solar, wind, battery, energy efficiency, grid modernization, and carbon capture utilization and storage (CCUS) fields.

This Look Book presents an overview of diverse ventures building novel technologies that have the potential to help mitigate the effects of climate change. Maryland companies are finding ways to remove carbon from industries such as chemicals, natural gas, building materials, and concrete. They are developing imaginative ways to use new chemistry to build better batteries and other materials with cheaper and more abundant resources. Several Maryland companies are leveraging artificial intelligence, machine learning, and cloud-based technologies to prepare for severe weather or help lower energy usage in buildings. Many of these ventures have started in Maryland's universities, research labs, and entrepreneurs' garages. In addition, the Look Book highlights the growing ecosystem of organizations and programs supporting such ventures.

MEIA, MCEC, and our partners are pleased to celebrate our growing Maryland climate tech ecosystem. We hope you find value in this resource and opportunities to engage with our network.

Sincerely,



Wade Haerle | Director
wade.haerle@mdeia.org



Mike Ducker | Associate Director
mike.ducker@mdeia.org

(1) MCEC is a state corporate instrumentality created by the General Assembly in 2008 with a statute-directed mission to advance clean energy and energy efficiency products, services, and technologies as part of a specific economic development strategy. Learn more at www.mdcleanenergy.org.

Table of Contents

Cleantech vs Climate Tech 3

Maryland Climate Tech Life Cycle 4

Maryland Energy Innovation Accelerator (MEIA) Target Program Match 5


Maryland Climate Tech Companies 6

Summaries of New and Exciting Maryland Technologies in the Labs 19


Maryland Climate Tech Ecosystem Overview of Supporting Programs & Resources 20

Icon Key for Climate Tech Company Focus Area(s)


Noted in Profile Page Footers




Batteries



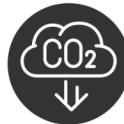
Biomass




Carbon Capture




Carbon Neutral




Carbon Reduction




Renewable Energy




Resilience




Smart Systems



Sustainable Materials



Transportation



Zero Carbon

Cleantech vs. Climate Tech

MEIA looks at cleantech and climate tech as investment asset classes. It's essential to understand their history, definition, and trends to see why MEIA is currently focused on climate tech.

Investors started to heavily support **cleantech** ventures in the early 2000s, which includes any new business model or technology that increases the performance, productivity, and efficiency of production while minimizing negative impacts on the environment. Ventures in this asset class include clean energy, clean air, water treatment, transportation, recycling and waste reduction, supply chain improvement, the built environment, and manufacturing. Because of the long timeframe for investors to see returns from cleantech, a new asset class emerged in 2016 called climate tech. **Climate tech** covers any new business model and technology that mitigates the impacts and drivers of global greenhouse gas emissions (i.e., climate change). Climate tech includes clean energy, carbon removal, and climate management while reducing carbon in food, land use, industrial, transportation, and land use.

There are overlaps between the two assets. Still, some differences with cleantech focus more on clean air, recycling, and clean water, and climate tech focuses more on carbon capture, agtech, and geoengineering. While cleantech investments are small, climate tech investments have risen substantially to \$40 Billion over the last two years. With such a large amount of capital in climate tech, MEIA will continue to focus on this asset class in the near term while open to cleantech companies with commercial promise.

SOURCES:

<https://www.ctvc.co/exits-analysis-clean-tech-climate-tech/>

<https://www.ctvc.co/40b-and-1-000-deals-in-2022-market-downtick/>

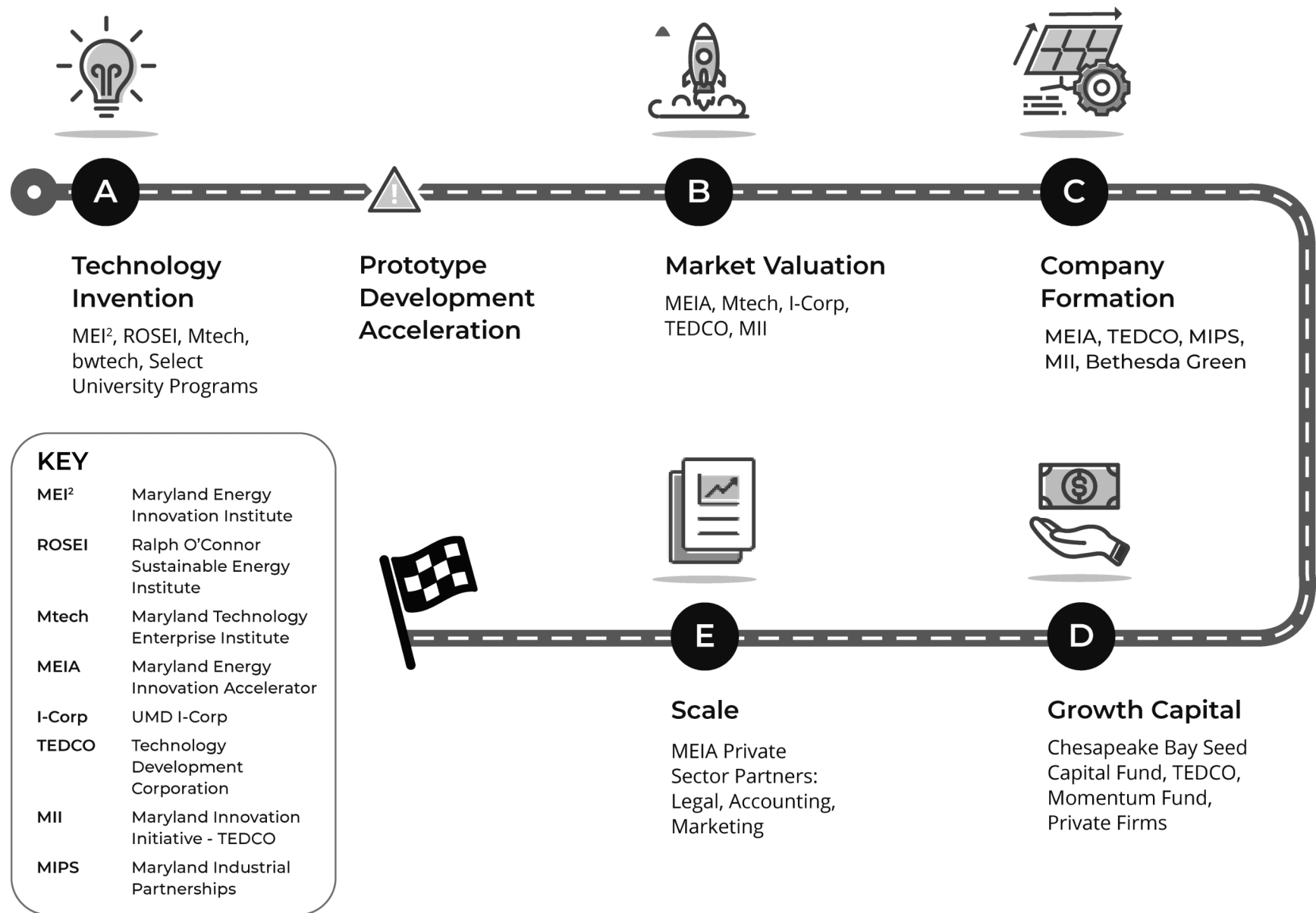
<https://cleanenergyventures.com/clean-energy-venture-capital/climate-tech-is-cleantech-in-need-of-a-rebrand/>

