

Powering the Future - Building Maryland's Energy Innovation Ecosystem

FY25 Annual Report



MARYLAND ENERGY
INNOVATION INSTITUTE

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MESSAGE FROM THE DIRECTOR



Dr. Eric Wachsman, Director
Distinguished University Professor
William L. Crentz Centennial Chair in
Energy Research

I'm happy to report on the continued success of the Maryland Energy Innovation Institute (MEI²) in growing the State's economy through the development of clean sustainable energy technologies and advancement of the companies commercializing those technologies. Since its inception in 2017 MEI² has helped obtain over \$325M in federal energy research awards a ~40X return on investment for the State of Maryland based on federal research funding alone. The University of Maryland (UMD) continues to lead in US Department of Energy (DOE), Advanced Project Agency-Energy (ARPA-E) awards with a total to 52 awards for \$165M in total research funding since ARPA-E's inception in 2009, more than any other academic institution in the nation other than MIT and Georgia Tech.

Through coordination of the MEI² Seed Grant program and the Maryland Clean Energy Center's (MCEC's) Maryland Energy Innovation Accelerator (MEIA) program, 66 new energy innovation companies were formed or advanced in Maryland to date. From a survey of these Maryland innovation companies, in FY2025 they raised \$19.6M in new private investment bringing the total to \$99M, and \$50.8M in new federal grant funding bringing the total to \$162M, created 66 new full-time jobs bringing the total to 291, and 41 new patents were filed bringing the total to 243.

With regard to patents, the University System of Maryland was ranked 8th in the Nation and 22nd in the world among U.S. public institutions for patents awarded in 2024. The majority of these patents (71) were awarded to the University of Maryland, College Park, of which 40% of these (far more than any other technology) were for energy. Patents are the leading indicator of economic impact from university research, and this success demonstrates the potential for Maryland's energy research to create new companies and grow its economy.

Maryland continues to have tremendous potential for economic development from home grown, innovative clean energy technologies, and should consider this when setting R&D investment priorities. Moreover, much has been made recently about AI and Quantum and their potential financial impact, but it is only through the types of clean energy technologies being developed at MEI² that AI and Quantum can be deployed without significant increases in the financial cost of energy to the consumer and the cost of energy to the environment through increased greenhouse gas emissions.

\$71.5M	FY2025 Federal Energy Research Funding	→
\$324.5M	Federal Energy Research Funding since 2017	→
40X	Return on Investment in federal research funding	→

INSTITUTE OVERVIEW



Vision

Established in 2017 by the Maryland General Assembly, the Maryland Energy Innovation Institute (MEI²) was founded to support the development of clean-energy technology innovations from companies and universities across Maryland, thereby boosting economic growth and jobs in the state's clean-energy sector.

The institute supports entrepreneurial engineers and scientists working on technologies poised to revolutionize the energy industry. From groundbreaking energy research, to seed grants that enable demonstration of the technology in working prototypes, to accelerator programs that prepare fledgling companies for the crucible of the open market, MEI² offers a range of clean energy business development opportunities.

