2024 Energy I-Corps Annual Report

U.S. Department of ENERGY | Office of Technology Transitions

Energy I-Corps trains National Lab researchers in evaluating industry needs and potential market applications for their DOE technologies.

An initiative of the U.S. Department of Energy Office of Technology Transitions

Letter From the Director

Greetings,

It's hard to believe, but the U.S. Department of Energy (DOE) Office of Technology Transitions (OTT) hosted its ninth year of the Energy I-Corps program with unequivocal success. This annual report presents the program's latest impacts.

Energy I-Corps (EIC) delivers workforce development training and funding to our National Lab researchers to support clean energy technology commercialization. Delivering National Laboratory-developed technologies to market is critical in meeting our climate goals, making this program's entrepreneurial experience invaluable. The on-the-job training allows our researchers to avoid the "valleys of death" often faced along the research, development, demonstration, and deployment continuum.

Since its inaugural year, EIC has trained more than 510 DOE researchers, who have gone on to raise more than $197 million in follow-on funding. Key to the program is teaching researchers how to engage with the market to understand how real-world issues can be solved by their technology solution. That's 510 researchers returning to their National Labs with experience with industry engagement. The impact extends far beyond these participants, as they bring their learnings back to their teams to inform a culture of market awareness, in turn boosting the viability of lab technologies.

This year, we started to see positive results from the restructured EIC program. We also continued to integrate OTT's "Adoption Readiness Levels" framework into the entire EIC portfolio, which gives the participants the language for commercialization no matter what stage of commercialization they are in. This is a complement to Technology Readiness Levels and expands the view beyond technology hurdles to market barriers that must be overcome for successful commercialization.

Below are just three examples that illustrate the impact of EIC:

- The Cohort 13 Ducted Fuel Injection team from Sandia National Laboratories is tackling emissions from diesel engines, with some pollutants being reduced by at least 50%. The technology cost effectively reduces toxic emissions while maintaining all the desirable attributes of conventional diesel combustion. The team leveraged EIC support to secure partnerships with John Deere, Cummins, and other experts in the industry to ensure this technology's success.
- Oak Ridge National Laboratory's Ultrasonic Technology Solutions team, from Cohort 10, transformed its DOE technology into a successful startup. The technology is a more efficient, less energy-intensive solution to dry materials en masse. The startup has since secured major partnerships, including projects with NASA, and has eight employees.
- The National Renewable Energy Laboratory's RouteE team, after securing a partnership with Google Maps, now powers the "green leaf" feature to optimize routes using less fuel and time. Google estimated that using this technology could reduce on-road greenhouse gas emissions in the United States by 1%, keeping the associated fuel cost in the hands of the end user.

We also marked several key milestones in 2024:

- Savannah River National Laboratory joined Topic 2 this year, increasing total lab participation to 13 labs of 17 labs.
- Nevada National Security Site, Pantex Plant, and Y-12 National Security Complex were awarded EIC funding for the first time. With their participation, the EIC portfolio will have seen participation from 100% of DOE's National Laboratories, plants, and sites in program history.
- The funding ceiling for Topic 1 collaborative projects increased to $150,000.
- For the first time, non-OTT offices fully funded Topic 3 projects, demonstrating these projects' value across DOE.

OTT's mission is to expand the public impact of the department's research, development, demonstration, and deployment portfolio. In the program's history, all National Labs, plants, and sites have participated in at least one EIC topic, and 21 DOE program and technical offices have provided funding to teams going through the EIC program.

EIC's reach continues to lengthen. I encourage EIC alumni to be ambassadors for both the program and technology commercialization. It's only when a technology is transferred to the public that its full impact can be realized.

Dr. Vanessa Z. Chan

Chief Commercialization Officer, U.S. Department of Energy

Director, Office of Technology Transitions

Contents

Portfolio Overview

About Energy I-Corps

The U.S. Department of Energy (DOE) invests billions of dollars every year into the National Lab complex. This investment allows the DOE National Laboratories and DOE plants and sites to tackle the critical scientific challenges of our time—from renewable energy to quantum computing to creating a more resilient energy grid. The discoveries and innovations being developed by the labs have an even greater impact when we invest in bringing these ideas to the market where they can benefit the nation and world.

Established within DOE in 2015, the Office of Technology Transitions (OTT) is committed to expanding the commercial impact of DOE's research, development, demonstration, and deployment portfolio to advance the economic, energy, and security interests of the nation.

Energy I-Corps (EIC) became a part of the OTT portfolio in 2018. To better arm researchers to collaborate with industry and turn research and development into demonstration and deployment, DOE employs a suite of efforts under the EIC portfolio. These aim to help researchers gain industry insight to guide innovation and advance energy-related technologies toward commercialization.

Since 2015, DOE has offered the immersive 10- to 12-week EIC training program, also known as "Training Cohorts," across the DOE National Lab system. In 2023, the program expanded to include a pre-Training Cohort offering, introduced as Topic 1: Pipeline Development, and a post-Training Cohort offering, named Topic 3: Post Energy I-Corps. Under Topic 1: Pipeline Development, DOE National Labs and DOE plants and sites propose projects aimed at increasing their researchers' applications for future Topic 2: Training Cohorts. Under Topic 3: Post Energy I-Corps, graduates of the Training Cohorts apply for funding to aid their next step toward commercialization.

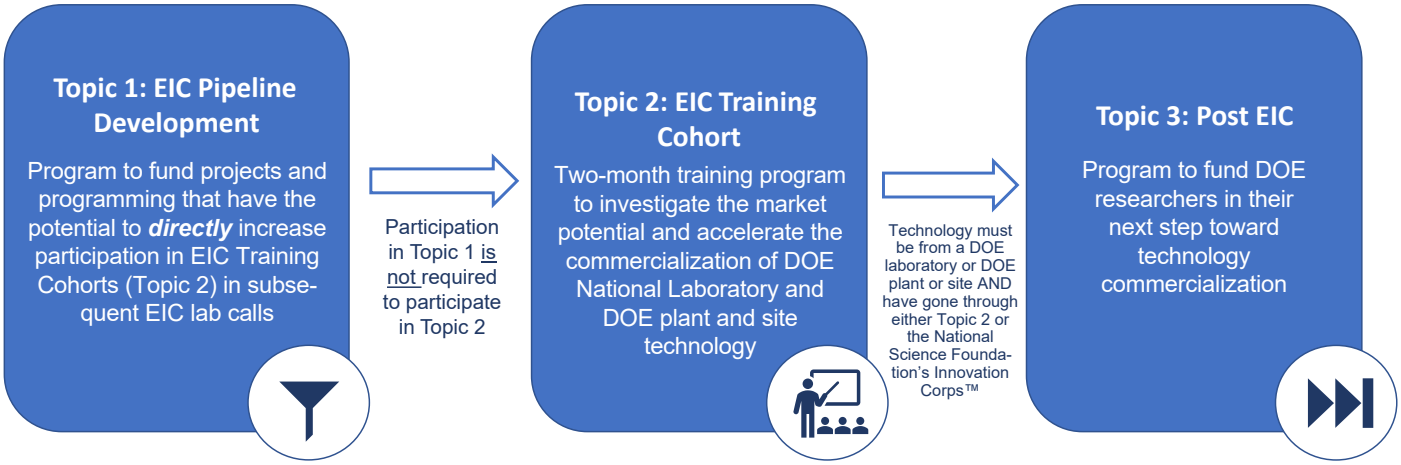


Figure 1: Energy I-Corps Program Structure

While the bulk of this report will focus on Topic 2: Training Cohorts, we are pleased to share updates on Topic 1: Pipeline Development and Topic 3: Post Energy I-Corps before diving in to Training Cohort metrics.

Portfolio Overview

Topic 1: Pipeline Development

In response to the evolution of the EIC program within DOE and feedback from National Lab partners and DOE program office supporters, OTT developed the Energy I-Corps Pipeline Development (Topic 1) opportunity. Topic 1 is a refocused version of the previously offered EIC "Satellite," "Site," or "Asynchronous" funding. Within this topic, DOE National Labs and DOE plants and sites are provided funding to implement projects and programming that have the potential to directly increase participation in subsequent EIC Training Cohorts. Selected projects with a single DOE National Laboratory or DOE plant or site applicant are awarded up to $100,000, and selected projects with at least three DOE National Laboratories or DOE plants or sites applying together are awarded up to $150,000. OTT provides each lab with the latitude to develop a program to best serve their unique research community while seeding the idea of participation in Topic 2: Training Cohorts.

2023 Topic 1 Projects

Fiscal Year (FY) 2023 was the first time the refocused Topic 1 programming was offered. Although projects were awarded in FY 2023, the active work took place through FYs 2023 and 2024. The cumulative goals of the FY 2023 projects were to provide site-specific entrepreneurial training to more than 80 researchers and increase the number of submissions to the Spring 2024 EIC Training Cohort lab call by more than 15 new submissions. Although one project is still ongoing, the FY 2023 Topic 1 cumulative goals were successfully met. FY 2023 projects provided site-specific entrepreneurial training to 155 researchers and generated 20 submissions to the Spring 2024 EIC Training Cohort.

FY 2023 Topic 1 Cumulative Goals	FY 2023 Topic 1 Cumulative Actuals
Researchers Trained: 80	Researchers Trained: 155
New Topic 2 Submissions: 15	New Topic 2 Submissions: 20

2024 Topic 1 Projects

The FY 2024 selected projects have a range of tasks, including entrepreneurial training, customer discovery, pitch competitions, support for Topic 2 applications, and networking with industry partners. The cumulative goals of the projects aim to provide site-specific entrepreneurial training to more than 140 researchers, conduct more than 300 stakeholder discovery interviews, engage more than 30 external partners, and increase the number of submissions to future EIC Training Cohorts by at least 30 new submissions.