<https://energy.mit.edu/publication/venture-capital-cleantech/>

"While climate tech has a unique set of priorities based on addressing a monumental, global challenge, cleantech is focused on improving humankind's efficiency and interaction with the environment around us."

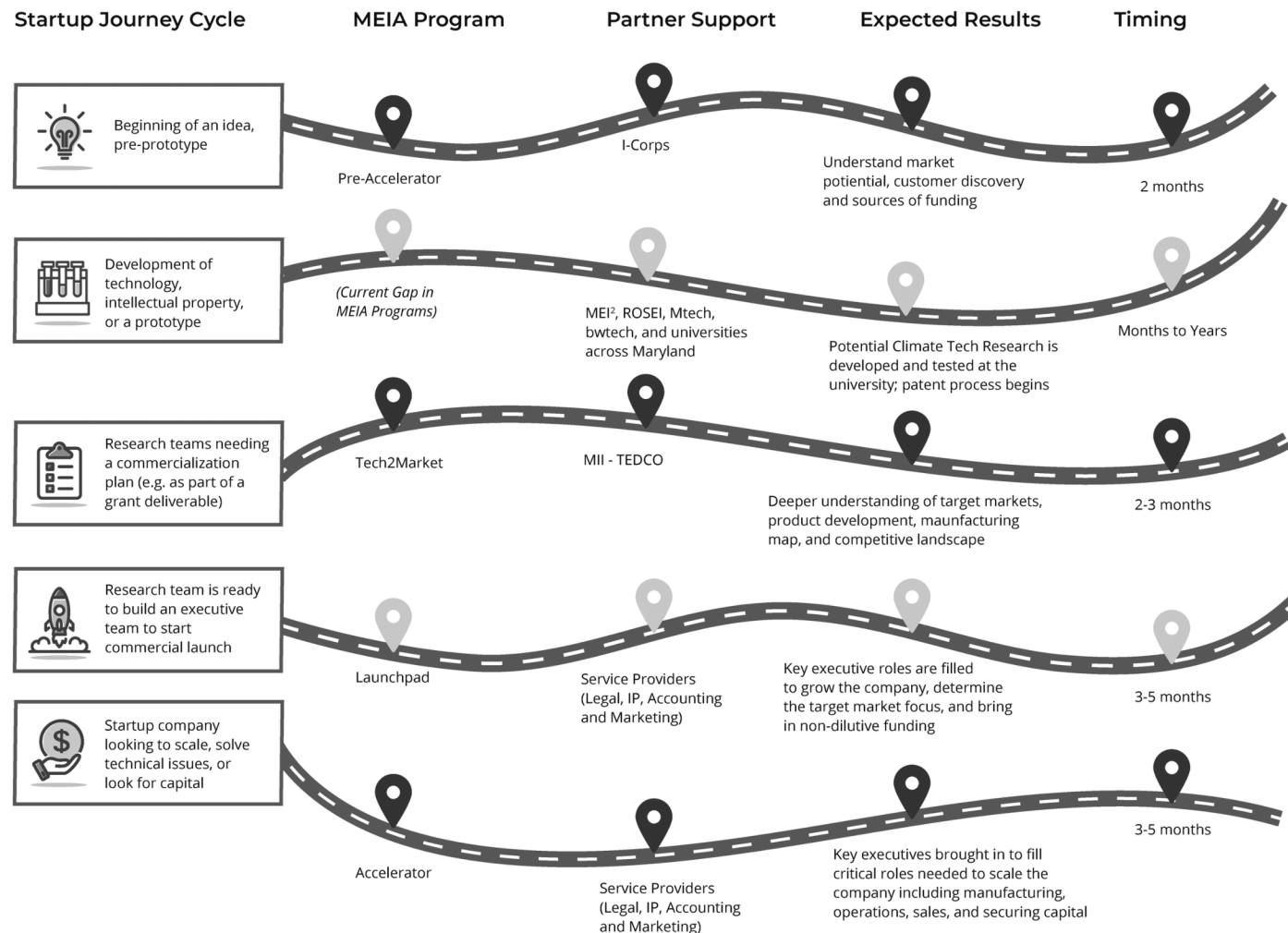
(1) <https://cleanenergyventures.com/>

Maryland Climate Tech Life Cycle



Maryland Energy Innovation Accelerator (MEIA)

Target Program Match



Maryland Clean Tech Companies



Alchemy

www.alchemy.tech

SUMMARY: Alchemy is a University of Maryland and Maryland Energy Innovation Institute startup company developing low-carbon to no-carbon solutions to society's need for electric power and important industrial chemical feedstocks. Alchemy is focused on transforming earth's abundant chemical resources into value-added products via ion-conducting ceramics.

LOCATION: College Park, Maryland

EXECUTIVE SUMMARY: The methane in natural gas is one of the largest contributors to climate change with 80 times the impact as CO₂ on a per molecule basis. Alchemy's technology converts methane into valuable liquid commodity chemicals with no greenhouse gas emissions thus providing a profitable solution to climate change.

Alchemy focuses on the \$60 billion gas-to-liquids (GTL) processing market. The Alchemy reactor represents a step change in process intensification over the existing technology developed decades ago by combining catalysis and gas separation into a single step process, thereby eliminating much of the massive capital requirements to build new GTL plants. The reactor is more efficient and modular, enabling new GTL plants to be closer to end users.