Mission

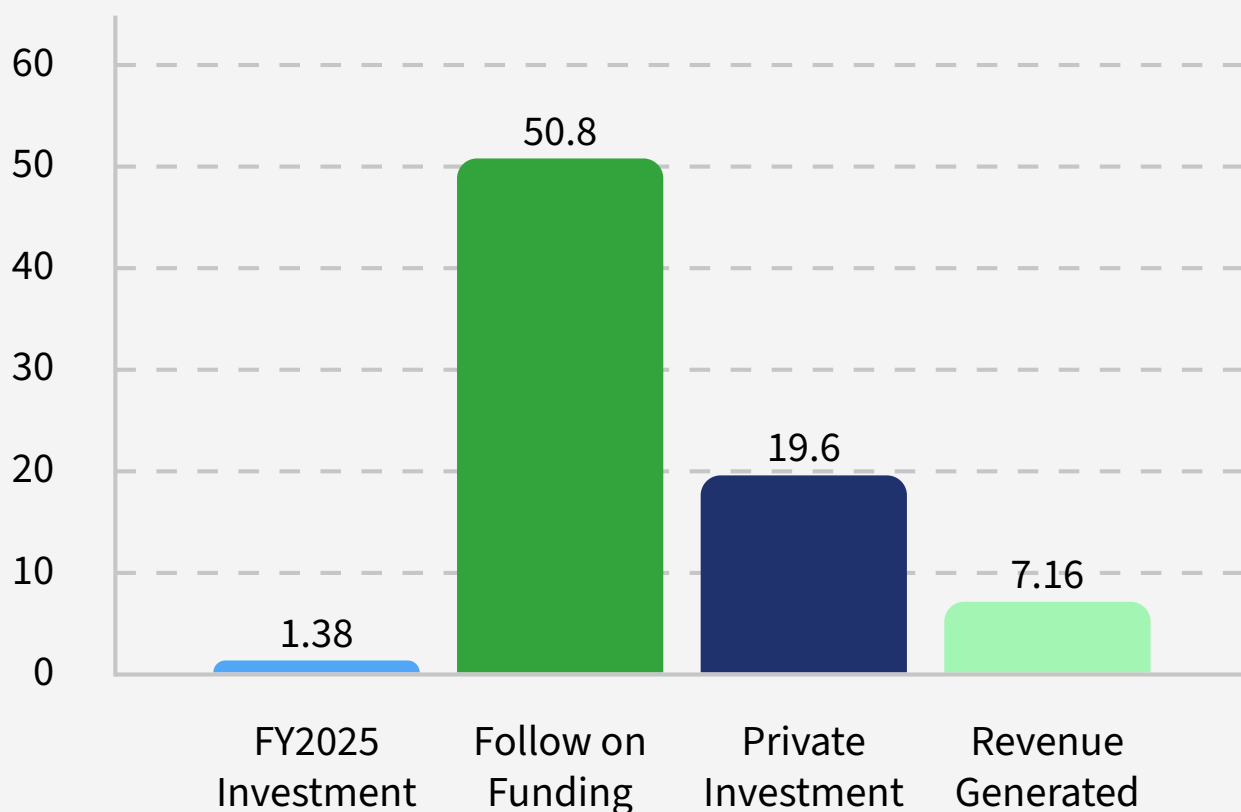
The Maryland Energy Innovation Institute's mission is to catalyze clean energy technology that stimulates economic growth and creates a sustainable future.

RETURN ON INVESTMENT

THE MARYLAND ENERGY INNOVATION INSTITUTE (MEI²) IN PARTNERSHIP WITH THE MARYLAND ENERGY INNOVATION ACCELERATOR (MEIA) has created an energy innovation ecosystem that is committed to rapidly bringing new solutions and technologies to market to help create a sustainable future. The institute supports entrepreneurial engineers and scientists working on technologies poised to revolutionize the energy industry. From groundbreaking energy research, to seed grants that enable demonstration of the technology in working prototypes, to accelerator programs that prepare fledgling companies for the crucible of the open market, MEI² offers a range of clean energy business development opportunities. **In FY2025**, MEI² and MEIA invested \$1,384,000 into accelerating these technologies and companies; which in turn has led to \$7M in revenue, approximately a 20X ROI in private investment and a >50X ROI in follow on funding.



MEI² & MEIA Return on Investment FY2025 (shown in \$M)



RETURN ON INVESTMENT

TO DATE, 66 companies have received support from the MEI²/MEIA ecosystem. From a human and economic perspective, measuring the return on investment (ROI) for clean energy technologies means considering how they impact people, communities, and long-term economic growth in addition to financial returns. Economically, ROI includes not just lower energy costs and job creation in manufacturing, installation, and maintenance, but also the ripple effects of building new industries and supply chains that strengthen local and national economies. To date, MEI² and MEIA have invested \$7,139,000 into Maryland's economy. Investing in MEI² and MEIA has yielded the State a 2X ROI in revenue; 12X ROI in private investment; and 22X ROI in follow on funding.



**MEI² & MEIA
Total Investment**
\$7,139,000



**Maryland
Companies
formed and/or
accelerated**
66



**Follow on
Funding**
\$162,445,228



**Full Time Jobs
Created in
Maryland**
291



**Private
Investment**
\$98,984,747



Patents Filed
243



**Revenue
generated**
14,127,541

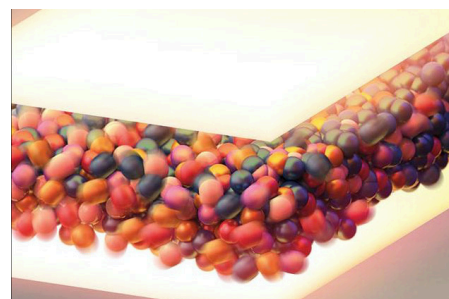
ENERGY ECOSYSTEM

Building Our Future...