FY 2023 Topic 1 Project Spotlight: Fermi National Accelerator Laboratory

Fermi National Accelerator Laboratory (FNAL) offered the Entrepreneurship and Commercialization Practicum, a two-month program to raise awareness of EIC within the lab and deliver effective commercialization training content. Nine researchers participated in the practicum, including 55% with diverse backgrounds. The effort led to one team joining Training Cohort 18: QICK, funded by the DOE Office of Science (SC) Advanced Scientific Computing Research program.

Cofunded by the SC Accelerator Research & Development and Production program, the SC High Energy Physics program, and OTT

FY 2023 Topic 1 Project Spotlight: Argonne National Laboratory

Argonne National Laboratory's (ANL's) Energy I-Corps Pipeline Development Program sought to enhance commercialization training and increase Topic 2 applications. The program involved best practice analysis, informational sessions, and tailored trainings. It provided an Energy I-Corps Light course to 23 participants and a Technology Commercialization and Entrepreneurship 101 workshop to 15 researchers. These efforts resulted in three applications to each FY 2024 Training Cohort, with two teams selected: Team Advanced Cathodes, cofunded by the Advanced Materials and Manufacturing Technologies Office (AMMTO) and the Vehicle Technologies Office (VTO) in Cohort 18, and Team SprayCell, funded by VTO in Cohort 19.

Portfolio Overview

All Topic 1 projects selected in FY 2024 were fully funded by OTT.

- **Brookhaven National Laboratory** ran an Entrepreneurial Training Program featuring a two-day workshop on business models, value propositions, customer discovery, and networking with EIC alumni.
- **FNAL** hosted a two-month entrepreneurial program called the Fermilab Entrepreneurship and Commercialization Practicum, focusing on commercialization through lab technology and guidance from industry experts.
- **Idaho National Laboratory** (INL) and Thomas Jefferson National Accelerator Facility delivered a six-week Energy I-Corps Pipeline Development Program offering 30 hours of entrepreneurial training and stakeholder interviews to lab researchers.
- **Lawrence Berkeley National Laboratory** (LBNL) updated its Entrepreneurship Partnering Tool and offered Energy I-Corps Lite courses, personalized prep, engagement opportunities with local industry professionals, and entrepreneurship training for postdoctoral scientists.
- **Los Alamos National Laboratory** executed a multiday Energy I-Corps Lite workshop, training researchers on technology commercialization and assessing market opportunities.
- **National Renewable Energy Laboratory** (NREL) ran Energy I-Corps Sprint, an entrepreneurial training program for 10 to 15 researchers, focusing on market research, local startup tours, and commercialization training.
- **Pacific Northwest National Laboratory** (PNNL) partnered with Washington State University Tri-Cities for an Innovation Lab covering core entrepreneurial elements with teams of researchers and students.
- **PNNL** and **National Energy Technology Laboratory** (NETL) partnered with Washington State University Tri-Cities to deliver a short course introducing lean launch startup principles to researchers, students, and entrepreneurs.
- **Princeton Plasma Physics Laboratory** is promoting commercialization by leveraging the National Science Foundation's (NSF's) regional Innovation Corps (I-Corps™) Site for entrepreneurial education and pipeline development.
- **Sandia National Laboratories** (SNL), **Kansas City National Security Campus**, **Nevada National Security Site, Pantex Plant**, and **Y-12 National Security Complex** will run the National Laboratory Entrepreneur Accelerator Pipeline Program (NLEAP+), a two-day entrepreneurial accelerator with mentorship, business model development, and commercialization resources.

For additional information on the Topic 1 projects, visit https://www.energy.gov/technologytransitions/energy-i-corps-topics-1-and-3-fy24-spring and https://www.energy.gov/technologytransitions/energy-i-corps-topics-1-and-3-fy24-fall.

FY 2023 Topic 1 Project Spotlight: Pacific Northwest National Laboratory

PNNL, in collaboration with the Washington State University Tri-Cities Entrepreneur in Residence program, offered a short course on commercialization, open to both researchers and students. Eight researchers, including 40% with diverse backgrounds, completed the course covering core elements like Business Model Canvas, Value Propositions, Customer Discovery, and Competitive Analysis. The effort led to one team joining Training Cohort 19: Team NextGen Hydrothermal Liquefication, funded by the Bioenergy Technologies Office. Watch a video developed by PNNL to capture the value of EIC training and promote applications from their lab: https://youtu.be/EhLmCqXFUEk.

FY 2023 Topic 1 Project Spotlight: Savannah River National Laboratory

Savannah River National Laboratory (SRNL) hosted an informational overview session for its researchers and selected five patented technologies for potential Topic 2 submissions. Selected researchers received funding to create technology briefs and connect with university entrepreneurial programs to build their networks. The efforts resulted in Savannah River's first-ever Topic 2 team selection: Controlled Equilibrium Catalytic Isotope Exchange (CECIE), funded by OTT. See the CECIE Team Spotlight on page 31.

Portfolio Overview

Topic 2: Training Cohorts

The founding program in the EIC portfolio is the Topic 2: Training Cohorts offering. Topic 2 invites teams of researchers to participate in an immersive 10- to 12-week training, during which the researchers define technology value propositions, conduct at least 75 stakeholder discovery interviews, and explore viable market pathways for their technologies. Researchers return to their labs with a framework for industry engagement to guide future research and inform a culture of market engagement within the lab environment. In this way, EIC ensures our investment in the DOE National Labs and DOE plants and sites and maintains and strengthens long-term U.S. competitiveness. Topic 2 is managed by NREL in Golden, Colorado.

Topic 3: Post Energy I-Corps

In response to the evolution of the EIC program within DOE and feedback from DOE National Laboratories, DOE plants and sites, and DOE program office supporters, OTT developed Topic 3: Post Energy I-Corps. Introduced in FY 2023, the Topic 3 opportunity aims to support the ongoing commercialization of DOE technologies that have either gone through Topic 2 or the NSF's I-Corps program. The funds, up to $100,000, are intended to cover the costs of the next actionable step in the team's commercialization journey and to help awardees reach their next source of more substantive funding.

The cumulative goals of the FY 2024 projects aim to engage more than 30 new external partners, create four new prototypes, and implement 11 new technology tests or deployments. Each project also has specific diversity, equity, inclusion, and accessibility goals, including outreach to underrepresented customer segments and engagement with students from underrepresented groups.

2023 Topic 3 Projects

Although the inaugural set of Topic 3 projects were awarded in FY 2023, active work to accomplish these projects took place during FY 2024. In fact, 4 of 5 projects are ongoing at the time of this writing.

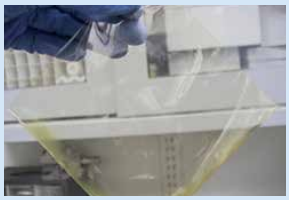
The cumulative goals of the FY 2023 Topic 3 projects were to engage more than 25 new external partners, produce 5 new National Laboratory CRADAs or patent license agreements, create 5 new prototypes, and implement 8 new technology tests or deployments.

FY 2023 Topic 3 Team Spotlight: Lawrence Livermore National Laboratory's MECS Team

The Micro-Encapsulated CO_2 Sorbents (MECS) technology removes carbon dioxide (CO_2) from ambient air. With Topic 3 funding, the team enhanced the device with features such as smart fluid dispensing and sample collection with quality control. These improvements validated a cost-effective method for scaling up MECS production. The team developed a prototype achieving greater than 90% successful encapsulation, held more than 20 meetings with industrial partners, and initiated patent licensing with commercial partners on five patents.

Cofunded by the DOE Office of Fossil Energy and Carbon Management (FECM) and OTT

FY 2023 Topic 3 Team Spotlight: Sandia National Laboratories' Polymer Membranes Team



The Polymer Membranes technology enhances flow battery efficiency and lifespan. With Topic 3 funding, the team is refining the technology by synthesizing and casting polymer films, validating the technology with a team at Harvard University, and testing them with industry. The project aims to produce a prototype and achieve 20% higher efficiency than incumbent technology in the current market. The results will support ongoing commercialization efforts by identifying roadblocks, partnership opportunities, and avenues for new intellectual property.

Portfolio Overview

Although the majority of projects are still ongoing, the FY 2023 Topic 3 cumulative goals have either been successfully met or on track to be met. To date, the FY 2023 Topic 3 projects have cumulatively engaged 21 new external partners, produced 8 new National Laboratory CRADAs or patent license agreements, created 5 new prototypes, and implemented 7 new technology tests or deployments. Four of the 5 FY 2023 Topic 3 projects awarded will be ongoing into FY 2025. OTT expects to meet all project goals by the end of each FY 2023 Topic 3 project period of performance.