CURRENT HIGHLIGHTS: Shell GameChanger—a program supporting early-stage ideas with the potential to impact the future of energy—selected Alchemy as one of the winners of the Chemicals Decarbonization Challenge 2021 to receive development funding over two years to demonstrate a single-step catalytic membrane reactor. Alchemy was founded by Eric Wachsman, Director of the Maryland Energy Innovation Institute, and William L. Creutz, Centennial Chair in Energy Research at the University of Maryland.



MEET THE TEAM:



Eric Wachsman, PHD
Founder and Executive Chair



Rodger McKain, PHD
CEO



AquaLith

www.aqualith.net

SUMMARY: AquaLith Advanced Materials, Inc. is developing high-energy density and low-cost materials for lithium-ion batteries, including new cathode, anode, and electrolyte technologies.

LOCATION: Columbia, Maryland

EXECUTIVE SUMMARY: In 2020, the lithium-ion global market was approximately \$37 billion (1), projected to reach \$193 billion by 2028. AquaLith takes advantage of this fast-growing market by developing safer technologies with a higher energy density, less expensive, and operating efficiently at colder temperatures. AquaLith's first commercial product is a cathode material that demonstrates 60% improvement over state-of-the-art lithium-ion batteries and doesn't contain nickel or cobalt. AquaLith's new material chemistries will empower consumer electronic devices and electric vehicles to spend significantly less time charging their batteries. AquaLith battery technology has been demonstrated to work efficiently in colder weather in which current lithium-ion batteries can struggle.

CURRENT HIGHLIGHTS: In 2021, AquaLith raised \$750,000 from the Maryland Momentum Fund (MMF) and a consortium of private investors (2). This funding will allow AquaLith to expand its development laboratory and start the production of sample products. AquaLith was developed at the University of Maryland based on the work of Chunsheng Wang, Robert Franklin, and Frances Riggs Wright, Distinguished Chair, Department of Chemical & Biomolecular Engineering, in collaboration with Kang Xu, ECS Fellow, ARL Fellow. The technology includes a new ultra-high energy cathode, a novel silicon anode, and a non-flammable aqueous electrolyte.



MEET THE TEAM:



Gregory Cooper
Co-founder and CEO



Chunsheng Wang
Co-founder

(1) <https://www.fortunebusinessinsights.com/industry-reports/lithium-ion-battery-market-100123>

(2) <https://www.usmd.edu/newsroom/news/2181>



BrightWave

www.brightwavellc.com

SUMMARY: BrightWave's next-gen bioreactor systems generate lab-quality algae biomass – one of the world's most versatile feedstocks – at an industrial scale large enough to significantly impact several global challenges.

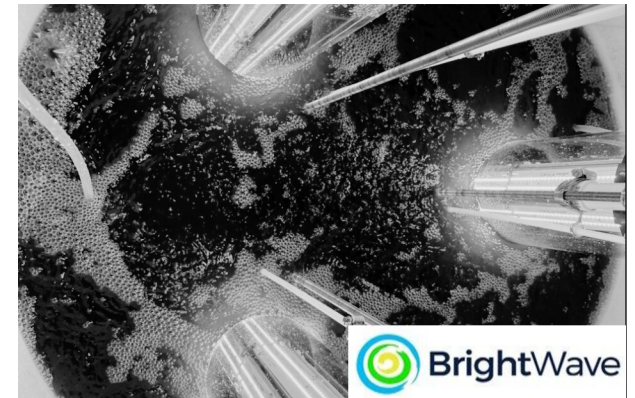
LOCATION: Clarksville, Maryland

EXECUTIVE SUMMARY: The market for algae is currently \$20 billion, with an expected annual growth rate of nearly 11%. The current algae market is largely based on its use in animal and aquaculture feed, human food, organic farming, and fertilizer products. Because of this super plant's market potential, more capital is being invested in high-quality, low-cost algae production (1).

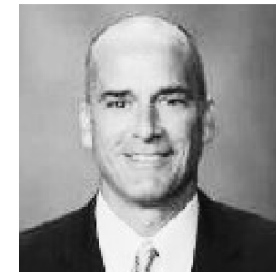
Even more exciting is algae's potential to fight food insecurity and climate change via applications such as CO2 removal (2), CO2 displacement in all types of manufacturing (3), and biofuels (4). These uses will enable wider adoption and larger markets of algae biomass.

BrightWave has developed and patented an innovative microalgae photobioreactor (PBR) that produces lab-quality biomass at an industrial scale with the smallest land footprint in the industry. The PBRs are internally illuminated and self-cleaning. They reduce downtime and contamination risk to practically zero. BrightWave's PBRs outperform existing algae cultivation platforms by a wide margin.

CURRENT HIGHLIGHTS: BrightWave's PBRs are being deployed into multiple industries – food, medical, wastewater treatment, sustainable aviation fuels, and even a carbon-negative cement manufacturing venture. The PBRs were tested and certified at the University of Maryland Institute for Marine and Environmental Technology.



MEET THE TEAM:



Tim Shaw
Co-Founder, President



Ken Peretti
Co-Founder, CEO

(1) <https://www.forbes.com/sites/jenniferhicks/2018/06/15/see-how-algae-could-change-our-world/?sh=5e15adbb3e46>

(2) <https://www.azocleantech.com/article.aspx?ArticleID=1499>

(3) <https://www.dezeen.com/2022/07/29/algae-grown-limestone-route-carbon-negative-concrete-architecture-news/>

(4) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3152439/>



Carbon Lockdown

www.carbonlockdown.net

SUMMARY: Carbon Lockdown Project (CLP) was created to facilitate sustainable carbon sequestration technologies through wood harvesting and storage.

LOCATION: College Park, Maryland

EXECUTIVE SUMMARY: Removing carbon is critical to the global strategy to confront climate change. There has been an investment of \$28 billion in late-stage projects in carbon removal, utilization, and storage (CCUS) since 2010 (1). Several high-profile companies like Stripe, Google, and Meta have also committed to investing in CCUS.

The CLP has developed a practical, low-cost approach to scale carbon removal called Wood Harvesting and Storage (WHS). WHS is a hybrid natural/engineering technique combining human ingenuity with natural efficiency by burying woody biomass for long-term sequestration. Dr. Zeng's research estimates up to 10GtCO₂ carbon sequestration potential globally, enough to offset 27% of current fossil fuel emissions. Utilizing wood residuals in Wood Vaults in Maryland can offset all the greenhouse gas emissions from its agriculture sector (2).