The **Build Our Future Grant Pilot Program** is part of the Governor's Innovation Economy Infrastructure Act of 2023 and provides grants of up to \$2 million to private companies, nonprofit entities, local governments, as well as colleges and universities. Two additional MEI² energy seed grant recipients received awards this year (HighT-Tech and Liatris), joining Ion Storage Systems and InventWood, who received Build Our Future awards in 2024.

HighT-Tech received **\$1,000,000** for construction of a pilot manufacturing infrastructure to commercialize a novel, electrified, rapid high-temperature manufacturing process to disrupt the production of clean-tech material, including advanced batteries and hydrogen electrolyzers. The company is a spinoff from the University of Maryland, College Park and Johns Hopkins University.

HighT-Tech is also a 2025 Energy Seed Grant recipient and an alumnus of the Maryland Energy Innovation Accelerator (MEIA) program. The lead technical scientist is Dr. Yunhui Gong, Materials Science and Engineering at the University of Maryland.



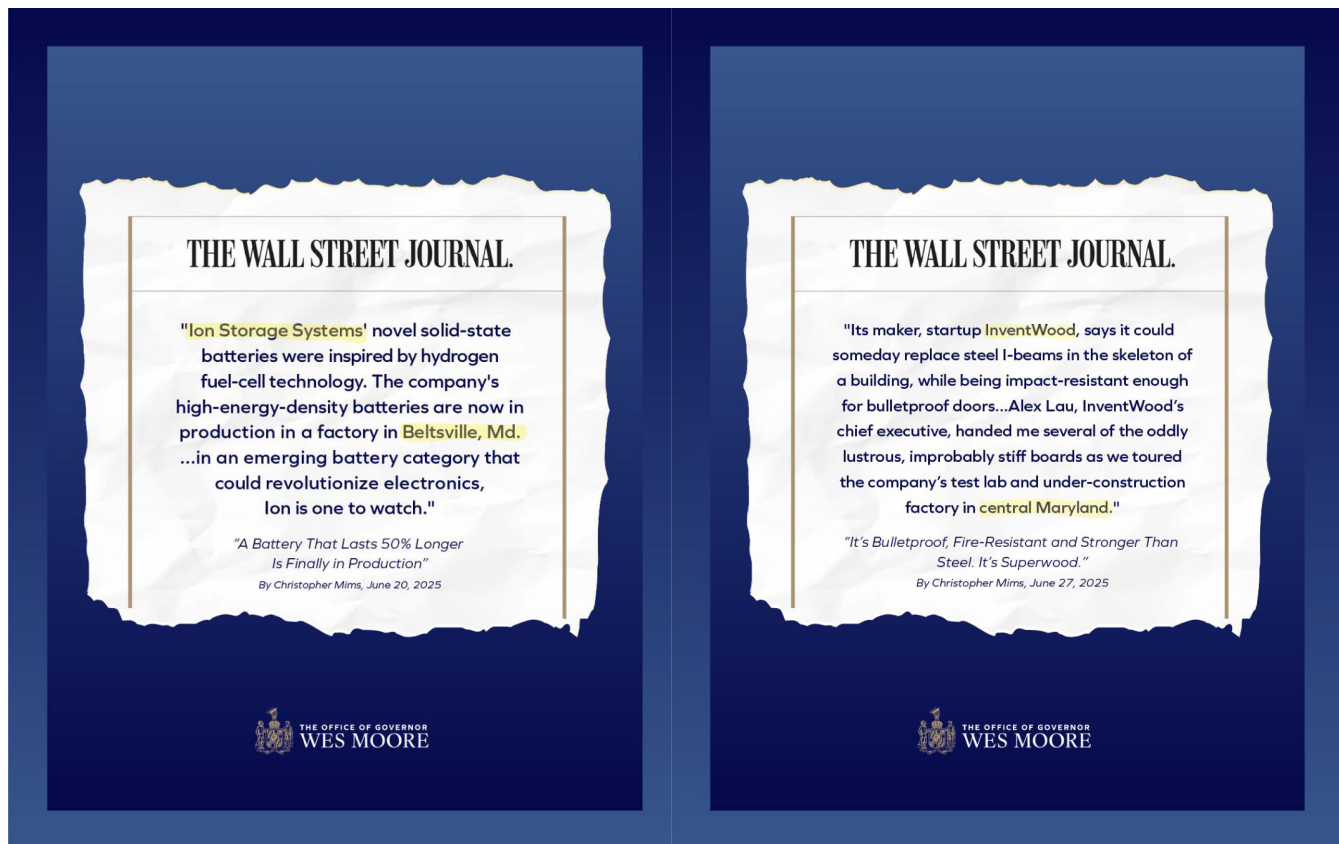
Governor Wes Moore visits Liatris

Liatris received **\$800,000** to construct a prototyping facility for next-generation thermal insulation materials in clean room space adjacent to existing headquarters. Validation of the technology would lead to an investment in larger-scale mass production.

In conjunction with UMD Assistant Professor in Chemical and Biomolecular Engineering (ChBE), Dr. Po-Yen Chen, Liatris received a 2022 Energy Seed Grant for their project Machine Learning-Accelerated Development of Non-Flammable Silica Aerogels for Building Thermal Insulation.

ENERGY ECOSYSTEM

Investing in the future, Changing the World...



"InventWood and Ion Storage Systems are proof that the investments that we've made to support industries of the future aren't just making Maryland more competitive – they're also changing the world." - Governor Wes Moore (July 2025)

ENERGY ECOSYSTEM