FY 2023 Topic 3 Cumulative Goals	FY 2023 Topic 3 Cumulative Actuals (To Date)
External Partners Engaged: 25	External Partners Engaged: 21
New CRADAs/Patent License Agreements: 5	New CRADAs/Patent license Agreements: 8
Prototypes Developed: 5	Prototypes Developed: 5
Tests or Deployments: 5	Tests or Deployments: 7

2024 Topic 3 Projects

The following six teams were selected in FY 2024 (projects are funded by OTT unless otherwise indicated):

- **ANL: Oleo Sponge** (originally members of Cohort 6) is accelerating the commercialization of its oil and petroleum absorbing technology through ecosystem engagement, prototype development with a manufacturing partner, and real-world demonstrations under industry conditions.
- **Lawrence Livermore National Laboratory (LLNL): PhotoSil** (Cohort 17) aims to validate experimental results of their silicone curation method, finalize a patent, test their technology on commercial printers, and engage partners to address industry challenges.
- **NREL: SeaDragon** (Cohort 17) is developing cost models, assessing competitors, and identifying strategic partners to support commercialization of their marine energy conversion technology.
  - Funded by the DOE Office of Energy Efficiency and Renewable Energy's (EERE's) Water Power Technologies Office (WPTO)
- **NREL: RouteE** (Cohort 8) is refining its vehicle electrification support dashboard based on industry feedback, demonstrating it with interested entities, and developing a plan for full-scale deployment.
  - Cofunded by EERE's VTO and OTT
- **SNL: Electro3D** (Cohort 16) is advancing its electrochemical 3D printing technology prototype to meet industry standards for producing printed circuit boards, driven by licensee interest.
- **SNL: GridSense** (Cohort 17) is engaging utility end users to refine the interface, optimize code, add features, and advance commercialization of their grid fault detection and location technology.
  - Funded by the Office of Electricity (OE)

For additional information on the Topic 3 projects, visit https://www.energy.gov/technologytransitions/energy-i-corps-topics-1-and-3-fy24-spring and https://www.energy.gov/technologytransitions/energy-i-corps-topics-1-and-3-fy24-fall.

FY 2023 Topic 3 Team Spotlight: Lawrence Livermore National Laboratory's Bioreactor Team

The Bioreactor technology converts gaseous feedstocks into value-added products. With Topic 3 funding, the team scaled their existing 2mL solid-state batch bioreactor to a liter-scale continuous flow reactor. The project involves customer discovery to understand gas fermentation industry needs, identify early adopters, and conduct techno-economic and life cycle analyses. These efforts aim to boost credibility, quantify industry impact, and locate a partner for advancing the technology toward commercialization.

Portfolio FAQs

What is Energy I-Corps?

The goal of all efforts within the EIC portfolio is to support and train DOE National Lab and DOE plant and site researchers to advance energy-related technologies toward commercialization.

How many teams have participated?

1. **Topic 1:** Pipeline Development: All 17 National Labs and all four DOE plants and sites have participated in either the Pipeline Development program or its previous iterations, referred to as "Site" and "Satellite" funding.
2. **Topic 2:** Training Cohorts: As of November 2024, 242 teams from 13 National Labs have participated in Topic 2 over the course of 19 cohorts and the pilot.
3. **Topic 3:** Post Energy I-Corps: As of November 2024, 11 teams from six National Labs have been awarded Post Energy I-Corps funding since its inception in FY 2023.

What are the benefits?

1. **Topic 1: Pipeline Development:** Each selected DOE lab, plant, or site awardee develops a Topic 2-promoting program that will most benefit its unique research community. This provides researchers with a taste of commercialization concepts and opportunities before deciding to commit to the full Topic 2 program. Taking examples from awarded FY 2024 programs, participants may benefit from a lab-hosted, lighter version of Topic 2, startup engagement, market research support, or other programming offerings.
2. **Topic 2: Training Cohorts:** Participants benefit from workshops taught by industry experts while gaining market insights gleaned from the more than 75 discovery interviews conducted during the duration of the program. The training equips DOE National Lab and DOE plant and site researchers with tools to evaluate the real-world relevance of their technologies and viable pathways to market. These tools help inform future research and potential partnerships at DOE National Labs and DOE plants and sites.
3. **Topic 3: Post Energy I-Corps:** Select teams with previous EIC or NSF's National I-Corps training receive funding to support their next step in commercialization to help avoid a valley of death in the commercialization pathway.

Who can participate?

1. **Topic 1: Pipeline Development:** DOE National Labs and DOE plants and sites can apply. Applicants suggest projects and programming that have the potential to directly increase participation in future EIC Training Cohorts.
2. **Topic 2: Training Cohorts:** DOE National Lab and DOE plant and site researchers wanting to pursue commercialization of DOE National Lab intellectual property can apply. This is a technology-agnostic program, but participants should fall within the DOE investment portfolio, including renewable energy, energy efficiency, advanced materials, nuclear energy, fossil energy, environmental management, national security, and others.
3. **Topic 3: Post Energy I-Corps:** Employees of the DOE National Lab complex are eligible to apply. The technology must be a DOE technology and have successfully gone through either Topic 2 or the NSF's National I-Corps program.

Who supports the participants?

1. **Topic 1: Pipeline Development:** Submitted applications are reviewed by OTT and shared with other DOE program offices and the National Nuclear Security Administration (NNSA) as funding opportunities. OTT is the primary funder of the Pipeline Development program. Programs from SC, for example, have also supported projects in the past.
2. **Topic 2: Training Cohorts:** Submitted applications are reviewed by OTT and relevant DOE program offices. The offices of EERE; Electricity; Environmental Management (EM); FECM; Nuclear Energy (NE); Cybersecurity, Energy Security, and Emergency Response (CESER); NNSA; and programs within SC have supported teams. Non-OTT program offices and agencies are the primary supporters of this opportunity.
3. **Topic 3: Post Energy I-Corps:** Submitted applications are reviewed by OTT and relevant DOE program offices and NNSA. FECM, OTT, VTO, and WPTO have supported projects in the past.

How can I get involved?

OTT solicits proposals for all three EIC topics through a lab call. Both FY 2024 EIC lab calls were publicly posted to EERE Exchange: https://eere-exchange.energy.gov/Default.aspx. If you are interested in participating in EIC, please contact your lab's Technology Transfer Office, email energyicorps@hq.doe.gov, or visit energyicorps.energy.gov to learn more.

Program Structure

From this point onward, this report will focus on Energy I-Corps Topic 2: Training Cohorts. The following terms will be used interchangeably: Energy I-Corps, EIC Topic 2, Training Cohorts, and cohorts.

For each Training Cohort of EIC, DOE National Labs, plants, and sites recruit researchers working on energy technologies that show potential for commercial application. Researchers selected for the program receive comprehensive training and conduct at least 75 discovery interviews with industry stakeholders during the program.

Once researchers complete the cohort program, they will have developed important industry connections and insights to better prepare their energy technologies for market acceptance and deployment. In addition, they will have established an industry-engagement framework applicable to future research.

Curriculum

The EIC curriculum was initially developed in partnership with the NSF. With the support of the National Labs and external industry advisors, OTT and NREL adapted the NSF's nationally recognized I-Corps training to meet the needs of the DOE Laboratory and DOE plant and site participants.

Adjustments made to the EIC curriculum address the specific challenges scientists working within the National Lab complex environment face when preparing their innovations for market, such as navigating the complexities of intellectual property, licensing opportunities, and startup development pathways. For example, in 2023, instruction surrounding Adoption Readiness Levels was added to the curriculum. As more teams complete the training, OTT and NREL continue to improve and enhance the Energy I-Corps Topic 2 curriculum to best meet participant and industry needs.

EIC comprises four key elements:

Implementation Team: NREL is responsible for developing and delivering the training, as well as providing program guidance to participating National Laboratories, plants, and sites.

Participating Labs, Plants, and Sites: Participating DOE National Labs, plants, and sites recruit, assemble, and submit applications for each cohort. The DOE National Labs, plants, and sites play an integral role in supporting teams before, during, and after the program. Support might include assistance in identifying team members, as well as technology transfer/technology deployment support for commercialization plans identified by the team during training.

Teams: Applicants apply to EIC as a team composed of a principal investigator with a commercially relevant technology, an entrepreneurial lead, and an industry mentor. The team works together to identify potential commercialization pathways for their selected technology, as well as opportunities where further development of the technology could lead to commercial value.

Training Program: Energy I-Corps Topic 2 spans 10 to 12 weeks, utilizing a custom-designed curriculum. During the program, teams attend in-person and virtual sessions, participate in weekly webinars, and learn from faculty how to systematically identify the most appropriate market applications and commercialization pathways for their technologies. Participation requires a considerable amount of time spent outside of the classroom conducting at least 75 stakeholder discovery interviews.

To date, teams have participated from:

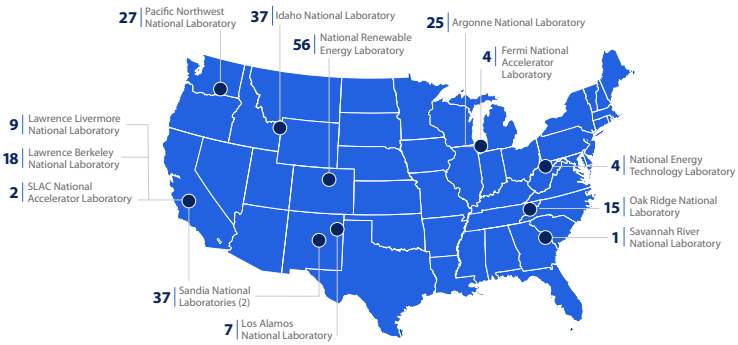
- Argonne National Laboratory
- Fermi National Accelerator Laboratory
- Idaho National Laboratory
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- National Energy Technology Lab
- National Renewable Energy Laboratory
- Oak Ridge National Laboratory
- Pacific Northwest National Laboratory
- Sandia National Laboratories
- Savannah River National Laboratory – *First time participant in FY 2024*
- SLAC National Accelerator Laboratory.

Quick Stats

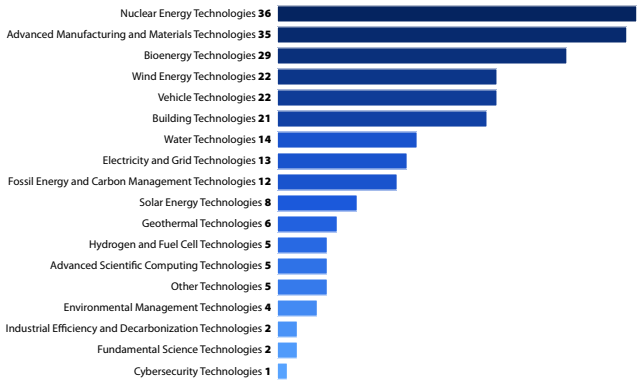
More than 110 EIC Topic 2: Training Cohort teams have collectively attracted more than $197 million in post program funding, with an average of $1.7 million per team. As of the end of the 19th training session in fall 2024, teams have worked with more than 245 industry mentors and conducted more than 17,500 discovery interviews to determine the commercial impact of their technologies.