The CLP has four primary goals: 1) Design, test, and evaluate technologies to sustainably sequester carbon that is verifiable and long-lasting. 2) Conduct projects and advise other entities in practicing carbon sequestration cost-effectively and sustainably 3) Monitor and verify carbon sequestration projects; issue 'Carbon Lockdown' certificates. 4) Serve as a platform for exchanging ideas, education, and professional connections.

CURRENT HIGHLIGHTS: The CLP is implementing its first project (3) in Maryland to bury and durably sequester 5000 tons of CO₂-equivalent (tCO₂e) of coarse woody biomass in a specially engineered structure called a Wood Vault listed on Puro.earth (4). The venture was founded by Dr. Zeng, the world's leading expert on this emergent carbon dioxide removal pathway.



MEET THE TEAM:



Ning Zeng
Co-Founder and
Head of Science

(1) <https://www.iea.org/reports/ccus-in-clean-energy-transitions/a-new-era-for-ccus>

(2) <https://www.youtube.com/watch?v=zOO9vspK2fE>

(3) <https://puro.earth/accelerate/carbon-lockdown-potomac-project-1-100187>

(4) <https://puro.earth/accelerate/carbon-lockdown-potomac-project-1-100187>



EDAC Labs

www.edaclabs.com

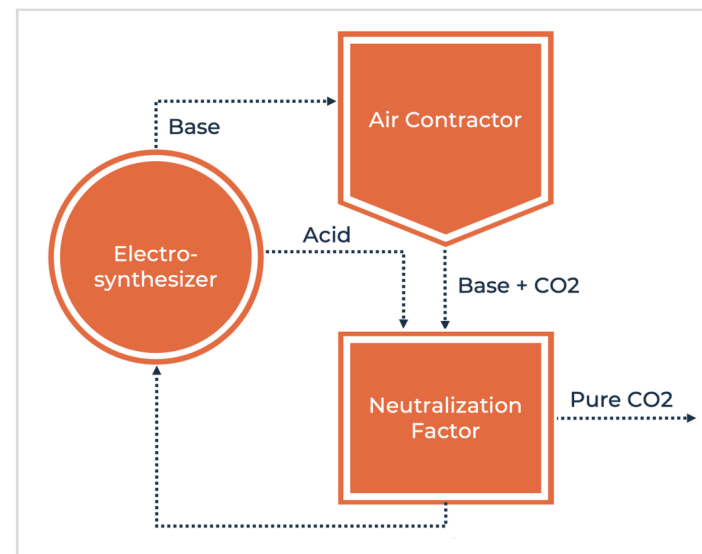
SUMMARY: EDAC Labs' technology performs deceptively simple direct air capture using acid/base chemistry.

LOCATION: Baltimore, Maryland

EXECUTIVE SUMMARY: EDAC Labs addresses climate change by removing carbon dioxide from the atmosphere. All IPCC 1.5-degree scenarios call for negative emissions. Cost-effective direct air capture negates emissions from hard-to-abate sectors such as transportation, cement, and steel.

EDAC Labs has developed an electrochemically driven way to make acid and base at unprecedentedly low energies and capital costs. It does this at room temperature and pressure using non-toxic materials. When applied to direct air capture, this "electrosynthesizer" device enables a simple, closed-loop process to capture, release and regenerate the captured solution. EDAC Labs will mass-produce electrosynthesizers and assemble carbon capture systems for sale to project developers. EDAC Labs targets a price per ton captured of less than \$100 as early as 2026.

CURRENT HIGHLIGHTS: EDAC Labs is a spin-out of Johns Hopkins University School of Engineering. It is led by CEO James Lavin, CTO Professor Chao Wang, and COO Brian Toll (pictured left to right). EDAC Labs recently demonstrated a continuously operating 1KG/day CO₂ direct air capture system in Dr. Wang's lab at Johns Hopkins University. Its next milestone is a 10KG/day fully integrated, continuous carbon capture system.



MEET THE TEAM:



James Lavin
CEO



Prof. Chao Wang
CSO



Brian Toll
COO



HighT-Tech

www.hight-tech.com

SUMMARY: HighT-Tech LLC is a powerful and disruptive synthesis platform for shockingly synthesizing various materials, including ceramics, high entropy alloys, and catalysts.

LOCATION: College Park, Maryland

EXECUTIVE SUMMARY: The Catalyst market was over \$37 billion in 2021 (1). This market includes Ammonia, Refinery Hydrotreating, autocatalyst, and fuel cells. The processing of these chemicals is harmful to the environment; chemical and petrochemical processes emit 5.8% of greenhouse gas emissions (2).

HighT-Tech LLC provides disruptive materials science-based technologies derived from the novel shock synthesis method and ultrafast high-temperature sintering (UHS) technique. HighT-Tech's patented manufacturing and tuning of high entropy catalyst materials will create high-performance, perfectly mixed, and stable multi-element catalysts. This technology enables energy-efficient, clean, and low-cost catalyst manufacturing; enables the discovery of new materials and performance optimization; enables multiple catalyst functions within one material; and enables alloying of low-cost elements to replace noble metals. By doing this, HighT-Tech manufacturing reduces the overall cost and energy use. For example, in a nitric-asset fertilizer plant, HighT-Tech will cut precious metal count by over 50% and double the catalyst lifetime while reducing carbon emissions, saving \$1 million in operating costs.

CURRENT HIGHLIGHTS: HighT-Tech is leading a new ARPA-E OPEN 2021 project with the University of Maryland and Johns Hopkins University to create scalable manufacturing processes of high-entropy alloy catalysts (HEA) for ammonia oxidation with enhanced catalytic activity, selectivity, and stability. The company was started in 2019 to commercialize transformative technologies from the University of Maryland and Johns Hopkins University.

(1) <https://www.precedenceresearch.com/catalyst-market>

(2) [https://ourworldindata.org/ghg-emissions-by-](https://ourworldindata.org/ghg-emissions-by-sector#:~:text=Energy%20use%20in%20industry%3A%2024.2%25&text=Chemical%20%26%20petrochemical%20(3.6%25)%3A%20energy,oil%20and%20gas%20extraction%2C%20etc.)