The University of Maryland, College Park (UMCP), together with other schools in the University System of Maryland (USM), ranks eighth among U.S. public institutions and 22nd in the world for patents awarded in 2024 according to a new report released by the National Academy of Inventors (NAI). According to the report, the U.S. Patent and Trademark Office last year granted 114 patents to five USM institutions; of which UMCP holds 71—up from 59 the year prior

Among the patents are:

- A battery that uses a special graphite material with halogen added to make it work better and last longer, developed by Dr. Chunsheng Wang and collaborators;
- A special type of material that can conduct ions and composed of tiny "nanofibrils" that could be used in devices and technologies like batteries or fuel cells. The technology, licensed by WH Power, was developed by Professor Emeritus Dr. Robert Briber along with Dr. Liangbing Hu;
- A way to convert methane gas into liquid fuel for easier and less expensive transport, licensed by Alchemy, and developed by Dr. Eric Wachsman and Dr. Dongxia Liu.

8TH

AMONG U.S. PUBLIC INSTITUTIONS FOR NUMBER OF PATENTS AWARDED IN 2024

22ND

IN THE WORLD FOR NUMBER OF PATENTS AWARDED IN 2024

40%

OF THE PATENTS WERE FOCUSED ON ENERGY

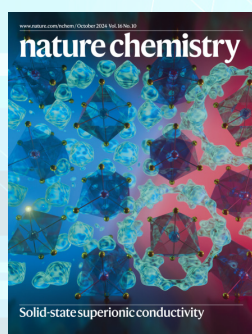
Ion Storage Systems (ION), a Maryland-based leader in next-generation solid-state battery technology, announced it has begun shipping Cornerstone, the first commercial generation of ION's solid-state battery technology, to leading consumer electronics companies. These multilayer cells are specifically designed for future integration into smartphones, laptops, wearables, and other compact, high-performance products. ION's solid-state platform delivers what the battery industry has long promised but never fully realized: long cycle life, no swell, and enhanced safety, without bulky compression systems.



ENERGY BREAKTHROUGHS

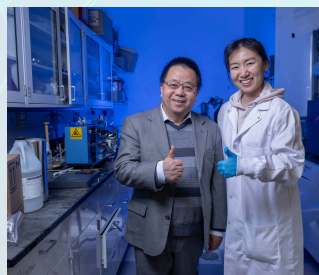
SIGNIFICANT AND IMPACTFUL RESEARCH progress was made in FY2025 through inventions and publications. Multiple papers were published in high profile journals such as *Nature* and *Science* (ranked 1st and 3rd internationally). Not only have these papers appeared in journals, but they have graced the cover of these journals as well.