19 COHORTS OF ENERGY I-CORPS

242 TEAMS | **13** NATIONAL LABORATORIES



BRINGING **ENERGY INNOVATIONS** TO



LEARNING FROM

245 industry mentors and **17,500+** stakeholder discovery interviews with organizations like

EPRI, Shell, Ford, World Bank, Breakthrough Energy, John Deere, Siemens Gamesa, Chevron, Eaton, Samsung, Lowes, Johns Manville, LEGO, U.S. Army, Trane, Tesla, GM, Dow Chemical, 3M, Whirlpool, GE, Home Depot, Google, and Amazon

$197M+
Post program funding raised from EIC technologies

510+
National Lab researchers trained

21
Offices within DOE and NNSA contributing funds to EIC teams and projects

17,500+ Stakeholder Discovery Interviews

85 Licenses Executed

By the Numbers

To support participation in an EIC Training Cohort, teams are awarded funding from DOE program offices, DOE technology offices, NNSA, their National Lab, or industry partners. After the program concludes, teams often seek additional funding for continued commercialization activities. Post program funding may take many forms, including DOE funding, grants, laboratory research funding, cooperative research awards, industry support, private capital, etc. The information shown below highlights the initial funding investments as well as the post program funding that teams have reported.

PROGRAM FUNDING TO DATE
$18,425,000

POST-PROGRAM FUNDING
$197,138,637

Funding Snapshot

	Teams Funded	Investment	Post-Program Funding
Technology Office Funded	217	$16,612,500	$183,239,778
Lab Funded	14	$987,500	$10,754,998
Pilot	10	$750,000	$2,897,000
Privately Funded	1	$75,000	$246,861
Grand Total	**242**	**$18,425,000**	**$197,138,637**

Technology Office Funding Detailed Breakdown

DOE Funding Office	Teams Funded	Investment	Post-Program Funding
AMMTO	4	$360,000	$466,668
AMO*	29	$2,147,500	$32,799,739
BETO	27	$2,020,000	$8,587,107
BTO	13	$985,000	$3,818,250
CESER	1	$66,667	$250,000
EM	2	$150,000	$7,572,500
FECM	9	$702,500	$3,675,000
GTO	6	$475,833	$4,353,333
HFTO	5	$382,500	$1,811,857
IEDO	1	$80,000	$0
NAWI	2	$150,000	$4,600,000
NE	18	$1,349,167	$15,621,333
NNSA	17	$1,310,000	$9,102,002
OE	11	$859,167	$11,175,000
OTT	5	$380,000	$3,235,000
SC	7	$545,000	$8,530,000
SC-BES	1	$53,333	$333,333
SETO	7	$529,167	$44,076,333
VTO	22	$1,662,500	$7,830,323
WETO	16	$1,259,167	$4,730,000
WPTO	11	$845,000	$7,322,000
WWPTO	4	$300,000	$3,350,000
Total	**217**	**$16,612,500**	**$183,239,778**

*In 2023, AMO restructured to IEDO and AMMTO.

By the Numbers

TEAMS FUNDED: 242 **STAKEHOLDER DISCOVERY INTERVIEWS: 17,570**

By Laboratory

Lab	Teams Funded	Post-Program Funding Received	Discovery Interviews
ANL	25	$16,612,224	1,906
FNAL	4	$1,550,000	258
INL	36	$26,379,088	2,626
LANL	7	$2,102,000	563
LBNL	18	$26,422,500	1,324
LLNL	9	$16,630,500	484
NETL	4	$925,000	306
NREL	56	$67,157,359	4,193
ORNL	15	$11,187,714	1,166
PNNL	26	$12,992,250	1,793
PNNL/INL Joint Teams	2	$36,000	181
SLAC	2	$345,000	83
SNL	37	$14,799,002	2,609
SRNL	1	$0	78
Total	**242**	**$197,138,637**	**17,570**

By Cohort

Cohort	Teams Funded	Post-Program Funding Received	Discovery Interviews
0	3	N/A	225
1	14	$3,851,000	767
2	14	$28,846,222	815
3	8	$4,150,000	475
4	15	$48,015,000	937
5	12	$1,728,000	916
6	8	$14,634,361	606
7	8	$15,170,714	669
8	10	$6,095,000	776
9	12	$9,720,000	910
10	10	$8,925,500	763
11	17	$17,136,088	1,148
12	18	$9,538,750	1,361
13	16	$8,589,002	1,251
14	16	$7,630,000	1,052
15	10	$3,344,000	837
16	13	$3,364,000	1,029
17	11	$3,465,000	837
18	14	$2,936,000	1,112
19	13	N/A*	1,084
Total	**242**	**$197,138,637**	**17,570**

*Cohort completed during the writing of this report, so no post program funding to report yet

Participation by Technology Program Offices

EIC teams are funded by individual technology program offices within DOE. Labs also have the opportunity to fund teams or find industry partners to fund teams. Information provided on the following pages incorporates reporting from the first cohort pilot through Cohort 19, ending in November 2024.

Teams can be co-funded by multiple program offices. Co-funded teams are marked as "(.5)" or "(.33)" following their team name, depending on the number of funding program offices. Co-funded teams' interview numbers are divided by the number of funding program offices.

Advanced Manufacturing Office (AMO)

Team	Lab	Cohort	Discovery Interviews
Micro Miners (.5)	LLNL	2	30
NanoHeatBlock	ANL	2	83
Saline Solutions	LLNL	2	50
Fermians	FNAL	3	48
E-RECOV	INL	4	57
Re-Light	INL	5	75
Electroplate (.5)	INL	5	28
BaSiC	NREL	5	80
COMBA	LBNL	7	107
LaserSense (Iris Light Technologies)	ANL	7	79
FLO.materials	LBNL	7	78
HyMag (.5)	ANL	8	39
CAN-Coatings	ANL	8	72
Shakti Power Systems	ANL	9	71
C-CHiRP	ANL	10	78
E-Ionsorb	LLNL	10	61
EMEE	INL	11	79
ARME	PNNL	11	77
Sustainability Integrators	INL	11	74
RE-Metal	INL	11	76
EC-Leach	INL	12	71
RECOVER (.5)	PNNL	12	39
WESAP	PNNL	12	93
CO_2 Converters (.5)	ANL	12	39
Wolfram Plating	SNL	13	68
GALILEO	ANL	13	80
Phase Changers	NREL	14	78
FrozEn	PNNL	14	79
CAML	SNL	14	55
Solar Dry Reforming	SNL	15	65
Mixed Plastic Upcycling	ORNL	15	88

TOTAL TEAMS FUNDED
29

INVESTMENT TOTAL
$2,147,500

POST-PROGRAM FUNDING
$32,799,739

DISCOVERY INTERVIEWS
2,096

Advanced Materials and Manufacturing Technologies Office (AMMTO)

Team	Lab	Cohort	Discovery Interviews
Diamond Semiconductors	SNL	16	77
Recyclobot	ANL	16	103
Litholution	INL	17	76
SSAM (.33)	PNNL	17	25
Advanced Cathodes (.5)	ANL	18	39
MatDNA (.33)	SNL	18	25
HEMatGan (.33)	SNL	18	31

TOTAL TEAMS FUNDED
4

INVESTMENT TOTAL
$360,000

POST-PROGRAM FUNDING
$466,668

DISCOVERY INTERVIEWS
376

Participation by Technology Program Offices

Bioenergy Technologies Office (BETO)

Team	Lab	Cohort	Discovery Interviews
High-Moisture Pelleting Process	INL	2	86
FiberSAS	ANL	3	76
WasteNot	ANL	3	70
FUSS	LANL	4	71
Bio-Blend aka OptiBlend	INL	4	75
Nitrilica	NREL	5	77
Glycoplastics	NREL	5	77
CuB Fuels	NREL	5	98
Electro-Active (.5)	ORNL	7	40
Fermeley	LBNL	8	81
EcoPod	LBNL	8	77
Embodied Carbon	NREL	9	78
Grab-X	ANL	9	83
CYCle	NREL	10	86
Greenrm	SNL	10	78
BETTER	NREL	11	73
UltraSep	LANL	12	76
Bio-NIPU (.5)	NREL	12	39
BioPack-ML	LANL	12	76
REVAMP	NREL	13	81
Bioreactor	LLNL	14	60
O2SAF	PNNL	15	77
CUBES	SNL	16	82
3HP	PNNL	16	78
ReCapture (.5)	NREL	18	42
Cellulose 2.0	INL	19	77
LignoCat	LBNL	19	75
NextGen Hydrothermal Liquefaction	PNNL	19	81

TOTAL TEAMS FUNDED
27

INVESTMENT TOTAL
$2,020,000

POST-PROGRAM FUNDING
$8,587,107

DISCOVERY INTERVIEWS
2,070

Building Technologies Office (BTO)

Team	Lab	Cohort	Discovery Interviews
VOLTTRON	PNNL	2	33
MAI for Buildings	ORNL	3	74
SwitchGlaze (.5)	NREL	3	27
Thermoelectric Dryer	ORNL	4	45
Beyond Fault Detection	NREL	5	76
GreenBlox	NREL	6	74
Amber LEDs	NREL	9	77
ThermaStor	LBNL	9	78
EB Treement	FNAL	11	56
Bio-NIPU (.5)	NREL	12	39
FreeSpace Tank Team	NREL	12	77
UBEM	LBNL	12	77
Catch It	NREL	16	77
Retrofit-Ready Decarb	LBNL	17	75