[sector#:~:text=Energy%20use%20in%20industry%3A%2024.2%25&text=Chemical%20%26%20petrochemical%20\(3.6%25\)%3A%20energy,oil%20and%20gas%20extraction%2C%20etc.](https://ourworldindata.org/ghg-emissions-by-sector#:~:text=Energy%20use%20in%20industry%3A%2024.2%25&text=Chemical%20%26%20petrochemical%20(3.6%25)%3A%20energy,oil%20and%20gas%20extraction%2C%20etc.)



MEET THE TEAM:



Bob Gatte
CEO



InventWood

www.inventwood.com

SUMMARY: InventWood® is an innovator of advanced wood materials, addressing climate change while providing material technologies with better performance, lower costs, and greater sustainability over commonly used alternatives.

LOCATION: College Park, Maryland

EXECUTIVE SUMMARY: The production of materials like steel and cement is responsible for ~15% of the global emissions that drive climate change. Despite this, the steel demand is massive, with the global structural steel market representing \$290 billion in 2019 (1). At the same time, architects and builders are looking for alternatives that can provide performance and cost advantages over steel, given its numerous shortcomings.

InventWood is to offset further ecological damage caused by steel by replacing it with materials made from cellulose, the world's most abundant biomaterial. In other words, as all InventWood materials are made from wood or other plant materials, they can sequester carbon, helping address the causes of climate change. InventWood's main product, MettleWood, is 50% stronger than commonly used structural steel, 80% lighter, and 50% less expensive than steel. The structure of MettleWood® gives it 10x the stiffness of regular wood and natural resistance to fire, moisture, and termites. Best of all, MettleWood® can be made from fast-growing wood species that can be sourced sustainably and inexpensively.

CURRENT HIGHLIGHTS: InventWood was recently selected for a \$20 million ARPA-E SCALEUP award and gained its first commercial revenue in 2020. Because its product is so novel, it has been covered by media covering innovation like FastCompany, Nature, New Science, and Scientific America. InventWood was founded in 2016 by Dr. Liangbing Hu and Dr. Amy Gong to commercial cellulosic material innovations discovered at the University of Maryland Department of Materials Science and Engineering (MSE).

(1) <https://www.statista.com/statistics/1109558/structural-steel-market-size-worldwide/>



MEET THE TEAM:



Liangbing Hu, Ph.D. - Founder
Josh Cable, CFA - Chief Executive Officer
Amy Gong, Ph.D. - Chief Science Officer



Ion Storage Systems

www.ionstoragesystems.com

SUMMARY: ION Storage Systems creates solid-state lithium metal batteries to power the future of electrification.

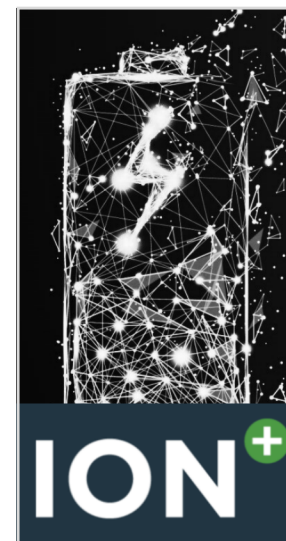
LOCATION: Beltsville, Maryland

EXECUTIVE SUMMARY: The global market for 2022 for lithium-ion batteries is almost \$50 billion, and with so many new products using batteries, the market is expected to grow by 18% per year. By 2030, The market's expected to be almost \$183 billion (1).

ION provides safe, fast charging, simple, energy-dense, cost-effective, and versatile solid-state battery technology. An essential part of ION's platform is its non-flammable ceramic structure. Reducing fires will lower overhead and cost for companies that produce ION batteries. Additionally, by focusing on the design of the anode/electrolyte structure, ION has met next-generation performance metrics, including high-energy density, strong cycling performance, wide temperature range, and fast charging. The manufacturability of ION's technology also sets the company apart as it borrows from existing lithium-ion manufacturing processes or already-scaled ceramic processing.

CURRENT HIGHLIGHTS: ION's batteries are focused on the transportation, defense, and aerospace industries. The company has partnered with several automakers, the Defense Logistics Agency, and Lockheed Martin, with plans to make 1 million phone-sized batteries starting this year. ION is the only solid-state technology to achieve ARPA-E and the DOE Vehicle Technologies Office fast-charge goals for Li-cycling current density at room temperature. In 2022, the company closed a \$30 million Series A investment round.

(1) <https://www.bloomberg.com/press-releases/2022-06-07/lithium-ion-battery-market-size-worth-182-53-billion-by-2030-grand-view-research-inc>



MEET THE TEAM:



Ricky Hanna - CEO & Board Director
Dr. Greg Hitz - CTO & Founder
& Team



Ionic Devices

www.mdeia.org/participating-startups

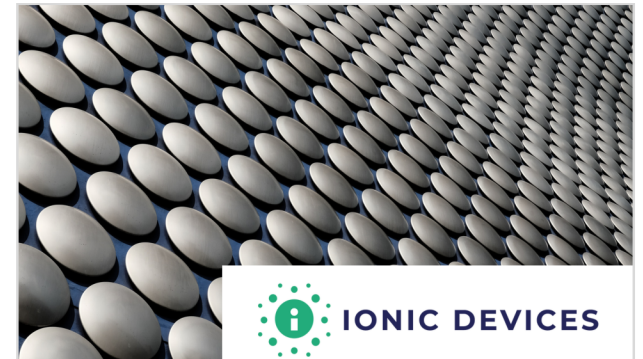
SUMMARY: Ionic Devices is commercializing a novel methodology for lithium-ion batteries by leveraging semiconductor manufacturing methods.

LOCATION: College Park, Maryland

EXECUTIVE SUMMARY: The battery value chain is expected to grow by 10 from 2020 to 2030 to an annual revenue of \$410 billion. The expected growth has catalyzed an unprecedented level of investment in battery manufacturers (1).

To ensure these risky investments into Battery manufacturing succeed, Ionic Devices is commercializing a novel methodology to produce lithium-ion batteries by leveraging semiconductor manufacturing methods. These batteries have energy and power metrics that are orders of magnitude higher than conventional solid-state systems and are comparable to current market standards for liquid systems. Ionic Devices produce safe, solid batteries with 15-30X more energy at orders of magnitude higher power.