Liu, Z., Chien, P.H., Wang, S. et al. Tuning collective anion motion enables superionic conductivity in solid-state halide electrolytes. *Nat. Chem.* 16, 1584–1591 (2024).
<https://doi.org/10.1038/s41557-024-01634-6> (cover)



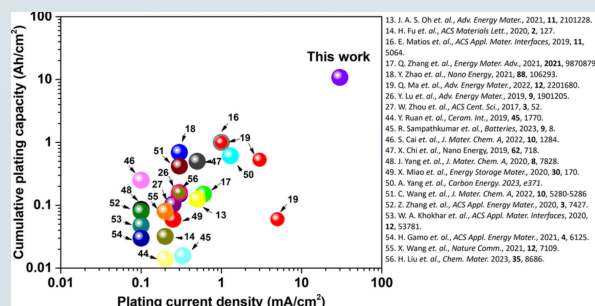
UMD scientists show how a family of electrolyte solids undergo a temperature-triggered transition from low to high conductivities due to collective anion motion. Using the uncovered structure–property relationships, they develop new electrolytes with lower transition temperatures to achieve superionic conductivities at room temperature. The cover is an artistic representation of lithium-ion movement through the solid-state electrolyte.

Zhang, X., Pollard, T.P., Tan, S. et al. Li⁺(ionophore) nanoclusters engineered aqueous/non-aqueous biphasic electrolyte solutions for high-potential lithium-based batteries. *Nature Nanotechnology* (2025).



- Achieved new milestones in the field of aqueous battery electrolytes.
- Developed a novel electrolyte system to eliminate long-standing technical barriers in aqueous energy storage.
- This innovation successfully overcomes the long-standing reduction potential limit of aqueous electrolytes—extending it from 1.3 V down to 0.0 V—and opens the door to truly high-energy-density aqueous batteries.

Prem Wicram Jaschin, Christopher R. Tang, and Eric D. Wachsman. High-rate cycling in 3D dual-doped NASICON architectures toward room-temperature sodium-metal-anode solid-state batteries; *Energy Environ. Sci.*, 17, 727–737 (2024). <https://doi.org/10.1039/D3EE03879C>



Integrated patented 3D architecture and solid-state sodium-electrolyte composition to achieve record high current density of **40 mA/cm²** and cumulative capacity (lifetime) of **11 Ah/cm²** for a solid-state Na_{metal} battery at room temperature with no applied pressure.

ENERGY SEED GRANTS

Open to all academic institutions in Maryland, annual seed grants are awarded by MEI² at two levels: phase 1 grants up to \$100,000, and phase 2 up to \$200,000 for projects that received prior seed funding. Since 2018, 38 companies and/or university researchers have received funding from the seed grant program, including those from the University of Maryland College Park, the University of Maryland Baltimore County, Morgan State University, the University of Maryland Eastern Shore, and Johns Hopkins University. The Energy Innovation Seed Grants are open to all full-time tenured or tenure track faculty members at any Maryland state academic institution or Maryland companies affiliated with and commercializing inventions created by those faculty.

38

**Total Seed Grants
Awarded**

\$3,735,500

**Total Seed Grant
Funding Awarded**

FY2025 Energy Seed Grants

- High Temperature Shock Catalysts Reducing Methane Emissions; Lead PI: Yunhui Gong, University of Maryland College Park; Partnering Company: High-T Tech
- Reversible Electrodeposition as an Enabler for Sustainable Battery Use: Enabling the Recycling and Reuse of Li-ion Battery Packs; Lead PI: Paul Albertus and Sriniraghavan, University of Maryland College Park
- Wood Vault as a Negative Emissions Technology; Lead PI: Neng Zeng, University of Maryland College Park
- Validation of Universal 15-Minute Rapid-Full Charge Battery Technology; Lead PI: Chunsheng Wang, University of Maryland College Park