TOTAL TEAMS FUNDED
13

INVESTMENT TOTAL
$985,000

POST-PROGRAM FUNDING
$3,818,250

DISCOVERY INTERVIEWS
885

Participation by Technology Program Offices

Cybersecurity Energy Security and Emergency Response (CESER)

Team	Lab	Cohort	Discovery Interviews
Fire Map (.5)	SNL	16	38
OptimalEnergy (.33)	SNL	19	28

TOTAL TEAMS FUNDED
1

INVESTMENT TOTAL
$66,667

POST-PROGRAM FUNDING
$250,000

DISCOVERY INTERVIEWS
65

Office of Environmental Management (EM)

Team	Lab	Cohort	Discovery Interviews
Gamma Rayality (GRI)	LBNL	6	77
Purebeam	FNAL	7	78

TOTAL TEAMS FUNDED
2

INVESTMENT TOTAL
$150,000

POST-PROGRAM FUNDING
$7,572,500

DISCOVERY INTERVIEWS
155

Hydrogen and Fuel Cell Technologies Office (HFTO)

Team	Lab	Cohort	Discovery Interviews
Polymer Membranes	SNL	2	41
CryoH2	LLNL	4	56
Electro-Active (.5)	ORNL	7	40
High Flying Hydrides	NREL	13	78
GreenHEART (.5)	NREL	17	38
P-SOEC	INL	19	77

TOTAL TEAMS FUNDED
5

INVESTMENT TOTAL
$382,500

POST-PROGRAM FUNDING
$1,811,857

DISCOVERY INTERVIEWS
330

Participation by Technology Program Offices

Fossil Energy and Carbon Management (FECM)

Team	Lab	Cohort	Discovery Interviews
MECS	LLNL	4	64
CO_2BOL-NG	PNNL	5	75
Memzyme	SNL	10	81
CO_2 Converters (.5)	ANL	12	39
ALFa-LDS for Methane	LANL	15	72
Pipeline Sensors	NETL	15	78
Lignocrete	NREL	17	76
ReCapture (.5)	NREL	18	42
Green Capture	ORNL	19	86
SCANIT	LBNL	19	78

TOTAL TEAMS FUNDED
9

INVESTMENT TOTAL
$702,500

POST-PROGRAM FUNDING
$3,675,000

DISCOVERY INTERVIEWS
691

Geothermal Technologies Office (GTO)

Team	Lab	Cohort	Discovery Interviews
Micro Miners (.5)	LLNL	2	30
TOUGH	LBNL	2	54
GeoCAES	NREL	4	51
Sandia Technology Systems	SNL	4	40
Dual-Source Heat Pump	ORNL	16	76
MatDNA (.33)	SNL	18	25
HEMatGan (.33)	SNL	18	31
Xhangi	LANL	19	111

TOTAL TEAMS FUNDED
6

INVESTMENT TOTAL
$475,833

POST-PROGRAM FUNDING
$4,353,333

DISCOVERY INTERVIEWS
417

Industrial Efficiency and Decarbonization Office (IEDO)

Team	Lab	Cohort	Discovery Interviews
ENERWAVE	NETL	18	79

TOTAL TEAMS FUNDED
1

INVESTMENT TOTAL
$80,000

POST-PROGRAM FUNDING
$0

DISCOVERY INTERVIEWS
79

Participation by Technology Program Offices

National Alliance for Water Innovation – LBNL (NAWI)

Team	Lab	Cohort	Discovery Interviews
Water DAMS	NREL	11	82
Water-TAP3	NREL	11	72

TOTAL TEAMS FUNDED
2

INVESTMENT TOTAL
$150,000

POST-PROGRAM FUNDING
$4,600,000

DISCOVERY INTERVIEWS
154

Office of Nuclear Energy (NE)

Team	Lab	Cohort	Discovery Interviews
QUAKE	INL	2	35
Monolith	SNL	3	37
Dry Cask Vital Signs	INL	4	51
Change Detection Systems	INL	4	71
EMRALD	INL	5	76
Electroplate (.5)	INL	5	28
AMAFT	INL	5	76
4C's	INL	6	38
ELINA	INL	6	102
HOT	INL	7	75
AxiVis	INL	7	90
M2LD	INL	8	116
Rotoro	INL	9	77
Thermal Sound On	INL	10	73
Mesofluidics	PNNL	13	63
Feedforward K9	INL	14	60
MIA	ORNL	17	94
SSAM (.33)	PNNL	17	25
SHIELDS	INL	19	76

TOTAL TEAMS FUNDED
18

INVESTMENT TOTAL
$1,349,167

POST-PROGRAM FUNDING
$15,621,333

DISCOVERY INTERVIEWS
1,263

National Nuclear Security Administration (NNSA)

Team	Lab	Cohort	Discovery Interviews
Enduring Advantage	SNL	10	75
UXI	SNL	10	81
HECATE	SNL	11	81
CAP Fastener	SNL	11	60
MAD3	SNL	12	74
EPDR	SNL	12	71
ThermaSET	SNL	13	103
Fractured	SNL	13	76
Disease Precognition	LANL	14	82
nDETECT	SNL	14	75
Tough Adhesive	ORNL	15	74
Ridged Electrodes	SNL	16	77
Electro3D	SNL	16	76
MagTag	SNL	17	75
PhotoSil	LLNL	17	77
InterFluid Sensors	SNL	18	72
NERO	SNL	19	79

TOTAL TEAMS FUNDED
17

INVESTMENT TOTAL
$1,310,000

POST-PROGRAM FUNDING
$9,102,002

DISCOVERY INTERVIEWS
1,308

Participation by Technology Program Offices

Office of Electricity (OE)

Team	Lab	Cohort	Discovery Interviews
DCAT	PNNL	6	75
Glass paper	INL	8	75
EnergyBlox	SLAC	8	27
EcoBlock	LBNL	9	75
DER-CAM	LBNL	9	78
TRAST	PNNL	11	78
THERMS (.5)	SNL	12	34
C3D	INL	13	87
MASTERRI	INL	14	55
GRIP	SLAC	14	56
Fire Map (.5)	SNL	16	38
GridSense	SNL	17	80
OptimalEnergy (.33)	SNL	19	28

TOTAL TEAMS FUNDED
11

INVESTMENT TOTAL
$859,167

POST-PROGRAM FUNDING
$11,175,000

DISCOVERY INTERVIEWS
785

Office of Science (SC)

Team	Lab	Cohort	Discovery Interviews
SuperChips	LBNL	11	72
INN-Design	NREL	12	69
RoboDT	ANL	14	76
Efficient Isotopes	PNNL	15	76
Intercept Imaging	LANL	18	75
GreenSight	ORNL	18	80
QICK	FNAL	18	76

TOTAL TEAMS FUNDED
7

INVESTMENT TOTAL
$545,000

POST-PROGRAM FUNDING
$8,530,000

DISCOVERY INTERVIEWS
524

Office of Science Basic Energy Science (SC-BES)

Team	Lab	Cohort	Discovery Interviews
MatDNA (.33)	SNL	18	25
HEMatGan (.33)	SNL	18	31

TOTAL TEAMS FUNDED
1

INVESTMENT TOTAL
$53,333

POST-PROGRAM FUNDING
$333,333

DISCOVERY INTERVIEWS
56

Participation by Technology Program Offices

Solar Energy Technologies Office (SETO)

Team	Lab	Cohort	Discovery Interviews
Solguard	NREL	2	51
Hydroscanner	LLNL	3	44
HALO	NREL	4	83
THERMS (.5)	SNL	12	34
AVIAN-SOLAR	ANL	15	123
NIO	NREL	16	79
SSAM (.33)	PNNL	17	25
Step 1	SNL	19	75

TOTAL TEAMS FUNDED
7

INVESTMENT TOTAL
$529,167

POST-PROGRAM FUNDING
$44,076,333

DISCOVERY INTERVIEWS
514

Vehicle Technologies Office (VTO)

Team	Lab	Cohort	Discovery Interviews
Smart Charge Adapter	ANL	2	71
CellSage	INL	4	44
Lubricant Engineers	PNNL	4	75
MicroWatts	NREL	5	75
FAST	PNNL	6	91
Beyond Lithium-Ion Batteries	ANL	7	82
routeE	NREL	8	80
BOND-NORTHWEST	PNNL	8	93
Resilicoat	ANL	9	82
HeadCount	NREL	10	74
SWaP Electronics	SNL	11	47
RECOVER (.5)	PNNL	12	39
e-Mission	NREL	12	78
Athena	NREL	13	82
DFI	SNL	13	76
EnStore for BTMS	NREL	13	88
Lithium Battery	INL	13	75
Real-Twin	ORNL	14	78
ShAPE Recycling	PNNL	14	63
ZAV-SNL	SNL	14	48
Track Analytics	SNL	16	75
Advanced Cathodes (.5)	ANL	18	39
SprayCell	ANL	19	110

TOTAL TEAMS FUNDED
22

INVESTMENT TOTAL
$1,662,500

POST-PROGRAM FUNDING
$7,830,323

DISCOVERY INTERVIEWS
1,665

Wind and Water Power Technologies Office (WWPTO)

Team	Lab	Cohort	Discovery Interviews
Dynamic Line Rating aks GLASS	INL	3	72
RF Tag	PNNL	4	75
Autonomous Concrete Printing	NREL	4	79
WindSOCK	NREL	5	75

TOTAL TEAMS FUNDED
4

INVESTMENT TOTAL
$300,000

POST-PROGRAM FUNDING
$3,350,000

DISCOVERY INTERVIEWS
301

Participation by Technology Program Offices

Water Power Technologies Office (WPTO)