CURRENT HIGHLIGHTS: Thus far, 2 patents have been issued for this technology, and two other patent applications are in process. Keith Gregorczyk, Assistant Research Scientist of Materials Science and Engineering at the Institute for Research in Electronics & Applied Physics at the University of Maryland, led the project. Ionic Devices works result from 15 years of DOE-funded research with a developed prototype.



MEET THE TEAM:



Dr. Keith Gregorczyk, UMD
Founder, CEO

(1) <https://www.mckinsey.com/capabilities/operations/our-insights/power-spike-how-battery-makers-can-respond-to-surging-demand-from-evs>



Liatriis

www.liatris.biz

SUMMARY: Liatriis is delivering the cleanest and fastest energy savings for businesses and consumers by mass-producing high-performance, low-cost composite insulation that is easy to install, environmentally friendly, non-flammable, and non-toxic.

LOCATION: Bethesda, Maryland

EXECUTIVE SUMMARY: Liatriis insulation helps scale up advanced building construction to be easier, faster to produce, and more affordable for owners. Liatriis uses proprietary composite materials which are high performance, well-suited to mass production, and environmentally friendlier than conventional insulation materials.

Liatriis has successfully produced the only industrially engineered composite material which is fully non-combustible per ASTM E136 and NFPA 285 standards.

Kenneth Research estimated the global market for fireproof insulation at \$20 billion annually. Increasingly strict fire requirements in the International Building Code now call for fully non-combustible products in key mid-rise and high-rise building types. The only fully non-combustible insulation product available today is mineral wool, which is significantly heavier and more challenging to install than the board-based insulation produced by Liatriis. Liatriis has also demonstrated products in R&D which are greater than R-8 / inch, the highest performance of any building insulation product.

CURRENT HIGHLIGHTS: Liatriis was founded in 2018 and signed a co-development agreement and supply agreement with Sto in 2019 (a major producer of exterior wall panels) to secure a first customer for its non-combustible insulation product. In 2021, Liatriis closed a \$1M Seed Round led by the MD Momentum Fund. Since then, Liatriis has received additional validation through major DOE and NSF grants totaling >\$3.2M. Liatriis's team is led by Frank and Arthur Yang, utilizing Arthur's 30+ years running R&D and scale-up operations in the insulation industry and Frank Yang's 15+ years of fundraising / strategic partnership and operating experience as a multiple-time founder.

(1) <https://www.linkedin.com/in/fcyang/>



MEET THE TEAM:



Frank Yang
Co-founder & CEO



Dr. Arthur J. Yang
Co-founder & CTO



Living Canopies

www.livingcanopies.com

SUMMARY: Living Canopies is a company that designs products to provide a more excellent shade and prettier sight for your outdoor space.

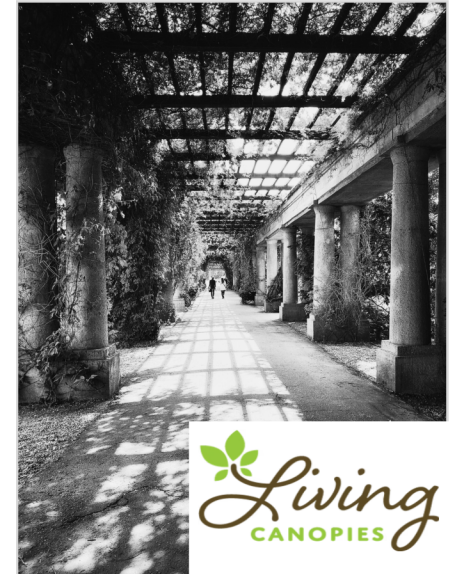
LOCATION: University Park, Maryland

EXECUTIVE SUMMARY: Urban areas become heat islands that experience higher temperatures because of the infrastructure built around them, absorbing and remitting the sun's heat. Because of heat recycling, daytime temperatures in urban areas can be 1–7°F higher than in outlying areas (1). When the Sun shines on traditional umbrellas with nylon canopies, the canopy can heat up to 120°F or more.

Living Canopies is a startup that is revolutionizing the way cities approach mobility. Their flagship product, the Cool Green Shelter for Transit Stops, is designed to address the growing need for public mobility options in cities and provide sustainable and equitable economic opportunities for all city residents. Living Canopies patent-protected design increases ridership, enhances customer experience, and reduces greenhouse gas emissions, making it a viable and attractive solution for cities and transit authorities. Their innovative shelters also incorporate solar power, a living green roof, device charging, and rainwater harvesting technologies. The company's 5-year goal is to have enough Green Shelters deployed in the market, which will result in a GHG reduction of 8000 MT-CO₂/y, 5.8 million new rides per year, storage of 9.3 million liters of stormwater per year, production of 2.5 GWh of solar electricity per year and a total cooling reduction of 1.3 million cooling degree-days. Living Canopies products will revolutionize how cities approach mobility.

CURRENT HIGHLIGHTS: Living Canopies is working with several city governments to support a better living environment for their citizens. The company was founded by Dave Tilly, an Associate Professor at the University of Maryland specializing in Ecological Technology Design.

(1) <https://www.epa.gov/heatislands#:~:text=Heat%20islands%20are%20urbanized%20areas,as%20forests%20and%20water%20bodies.>



MEET THE TEAM:



David R Tilley -
CEO & Co-founder



Manta Biofuel

www.mantabiofuel.com

SUMMARY: Manta Biofuel is a start-up biotechnology company using algae to make a cost-competitive renewable replacement for crude oil.

LOCATION: Owings Mills, Maryland

EXECUTIVE SUMMARY: Manta was founded with the ultimate goal of converting algae into carbon neutral biofuel. In the quest to make this dream a reality, they realized their cutting-edge magnetic separation technology could also be used to quickly and economically clean polluted water. In this process, they discovered a way to address two environmental problems: water pollution and carbon emissions.

Cleaning water is a \$300 billion industry, and large market segments are not being served. Since 2018, nearly two-thirds of all wastewater treatment lagoons have at least one pollutant exceeding EPA standards, often caused by excessive growth algae (1). These EPA compliance violations can mean hefty fines or even jail time. Addressing these EPA violations often requires the installation of new equipment, taking years and costing \$5 million or more. Manta's cutting-edge process uses magnetic sand, magnetite, and powerful magnets to remove >90% of contaminants, like algae and phosphorus, from the water. The mobile approach gives us access to markets that could not be previously addressed, such as rapid treatment of acute water problems nearby. Their solution can be deployed on an as-needed basis for as little as \$10K per month. This low cost allows customers like wastewater operators to quickly and cost-effectively address their problems without spending millions of dollars to upgrade facilities. Manta can use the algae removed from these jobs as a feedstock to make biofuel.