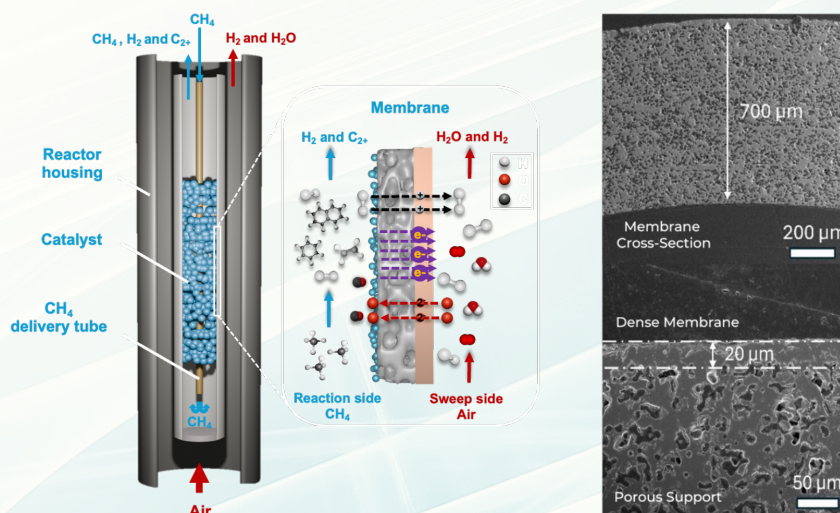
ENERGY BRIDGE FUNDING

New in FY2025 is the addition of the Energy Bridge Fund. Thanks largely to SB960, the Climate Tech Founders Fund signed by Governor Moore in May 2024, funds from the bill will allow MEI² and MEIA to provide expanded support services for prototype development and manufacturing through their energy seed grant program and MEIA's accelerator/launchpad programs. These awards are meant to provide and support companies that: (a) need cost share for federal or state proposals/awards; (b) need operating funds for work and payment prior to receiving their award funding, with a maximum of 20% of the total project cost up to \$250K.



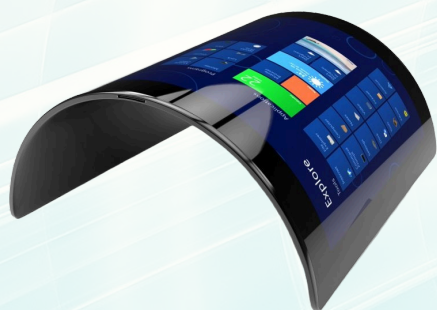
From wasted resources to sustainable fuels without CO₂ emissions, Alchemity's revolutionary process enables clean fuel production with zero carbon emissions.

alchemity.com



Manufacturing materials of the future. Conductive inks provide a more reliable pathway to apply electronic capabilities to nontraditional formats, including textiles, structurally integrated sensors, and flexible electronics.

matericgroup.com



ARPA-E AWARDS

THE U.S. DEPARTMENT OF ENERGY'S ADVANCED RESEARCH PROJECTS AGENCY-ENERGY (ARPA-E) funds and directs the research and development of advanced energy technologies. They bridge the gap between outlier energy ideas and mass market adoption, taking technologies from concept to prototype to world. ARPA-E's focused technology programs are carefully designed efforts to explore specific high-risk, high-reward research areas determined to have the potential to achieve one or more of aspects of ARPA-E's mission. UMD consistently ranks in the top three of university led ARPA-E awards.

52

#ARPA-E Awards since 2009

\$165M

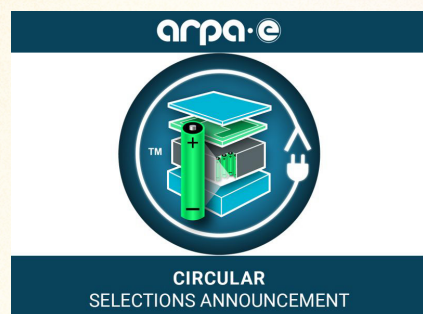
ARPA-E funding received

NEW ARPA-E AWARDS in FY2025

Highly Reliable Ion Source and Injection Beamline to Maximize Proton Beam Availability

\$4,293,007.00

Transmutex and UMD are developing a highly reliable ion source. They will modify a commercial ion source to reach the reliability required for efficient operation of the accelerator and the overall system. Using advanced data analysis, the team will continuously monitor and optimize the system's performance. The project's overarching goal is to enable nuclear waste transmutation to transform long-lived radioactive elements into shorter-lived ones, reducing their hazardous lifetime from 1 million years to a few hundred years.