Team	Lab	Cohort	Discovery Interviews
IHESS2020	INL	11	72
SLIC	PNNL	11	61
Irrigation Viz	PNNL/INL	12	96
GLIDES	ORNL	13	75
Lab-on-a-Fish	PNNL	13	52
Under the C	NREL	14	71
Hydrogen Ships	SNL	14	40
SeaDragon	NREL	17	57
Integrated Energy Box	NREL	18	75
NAIAD	PNNL/INL	18	85
PoSeiDOn	NREL	18	84

TOTAL TEAMS FUNDED
11

INVESTMENT TOTAL
$845,000

POST-PROGRAM FUNDING
$7,322,000

DISCOVERY INTERVIEWS
768

Wind Energy Technologies Office (WETO)

Team	Lab	Cohort	Discovery Interviews
HyMag (.5)	ANL	8	39
SpiderFloat	NREL	8	77
MADe3D	NREL	9	78
SAND	INL	9	77
ThermalTracker-3D	PNNL	9	56
HOPP	NREL	11	44
OpenOA	NREL	11	44
RBLO	NREL	12	57
TAP	NREL	12	76
WindEZ	NREL	14	76
HighWind	NREL	15	107
NoVo Rotor	NREL	16	79
Distributed Wind Toolkit	NREL	16	75
Hercules	NREL	17	75
GreenHEART (.5)	NREL	17	38
INDRAGUARD	ORNL	18	79
OptimalEnergy (.33)	SNL	19	28
Windpowercast	NREL	19	76

TOTAL TEAMS FUNDED
16

INVESTMENT TOTAL
$1,259,167

POST-PROGRAM FUNDING
$4,730,000

DISCOVERY INTERVIEWS
1,181

Lab-Funded Teams

Team	Lab	Cohort	Discovery Interviews
CI-ReClad	ORNL	1	75
Dynamic Aperture	ANL	1	23
EcoSnap	NREL	1	45
HYDRA	PNNL	1	40
SubLambda	PNNL	1	37
Tunation	ORNL	1	86
WISDEM	NREL	1	80
BioAlchemy	LBNL	2	51
Biolyst Renewables	NREL	2	81
Evodia	LBNL	2	45
Resin Wafer Deionization (RWEDI Solutions)	ANL	2	75
SwitchGlaze (.5)	NREL	3	27
OleoSponge	ANL	6	62
APeX Imaging	NREL	15	77

TOTAL TEAMS FUNDED
14

INVESTMENT TOTAL
$987,500

POST-PROGRAM FUNDING
$10,754,998

DISCOVERY INTERVIEWS
804

Participation by Technology Program Offices

Office of Technology Transitions

Team	Lab	Cohort	Discovery Interviews
UTS	ORNL	10	76
MAC	NETL	12	69
memQ	ANL	13	87
Hyper Team	NETL	13	80
CECIE	SRNL	18	78

TOTAL TEAMS FUNDED
5

INVESTMENT TOTAL
$380,000

POST-PROGRAM FUNDING
$3,235,000

DISCOVERY INTERVIEWS
390

Pilot Funded

Team	Lab	Cohort	Discovery Interviews
Frequency Sensing Load Controller	ANL	0	75
My Green Car	LBNL	0	75
TwistAct	SNL	0	75
ARAI	INL	1	96
C-Best	LLNL	1	13
Co-Culture Green	PNNL	1	34
Ring Burner	LBNL	1	71
SonicLQ	ANL	1	11
STARS	PNNL	1	78
Switchable Polarity Solvents	INL	1	78

TOTAL TEAMS FUNDED
10

INVESTMENT TOTAL
$750,000

POST-PROGRAM FUNDING
$2,897,000

DISCOVERY INTERVIEWS
606

Privately Funded

Team	Lab	Cohort	Discovery Interviews
Opt-grid	NREL	6	87

TOTAL TEAMS FUNDED
1

INVESTMENT TOTAL
$75,000

POST-PROGRAM FUNDING
$246,861

DISCOVERY INTERVIEWS
87

Post-Program Funding

Team post-program funding reported through August 2024.

Team Name	Post-Program Funding Received	Funded through Energy I-Corps by:
4C's	$1,500,000	NE
ALFa-LDS for Methane	$450,000	FECM
AMAFT	$103,000	NE
APeX Imaging	$150,000	NREL
ARAI	$161,000	Pilot
ARME	$225,000	AMO
Athena	$375,000	VTO
AVIAN-SOLAR	$1,644,000	SETO
Biolyst Renewables	$6,449,998	NREL
Bio-NIPU	$136,500	BETO, BTO
Bioreactor	$200,000	BETO
BOND-NORTHWEST	$40,000	VTO
C3D	$570,000	OE
CAN-Coatings	$300,000	AMO
Change Detection Systems	$775,000	NE
CO_2 Converters	$250,000	AMO, FECM
CO_2BOL-NG	$520,000	FECM
COMBA	$3,600,000	AMO
CuB Fuels	$360,000	BETO
CUBES	$1,100,000	BETO
DCAT	$10,000	OE
DFI	$2,372,000	VTO
Dual-Source Heat Pump	$1,270,000	GTO
Dynamic Line Rating aks GLASS	$1,850,000	WWPTO
EcoBlock	$8,000,000	OE
EcoSnap	$350,000	NREL
E-Ionsorb	$1,500,500	AMO
Electro3D	$150,000	NNSA
Electro-Active	$3,573,714	BETO, HFTO
ELINA	$6,505,000	NE
e-Mission	$675,000	VTO
EMRALD	$745,000	NE
Enduring Advantage	$435,000	NNSA
EPDR	$50,000	NNSA
E-RECOV	$280,000	AMO
Fermeley	$500,000	BETO
Fire Map	$500,000	CESER, OE
FLO.materials	$4,800,000	AMO

Post-Program Funding

Team Post-Program Funding (continued)

Team Name	Post-Program Funding Received	Funded through Energy I-Corps by:
Fractured	$16,000	NNSA
FrozEn	$450,000	AMO
GALILEO	$1,050,000	AMO
Gamma Rayality (GRI)	$6,022,500	EM
GeoCAES	$300,000	GTO
Glass paper	$1,560,000	OE
GreenHEART	$50,000	HFTO, WETO
GridSense	$275,000	OE
GRIP	$345,000	OE
HALO	$41,880,000	SETO
HEMatGan	$1,000,000	AMMTO, GTO, SC-BES
High-Moisture Pelleting Process	$1,400,000	BETO
HOT	$840,000	NE
Hyper Team	$725,000	OTT
IHESS2020	$4,000,000	WPTO (water)
Integrated Energy Box	$100,000	WPTO
LaserSense (Iris Light Technologies)	$807,000	AMO
MAC	$200,000	OTT
MAD3	$345,000	NNSA
MADe3D	$800,000	WETO (wind)
MASTERRI	$40,000	OE
MECS	$1,680,000	FECM
memQ	$1,020,000	OTT
MIA	$2,200,000	NE
Micro Miners	$4,900,000	AMO, GTO
Mixed Plastic Upcycling	$1,100,000	AMO
NAIAD	$36,000	WPTO
NanoHeatBlock	$1,782,026	AMO
nDETECT	$565,000	NNSA
NIO	$144,000	SETO
OleoSponge	$350,000	ANL
OpenOA	$285,000	WETO (wind)
Opt-Grid	$246,861	IP Group (Private)
PhotoSil	$100,000	NNSA
Purebeam	$1,550,000	EM
QUAKE	$2,820,000	NE
ReCapture	$1,800,000	BETO, FECM
RECOVER	$1,960,250	AMO, VTO

Post-Program Funding

Team Post-Program Funding (continued)

Team Name	Post-Program Funding Received	Funded through Energy I-Corps by:
RE-Metal	$1,230,000	AMO
Resin Wafer Deionization (RWEDI Solutions)	$1,701,000	ANL
REVAMP	$620,000	BETO
RF Tag	$1,500,000	WWPTO (water)
RoboDT	$6,030,000	OS
routeE	$1,795,000	VTO
Saline Solutions	$8,250,000	AMO
SeaDragon	$440,000	WPTO (water)
SLIC	$2,746,000	WPTO (water)
Smart Charge Adapter	$1,393,198	VTO
Solguard	$150,000	SETO
SonicLQ	$285,000	Pilot
SpiderFloat	$1,900,000	WETO (wind)
SSAM	$400,000	AMMTO, NE, SETO
STARS	$2,001,000	Pilot
SuperChips	$2,500,000	OS
Sustainability Integrators	$1,550,088	AMO
Switchable Polarity Solvents	$450,000	Pilot
SwitchGlaze	$2,300,000	BTO, NREL
TAP	$800,000	WETO (wind)
ThermalTracker-3D	$920,000	WETO (wind)
ThermaSET	$1,741,002	NNSA
Thermoelectric Dryer	$1,600,000	BTO
THERMS	$250,000	OE, SETO
Track Analytics	$200,000	VTO
Tunation	$154,000	ORNL
UBEM	$1,000,000	BTO
UltraSep	$1,652,000	BETO
UTS	$1,290,000	OTT
UXI	$5,700,000	NNSA
Water DAMS	$600,000	NAWI
Water-TAP3	$4,000,000	NAWI
WESAP	$2,220,000	AMO
WISDEM	$450,000	NREL
Wolfram Plating	$100,000	AMO
Total	**$197,138,637**	

Commercialization Successes and Team Spotlights

EIC Topic 2 aims to accelerate the deployment of energy technologies by delivering workforce development training and funding support to National Lab scientists and engineers. By empowering researchers to seek direct market feedback for their technology offerings, DOE-supported innovations have a broader impact on climate goals.