CURRENT HIGHLIGHTS: Manta Biofuel holds patents and trade secrets, has received grants from the U.S. Department of energy, and has raised capital through individual and strategic investors. In 2022 they launched a water treatment service and quickly gained solid traction. In Q3 2022, they achieved a major revenue milestone with 3 paid pond treatment projects for the Columbia Association in Maryland.

(1) <https://www.epa.gov/system/files/documents/2022-06/universe-lagoons-report-2022.pdf>



MEET THE TEAM:



Chris Lindsay, MS - Chief Executive Officer

Ryan Powell, Ph.D. - CTO and Founder

John Sturgis - Lead Engineer

Sanjana Dhananjaya, MS - Biologist

Morgan Kaumeyer, MS - Technical Field Manager

Kerry Powell - Grants Manager



New and Exciting Maryland Technologies in the Labs

FlexiCharge is a novel technology that generates power by utilizing the temperature difference between the human body and ambient air called a thermoelectric generator (TEG).



OPPORTUNITY: Wearable devices are one of the hottest markets and are expected to grow by 15% per year and reach \$186 billion in 2030 (1). This market opportunity is creating opportunities for Flexicharge to ensure there is 24/7 reliable power available to these devices.

CURRENT HIGHLIGHTS: FlexiCharge is founded by Dr. Deepa Madan, an Assistant Professor of Engineering at the University of Maryland Baltimore County. Dr. Madan has developed and patented safe, flexible, and high-performance rechargeable zinc batteries (RZB) using safe and biodegradable chitosan gel electrolytes.

Turbine Blade Vibration is developing a novel technology to measure the full-field vibration of a rotating wind turbine blade.



OPPORTUNITY: Wind Energy is the 2nd biggest and fastest-growing renewable technology being leveraged (2). Blades are smaller for onshore wind to be aligned with local community desires, so keeping the wind turbines working is essential to make onshore wind a competitive energy source.

CURRENT HIGHLIGHTS: Turbine Blade Vibration is founded by Weidong Zhu, a Professor of Mechanical Engineering at UMBC and inventor of a novel technology to measure the full-field vibration of a rotating wind turbine blade.

(1) <https://www.bloomberg.com/press-releases/2022-11-28/wearable-technology-market-to-hit-186-14-billion-by-2030-grand-view-research-inc>

(2) <https://www.iea.org/reports/wind-electricity>



Maryland Climate Tech Ecosystems Overview

The Maryland Climate Tech ecosystem is small but growing. The ecosystem starts with Maryland Universities.

The University of Maryland and John Hopkins have state-of-the-art labs that leverage brilliant professors and researchers working to develop and commercialize novel inventions or technologies. Entrepreneur Support Organizations (ESO) help commercialize university inventions to climate ventures by connecting them with markets, executive support, mentors, and investors. Here is a list of the organizations helping Maryland Climate Tech ventures grow.

Maryland Energy Innovation Accelerator



www.mdeia.org

PARTICIPANT TARGET: MEIA focuses on early-stage technology commercialization in partnership with Maryland-based Universities and labs to support Maryland's clean energy and climate goals. MEIA supports companies working in the solar, wind, battery, energy efficiency, grid modernization, and CCUS fields and those working with any other technology that reduces greenhouse gas emissions or provides negative emissions benefits in the electric, oil and gas, residential, commercial, or industrial sectors.

PROGRAMS OFFERINGS: MEIA has three major programs to support Maryland climate tech companies:

PRE-ACCELERATOR PROGRAM, a two-month, part-time course. As part of the program, each startup team is matched with an appropriate executive in the energy field, called an Energy-Executive-in-Residence (EEIR). Each team performs customer discovery and develops a business model canvas to assess market interest and inform product development.

LAUNCHPAD, a program in which MEIA recruits and matches each startup team with up to two EEIRs to help drive the company's commercialization. The EEIR(s) works with their team to perform deep customer discovery, develop a business model canvas, and progress to a full commercialization plan and pitch deck. Launchpad program aims to validate product-market fit and identify a CEO to partner with the inventor to launch the business.

THE ACCELERATOR PROGRAM, for which MEIA recruits one or more EEIR(s) to fill specific roles or solve problems for participating startups. MEIA connects startups to partners and funders to accelerate their trajectory to becoming investible companies.

In addition, MEIA leverages its business service partners to support legal, intellectual property protection, accounting, and marketing support.

Maryland Energy Innovation Institute (MEI²)

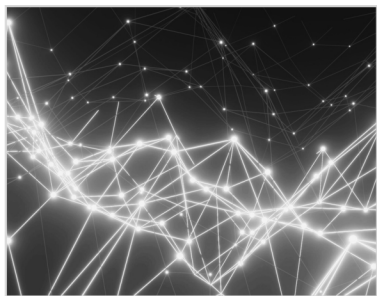


www.energy.umd.edu

PARTICIPANT TARGET: MEI² focuses on commercializing technologies from the Maryland University System and other academic research institutions in the state.

PROGRAM OFFERINGS: In addition to promoting and coordinating energy and environmental research across all state academic research institutions, the MEI² provides critical infrastructure to enable climate tech breakthroughs to become commercially viable companies, thereby stimulating economic growth and improving millions of lives across the state of Maryland. MEI² awards \$600K annually in energy seed grant funding and has helped launch 20 companies in the state.

Examples of MEI² Supported Startups



ION STORAGE SYSTEMS has developed a groundbreaking 3D ceramic electrolyte architecture that addresses the key issues hindering the commercialization of solid-state batteries (1). ION's non-flammable technology offers the safe operation, greater abuse tolerance, and volume and weight reduction.

(1) <https://ionstoragesystems.com/>

(2) <https://www.aqualith.net/>



AQUALITH ADVANCED MATERIALS, INC is developing high-energy density and low-cost materials for lithium-ion batteries, including new cathode, anode, and electrolyte technologies (2). The technology utilized in these batteries allows for the storage of significantly more energy and offers lower production costs since they are formulated without transition metals. The water-based electrolyte dramatically reduces the risk of fire in the event of a short circuit.