Rapid Surface Graphitization of Carbon Anode for In Situ Regeneration of Batteries

\$1,368,549.00

HighT-Tech will develop ultrathin and compact protective coating material for the surface of graphite using ultrafast high-temperature sintering. This approach will enable the implementation of simple and programmed protocols to increase the longevity of lithium-ion batteries containing graphite anodes. The research will lengthen the lifetime of lithium iron phosphate/graphite batteries, which have promising characteristics for use in electric vehicles, backup power, and utility-scale energy storage.

ARPA-E SHOWCASE 2025

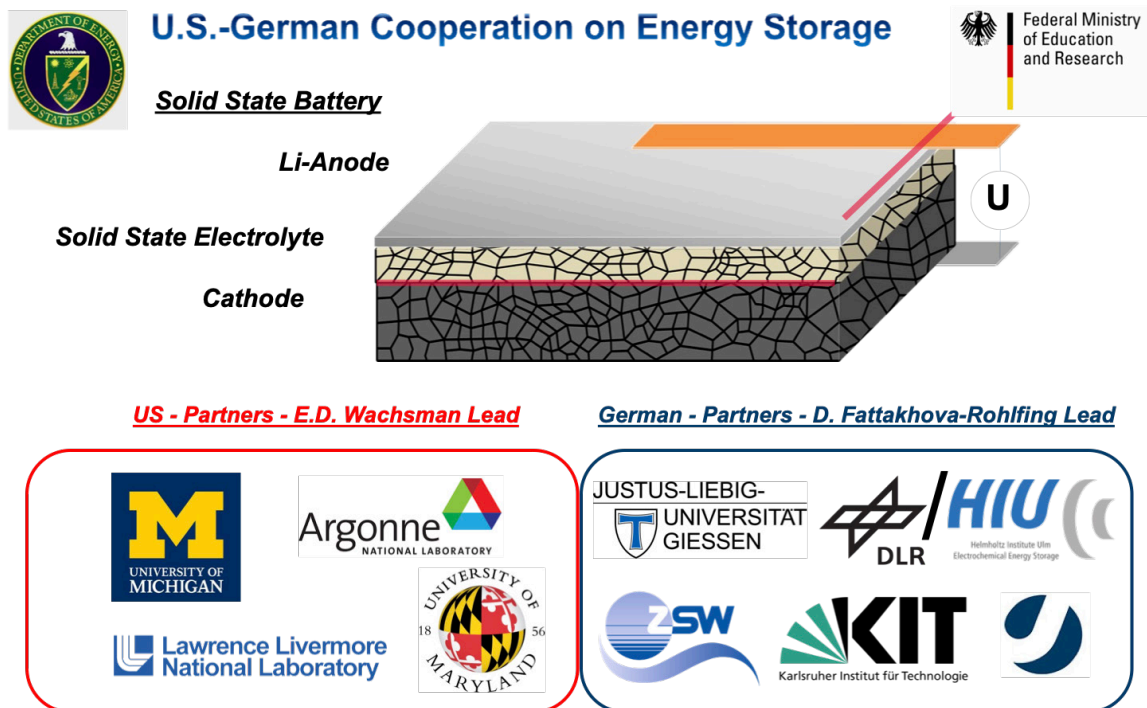
The highlight of the ARPA-E annual summit is the Technology Showcase which features top researchers, entrepreneurs, innovators, and engineers demonstrating their latest advancement in energy technologies. This year, the University of Maryland hosted 16 technology booths, and participated in 3 of the 8 technology demonstrations (hand selected by the ARPA-E program committee) - more than any other academic institution.



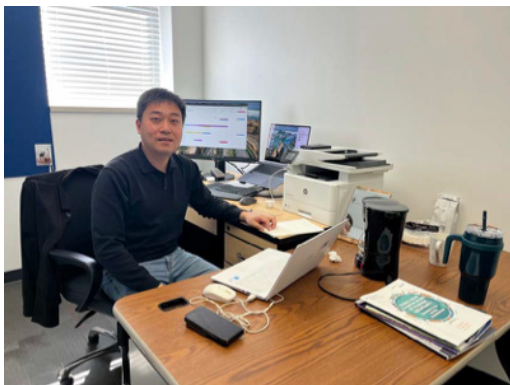
Highlights from the Technology Showcase include projects from EVs4ALL (top left); SCALEUP (top right); COOLERCHIPS (bottom left); PROPEL 1K (bottom right).