Since 2015, more than 510 National Lab researchers have matriculated through EIC. Participants graduate with a framework for industry engagement that guides future research and fosters a market-informed culture back at the lab. The program's impact extends into the market itself, with 25 new businesses launched based on EIC technology and 85 licenses executed.

The following pages showcase the commercialization success and impact—both during and after the program—of just a few of the teams that have participated in EIC.

EC-Leach

Lab: Idaho National Laboratory

Funding Organization: Advanced Manufacturing Office*

Cohort: 12

The EC Leach Team's Recycling Technology Already in High Demand

The mining industry produces sediment byproducts typically considered waste, despite valuable metals within. This EIC team, funded by DOE's AMO,* focused on recovering these metals for battery use. Team Electrochemical (EC) Leach from INL participated in Cohort 12. Since graduating, their technology has been licensed in the battery sector, with other companies pursuing mining applications.

Luis Diaz Aldana, an electrochemical engineer at INL, and his team initially created the EC Leach technology to extract precious metals from end-of-life lithium-ion batteries. The electrochemical process retrieves (or "leaches") the materials into one mass, then dilutes and divides them back into individual metals.

"We knew you could recover the metals and put them back into new batteries, but we didn't know who would be interested," Aldana said. "Energy I-Corps helped us identify ideal target customers. Some were expected and others we had never thought of. It was such a valuable experience because it helps you get out of your comfort zone."

The outreach paid off. Airtronics, an aircraft manufacturing facility and defense contractor, recently negotiated a license with INL to scale the battery materials extraction process.

"What made [the technology] immediately attractive is the growing demand for recycled materials," said Frank Oliver, Airtronics' chief technology officer (CTO). "It fits into a number of different processes, and we are designing a scaled-up system."

The system currently produces half a gallon of critical materials per day with a 98% recovery rate. The pilot goal is 5–10 gallons, eventually scaling to 500 gallons per day—the equivalent of two electric vehicle batteries worth of precious metals.

"If you look across the United States, there is an ample [battery] supply, and large recycling companies have already made deals with auto manufacturers to begin collecting [batteries]," Oliver said. "As a power-assisted electrochemical leaching system, EC Leach can easily slot into existing flows and supply chains. Powered by renewable energy, it can even eliminate the carbon footprint."

EC Leach's electrochemical technology separates precious metals for additional use on waste from gold and silver mining sites, including this one in Latin America. *Photo courtesy of Juan Carlos Villatoro*

Another commercialization lead started from within the team itself. Juan Carlos Villatoro, industry mentor for INL's EIC team, is chief executive officer (CEO) of Alquimista, a metals processing company focusing on securing supply chains of minerals critical to national security.

After working with the team, Villatoro now plans to license INL's electrochemical technology for use in another market: mining. It can recover precious metals from gold and silver mining waste for reuse.

"EC Leach can take waste from the mining industry and extract high-yield minerals, sometimes more valuable than the gold and silver originally mined," Villatoro said. "We discovered platinum, iridium, and more in [waste] concentrates—all of which are in high demand."

This makes it easier to recycle and reuse these materials, enabling the United States to import these materials from Latin America, diversifying the resource pool. The extracted minerals, such as cobalt, are essential for the creation of batteries, specifically the lithium-ion batteries used in electric vehicles.

Alquimista now has a $1.2 billion incentive investment package for a Platinum Group Metals refinery in El Salvador that will integrate the EC Leach technology into its system, set to be completed in 2025.

EC Leach's story exemplifies the transformative power of innovative technology and collaborative industry efforts, already making an impact from revolutionizing mining waste management in Latin America to advancing sustainable battery recycling in the United States.

*In 2023, AMO restructured to IEDO and AMMTO.

MagTag

Lab: Sandia National Laboratories

Funding Organization: National Nuclear Security Administration

Cohort: 17

Three-Time Energy I-Corps Participant Drives Innovation in Tracking and Storage Solutions

Kyle Guin, CEO and cofounder of VastVision Technologies, has a unique distinction—he has participated in the EIC program three times, each in a different role. On his third go-round, he not only mentored a team but also successfully licensed the technology they developed.

Guin began his journey as an undergraduate student in the NSF's I-Corps, continued in EIC as an entrepreneurial lead, and capped it off as an industry mentor after he left SNL in 2022 to start VastVision. His role as the industry mentor for the MagTag team—sponsored by DOE's NNSA—was made possible by his departure from Sandia and the extensive network he has built since.

"It's very different," Guin said, reflecting on his transition from participant to mentor. "Being an entrepreneurial lead is very intense, in-depth, day-to-day work. As a mentor, it's less so. I could mentor the MagTag team because I was separate from the lab, and I had a lot of contacts in the asset and inventory space."

MagTag is a tracking sensor that uses a magnetic elastic that expands in size when exposed to a magnetic field. It sends out a signal, receives a response, and reports shifts in temperature, making it ideal for tracking certain substances. Notably, the MagTag technology works without a battery, powered solely by the magnetic field.

Guin highlighted the technology's potential: "Shipping companies could place one of these small tags in all their packages with dangerous goods, like hydrogen, and the tracker can sense certain environmental factors about that package. If the hydrogen starts to leak, they can detect that. As the shippers take them off the truck, they can scan each sensor and see its status."

Recognizing its potential, Guin's company, VastVision, decided to license the MagTag technology. VastVision, an inventory management and asset tracking platform, currently interfaces with GPS and radio frequency identification (RFID) tracking. Guin hopes to integrate MagTag technology for situations where GPS and RFID are insufficient, such as with nuclear material.

Team MagTag graduated from Cohort 17 with their battery-free magnetic sensor that tracks temperature and environmental changes, supporting inventory management and nuclear waste monitoring. Left to right: Shelly Curtiss, EIC program advisor; Danielle France, EIC Topic 2 coach; Max Green, EIC instructor; Carolina Villacis, commercialization program manager for DOE's OTT; Vanessa Chan, DOE Chief Commercialization Officer; Jamin Pillar, entrepreneurial lead; Kyle Guin, industry mentor; Christian Arrington, principal investigator; Steve Albers, EIC instructor; Tom Teynor, EIC instructor, Rebecca Kauffman, EIC instructor.
Photo by DOE Photographer Donica Payne

"When burying nuclear waste underground, we're looking at [burying the waste for] a long time period—50 or more years—and we want to be able to [locate] it consistently, without worrying about batteries," said Jamin Pillars, principal member of the technical staff at Sandia and a member of the MagTag team. "[MagTag] can detect if there is some sort of reaction, so it becomes a fail-safe for nuclear waste storage. All we need is a loop antenna that transmits a magnetic field interacting with these tags."

Jamin Pillars, the entrepreneurial lead of the MagTag team, explains how EIC changed his perspective. "It helps you grow as a scientist or engineer," said Pillars. "We're very technical, analytical people. We don't think about customer discovery or how the market is going to absorb this technology."

While MagTag is still two to three years away from commercialization, Pillars and his colleague Christian Arrington are excited to see the technology get to market through VastVision.

"Energy I-Corps gave me a different perspective because it really hones in on that business side of the world," said Arrington. "Working in a national lab, you're always thinking of technical applications and needs, but not necessarily general business needs. It opened up that world to me."

"Joining a startup is not something I'd ever even thought about before Energy I-Corps," Pillars said. "But after graduation, we are very much on board for it."

memQ

Lab: Argonne National Laboratory

Funding Organization: Office of Technology Transitions

Cohort: 13

EIC Team Discovers How to LEEP Forward

memQ, a quantum technology startup, achieved critical milestones with support from two DOE programs: EIC and the Lab-Embedded Entrepreneurship Program (LEEP). Sean Sullivan, chief technology officer, participated in EIC Cohort 13 while at Argonne, sponsored by OTT. EIC provided key commercialization training to transform memQ from an academic research project into a viable business. After completing the program, Sullivan spun out a company and joined Argonne's LEEP node, Chain Reaction Innovations (CRI), where memQ rapidly developed its quantum networking prototypes. memQ's journey from lab research to commercial success underscores EIC's and LEEP's impact.

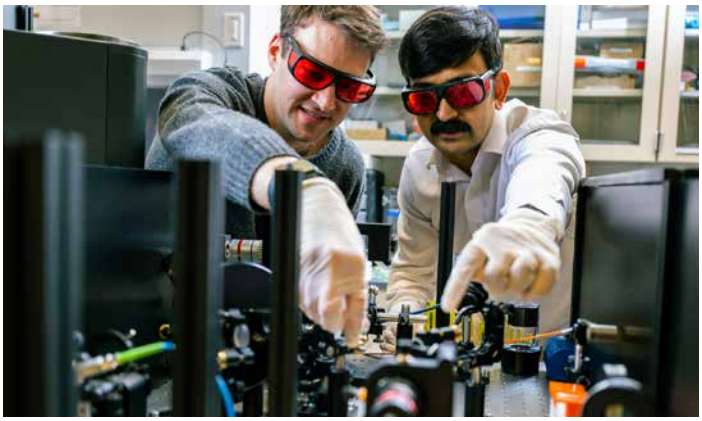
Quantum entanglement refers to the way particles remain connected even when separated by vast distances, so that a change to one particle affects the other, no matter how far apart they are. While the concept is complex, Sullivan emphasizes that understanding entanglement is not necessary to appreciate its importance in quantum computing.

"Entanglement is a powerful resource for quantum networks," Sullivan said. "We can generate pairs of entangled particles that travel through standard fiber-optic cables, enabling secure communication between quantum devices."

Unlike traditional computers, which use binary code (ones and zeros) to communicate, quantum computers use quantum bits (qubits). These qubits cannot be copied, making direct connections essential to maintain their state during communication, creating high security.