Ralph O'Connor Sustainable Energy Institute (ROSEI)



Energy at Hopkins

www.energyinstitute.jhu.edu

PARTICIPANT TARGET: ROSEI brings together technical researchers and social scientists across John Hopkins University to create and implement scalable, renewable energy technologies.

PROGRAM OFFERINGS: ROSEI creates a focal point for energy-related research and educational programs across John Hopkins University. In addition to integrating efforts to advance sustainable energy technologies, it aims to educate future energy leaders and support implementation, markets, and policies that promote an affordable and equitable green energy future for a more resilient world. Finally, ROSEI also offers grants to its research affiliates.

Examples of Technologies Coming Out of ROSEI



CUPTECH, a catalytic hydrocracking process that converts mixed plastics into the chemicals benzene, toluene, and xylene



EDAC Labs, deceptively simple direct air capture using acid/base chemistry (1).



ETCH, is an innovative chemical process to generate low-cost hydrogen by splitting natural gas into hydrogen and solid carbon

(1) <https://edaclabs.com/>

Maryland Industrial Partnerships (MIPS)

www.mips.umd.edu

PARTICIPANT TARGET: For Maryland-based startups, businesses, non-profits, that want to leverage the R&D capabilities of the University System of Maryland (USM). MIPS mobilizes inventive minds and extensive laboratory resources of the USM to create and develop the new products that feed the growth of Maryland businesses.

PROGRAM OFFERINGS: MIPS provides funding, matched by participating companies, for university-based research projects that help the companies develop new products. The program is administered at the flagship campus of the University of Maryland, College Park. It works throughout the 12 member institutions of the University System of Maryland, Morgan State University, and St. Mary's College. In these academic-industrial, public-private partnerships, MIPS connects the resources of the Maryland public universities to businesses from all parts of Maryland.

MIPS projects are not basic research but translational work that leads to new or improved products. The program funds can leverage the facilities, resources, and expertise within Maryland's public universities to create new products and opportunities. In the 36 years since the program started, 486 faculty researchers have worked with 678 Maryland companies to help develop new products, which has led to \$48B in company revenues. Through its partnership with the Maryland Department of Natural Resources, some of MIPS' funding is targeted specifically for Climate Tech R&D.

Maryland Momentum Fund

www.momentum.usmd.edu



PARTICIPANT TARGET: The Maryland Momentum Fund co-invests in early-stage startups affiliated with the University System of Maryland (USM).

PROGRAM OFFERINGS: Momentum Fund will make investments in the range of \$150,000 to \$250,000, with a maximum of \$500,000. These investments are equity purchases or convertible notes. The company must be valued at less than \$15 Million with solid market traction and a management team. The Maryland Momentum Fund is a co-investor, so the company must secure additional investment.

Maryland Technology Enterprise Institute (Mtech)



A. JAMES CLARK
SCHOOL OF ENGINEERING

MARYLAND TECHNOLOGY
ENTERPRISE INSTITUTE

www.mtech.umd.edu

PARTICIPANT TARGET: Mtech supports the University of System Maryland students and researchers and Maryland entrepreneurs. Mtech programs provide knowledge of how to successfully launch companies and guide aspiring and existing entrepreneurs through the entire lifecycle of launching and maintaining technology-based ventures.

PROGRAMS OFFERINGS: Mtech has a large portfolio of programs to guide aspiring and existing entrepreneurs through the entire lifecycle of launching and maintaining technology-based ventures, and they support technology product development partnerships in both fledgling and mature ventures. Some relevant programs for climate tech and cleantech solutions in our state include:

Chesapeake Bay Seed Capital Fund invests \$100,000 to \$500,000 in innovative solutions in Batteries, Agritech, Renewable Energy, Electric vehicles, Stormwater Solutions, Air Emissions, and Natural Filters (1).

Mtech Ventures is a University of Maryland incubator for technology-based innovations commercialized at the university (31).

UMD I-Corps provides real-world training on incorporating innovations into commercially viable companies to solve societal problems. The curriculum is based on the Lean Startup framework, through which researchers can better understand the market potential of an innovation (2).

(1) <https://www.mtechventures.umd.edu/chesapeake-bay-seed-capital-fund>

(2) <http://icorps.umd.edu/>

TEDCO

www.tedcomd.com

PARTICIPANT TARGET: TEDCO provides funding, resources, and connections that early-stage technology companies need to thrive in Maryland.

PROGRAM OFFERINGS: TEDCO has several funds and programs to support Maryland entrepreneurs. Some relevant capital funds for climate and cleantech ventures in the state include:

Maryland Innovation Initiative (MII) provides up to \$415,000 of grant funding for the commercialization of technologies through technology validation, market assessment, and the creation of startup companies in Maryland based on technology from a Qualified University (1).

TEDCO Seed Funds invest from \$100,000 to \$500,000 in Maryland companies that show promise of becoming venture-fundable companies or sustainable through customer revenue (2).

TEDCO Social Impact Funds invest up to \$200,00 to engage and invest in economically underserved founders and communities (3).

TEDCO Venture Funds invest between \$500,000 to \$1.5 million fund, which is focused on growing the next generation of outstanding early-stage businesses in Maryland (4).

(1) <https://www.tedcomd.com/funding/maryland-innovation-initiative>

(2) <https://www.tedcomd.com/sites/default/files/2022-10/Seed%20Funds%20Fact%20Sheet%202022.pdf>

(3) <https://www.tedcomd.com/funding/social-impact-funds>

(4) <https://www.tedcomd.com/sites/default/files/2023-03/Venture%20Funds%20Fact%20Sheet.pdf>

Bethesda Green



www.bethesdagreen.org

PARTICIPANT TARGET: Founders building for-profit business models for innovative and sustainable solutions to environmental and social challenges and ensuring compatibility between economic development and environmental protection around Montgomery County.

PROGRAM OFFERINGS:

INCUBATOR – Through this year-round program, Bethesda Green guides new entrepreneurs through the hurdles of early-stage business development.

ACCELERATOR – The Accelerator program includes high-touch coaching and an intensive curriculum.

RESIDENCY PROGRAM – Select members of the Accelerator program may receive financial awards from Bethesda Green and enter the Residency program.

AMPLIFIER PROGRAM – The Amplifier Program helps entrepreneurs to grow their teams, strengthen their business models, and expand their networks of customers, partners, and investors.



Maryland Energy Innovation Accelerator

5000 College Ave., Suite 31010
College Park, MD 20740
info@mdeia.org | 301-314-6061
www.mdeia.org