INTERNATIONAL COLLABORATION

The MARYLAND ENERGY INNOVATION INSTITUTE is actively cultivating numerous partnerships and collaborations at local, national, and international levels to advance the State and Institute's focus on clean energy technology research and innovation.



KOREA-U.S. ENERGY COOPERATION CENTER



KETEP is an organization under the Ministry of Trade, Industry and Energy of Korea and is responsible for planning, evaluating, and managing energy R&D. This cooperation center will enhance energy R&D collaboration with research institutions in Korea. Dr. Sunglook Sue (left) joined MEI² in March 2025. KETEP is issuing Korea-U.S. collaborative solicitations that UMD will be participating in with Korean partners.

INTERNATIONAL COLLABORATION



The U.S. - Israel Solid Energy Consortium (UISEC) encompasses the entire spectrum of development, from fundamental research on solid energy materials and properties to innovative cell design strategies and the fabrication of pre-commercial full cells for rigorous environmental and duty cycle testing. The ambitious objective is to achieve prototype cells boasting an energy density exceeding 425 Wh/kg and 1150 Wh/L at the stack level, while utilizing metallic anodes.



Bar-Ilan University



\$18M

Funding for 5 years

30

Publications in four years
8 joint publications

- >8 patents related to sodium and lithium cathode materials submitted.
- Cathodes developed in Year 1 are going through Proof Of Concept project with Industrial company (defense) in Israel.
- \$2.6M from the US DOE on "Microfabricated Nanolayers for Solid-State Batteries," and a new company (Ionic Devices) spun out for future commercialization.
- Discussing with partners in India the commercialization of sodium battery materials.

BATTERY COLLABORATIONS

CENTER FOR RESEARCH IN EXTREME BATTERIES



\$10M

**FY25 FUNDING IN DEFENSE
APPROPRIATIONS ACT**

CREB aims to foster and accelerate collaborative research in advanced battery materials and technologies and characterization techniques. CREB's focus is on batteries for extreme performance, environments and applications, such as those that may be used for defense, space or biomedical applications.

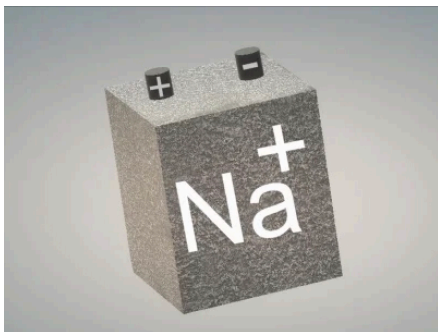
The LENS consortium, led by Argonne National Lab, aims to develop high-energy, long-lasting sodium-ion batteries using safe, abundant and inexpensive materials. This initiative addresses a critical need to reduce U.S. dependence on the limited and strategically important elements used in lithium-ion batteries, paving the way for a more sustainable future in electric-vehicle technology.



LENS

LOW-COST EARTH-ABUNDANT
NA-ION STORAGE CONSORTIUM

\$50M



\$75M

SAGES, led by PNNL, is one of the first missions of the Grid Storage Launchpad, a new, national capability designed to accelerate the development of advanced battery technologies. This \$75 million research facility, funded by OE, brings together all phases of the battery development and deployment cycle, ranging from fundamental materials and device prototyping to 100 kW-scale testing and validation.

APPENDIX 1. BUDGET

FY2025 BUDGET EXPENSES & FY2026 BUDGET

	FY2025 Budget	FY2025 Actuals	FY2026 Budget
Salary & Fringe	\$301,181	\$291,344	\$280,787
Seed Grants	\$575K (+375K)	\$400K (+359K*) will carry to FY26	\$600K (+\$250K*)
Reporting	\$2500	\$1400	\$2000
Events & Outreach	\$6,000	\$2530	\$5000
Supplies	\$8,000	\$5930	\$7000
Travel	\$8,000	\$8651	\$8000
Subtotal	900,681 (+359K)	\$709,855 (+359K)	\$902,787 (+\$250K)
MCEC	\$1.2M	\$1.2M	\$1.2M
Total	\$2,475,681	\$2,268,855	\$2,352,787

*Additional Funds from Climate Founders Fund for sole purpose of seed/bridge funding. ~\$200K from FY2025 seed grants will be carried to FY2026 for seed/bridge grant funding. Lack of federal funding being awarded recently hindered this process somewhat in FY2025.

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