"We are building hardware enabling different quantum devices—computers, sensors, and more—to communicate over networks," Sullivan said. "Just like the internet revolutionized regular computing, we're developing the network infrastructure for quantum technologies."

The idea for memQ originated from Sullivan's post-doctoral research at Argonne, developing new qubits for quantum communications. Collaborating with a University of Chicago colleague, they realized their research's commercialization potential, leading to memQ's founding.



Sean Sullivan and Manish Singh, principal investigator and entrepreneurial lead, respectively, from ANL took part in Energy I-Corps Cohort 13 before participating in Chain Reaction Innovations, Argonne's Lab Embedded Entrepreneurship Program. *Photo courtesy of ANL*

After memQ completed EIC in fall 2021, it won the George Shultz Innovation Fund (GSIF) award through the University of Chicago in February 2022. Sullivan then joined CRI in fall 2023, where memQ developed its first prototypes and began expanding. That makes memQ one of three teams from EIC to later join a LEEP node.

"We closed out a $2.5 million pre-seed round with private investors thanks to the technical de-risking from LEEP coupled with funds from the GSIF award," said Sullivan. "It meant we did not need to spend as much on expensive capital equipment up front to have a proof-of-concept."

Sullivan continues to apply EIC lessons as memQ grows, now employing six full-time and two part-time employees. The company is targeting a product launch by 2026, with some entangled-photon applications expected by 2025. Recently, in partnership with the Air Force Research Lab and AIM Photonics, memQ received its first full batch of semiconductor material for microchip production.

It is also a member of the Bloch Quantum Tech Hub, the nation's only quantum innovation group rallying entire sectors to combat financial fraud, secure the energy grid, and accelerate the development of life-saving drugs. The Hub received $500,000 from the U.S. Economic Development Administration in July 2024 to further strengthen the coalition. memQ is planning another private raise in early 2025.

Reflecting on the journey from lab research to market, Sullivan encourages scientists to embrace risk-taking.

"As scientists, we tend to be risk adverse, wanting a full dataset before making decisions," he said. "But stepping out of the lab into the market requires taking risks. I wish more scientists felt comfortable doing that."

UTS

Lab: Oak Ridge National Laboratory

Funding Organization: Office of Technology Transitions

Cohort: 10

From Nature to NASA: How Ultrasonic Technology Solutions Revolutionizes Drying

EIC team Ultrasonic Technology Solutions (UTS) from ORNL, funded by OTT, developed a more efficient, less energy-intensive solution to dry materials en masse. After participating in Cohort 10, UTS refined its technology and approach, ultimately launching a startup. Their groundbreaking work has sparked impactful partnerships, including with NASA, where UTS is developing space-efficient solutions for the International Space Station (ISS).

"As soon as we graduated [from EIC], we launched our startup company," said UTS Founder and CEO Ayyoub Momen. "Energy I-Corps helped us correct our storytelling. It makes a huge difference when you tell your story the way the customer wants to hear rather than just telling the story that you want."

Instead of using heat, UTS' novel approach uses high-frequency vibration of piezoelectric transducers for water removal. During the process, water leaves the wet item in the form of cold mist, which can be vented or reclaimed.

"Our process is up to five times more efficient and twice as fast as conventional heat-based dryers," said Momen. "Notably, it excels even further with thicker products."

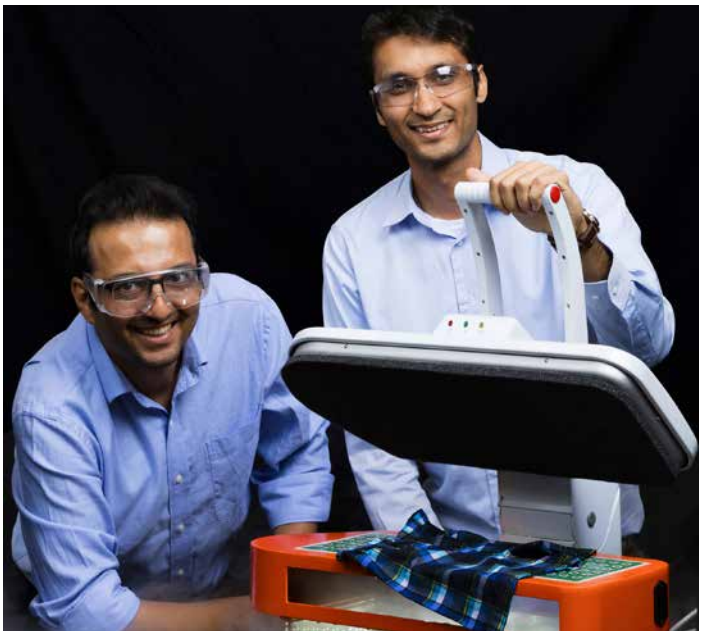
The inspiration for UTS came from observing mammals shake water off their bodies.

"That was an 'ah-ha' moment for me," Momen said. "We can intensify what we see in nature to make energy-intensive drying more sustainable."

About 15% of all energy use in the United States is for drying materials—everything from clothes to wood pulp and drywall. Typically, thermal energy is used to dry materials, but Momen's direct contact ultrasonic dryer technology, developed at ORNL, uses the piezoelectric effect to shake material at a microscopic level and extract water without heat.

"The water is extracted mechanically as cold mist that can be captured, recycled, or vented out," Momen said. "We are not using heat or evaporating water."

Momen and the UTS team joined EIC after several proof-of-concept studies at ORNL.



UTS makes drying up to five times more efficient by prioritizing mechanics at the microscopic level instead of using heat. From left to right: Ayyoub Momen, principal investigator; Viral Patel, former ORNL postdoctoral researcher. *Photo courtesy of ORNL*

"The program was eye opening for us," Momen said. "Customer discovery helped us understand customer pain points and adjust our approach. We interviewed more than 80 potential customers, and clarity came after about 40 or 50."

During EIC, UTS realized some of their assumptions were wrong—factors they thought were valuable for customers were not, and they undervalued drying speed.

UTS now has several clients with different applications for its technology. It has five major pilot demonstrations, four with large manufacturers and one on a smaller scale. On top of that, UTS has projects with DOE's BTO, the Advanced Research Projects Agency-Energy, and NASA.

One NASA project focuses on developing a clothes washer-dryer combo for the ISS. Astronauts currently wear the same clothes for days in a row, then dispose of them. A laundry system could dramatically reduce payload sent to the ISS.

Another NASA project involves recovering water from human waste. Every time an astronaut goes to the restroom, it costs many thousands of dollars due to unclaimed water. Human waste is 70% water, and UTS has demonstrated it can recover more than 90% of the water, reducing payload weight and cost.

UTS now has eight people on its payroll and plans on continued growth for the future.

"The journey was not easy, but it is very rewarding," Momen said. "I do not regret the decision I made to leave a stable job and start a company. DOE has all these great programs for aspiring entrepreneurs, and I highly recommend them to my peers."

CECIE

Lab: Savannah River National Laboratory

Funding Organization: Office of Technology Transitions

Cohort: 18

First Savannah River National Lab Team Graduates From Energy I-Corps With Deuterium Breakthrough

SRNL made its debut participation in the EIC program with the CECIE team, Controlled Equilibrium Catalytic Isotope Exchange. In Cohort 18, the CECIE team gained valuable insights including discovering new potential markets for their deuterium process. Originally focused on creating solvents, the team pivoted toward deuterium production, resulting in a more cost-effective process. The team credits the EIC program with sparking entrepreneurial thinking and inspiring future participation from lab colleagues. Team CECIE was funded by OTT.

"We didn't know how much work it was going to be, but the value I got out of it definitely outweighed the effort," said George Larsen, principal research scientist at SRNL. "Now I want to encourage other people in our lab to participate because of how rewarding the experience was, and also having peers who have gone through the program can prepare others for what's about to happen."

Larsen and his team plan to serve as ambassadors for EIC and will host an information session at SRNL during the next call for participants.

"There's so much to be leveraged from [EIC] to make your research more impactful," he said. "The program is particularly suited to answer the question, 'What is a commercial application for your research?' It's amazing to have an opportunity to look at out-of-the-box applications to see how those might translate to real-world impact."

Deuterated molecules are often more stable because the bonds with deuterium are stronger compared to bonds within their nondeuterated counterparts.

"If you put deuterium in battery electrolytes, then the battery can last twice as long," Larsen said. "Adding deuterium in certain spots on a medicine can reduce side effects and increase efficacy because it changes how the molecules move through the body."

Deuterated molecules are typically expensive to produce, and the reaction can be slow to complete. However, SRNL's CECIE process recovers the deuterium in less time, and the process is more economical.

The CECIE team at Cohort 18's kickoff event. From left to right: Carolina Villacis, commercialization program manager for DOE's OTT; Daren Timmons, director of Industrial and Strategic Partnerships at SRNL; Tyler Guin, entrepreneurial lead, Team CECIE; and George Larsen, principal investigator, Team CECIE. *Photo courtesy of George Larsen*

Through the EIC program, the CECIE team realized its initial market assumptions were not correct. Prior to focusing on deuterium production, the team was exploring production of a traditionally resource-intensive solvent.

"We thought we could introduce a solvent that's not currently made because it's too expensive or too difficult," Larsen said. "But we discovered most people have adapted to the existing supply of deuterated materials, and our original idea would not be a very large market."

However, while conducting this market research, the team was pleasantly surprised to uncover potential customers in the medical field interested in deuterated glucose.

"Some cutting-edge researchers are using deuterated glucose to do MRI imaging of tumors," Larsen said. "By measuring the deuterium signal of the glucose metabolism, we can extract more information about the tumor than by traditional methods, while avoiding current radiation exposure."

Based on this, the CECIE team is going to look at making deuterated glucose to reduce the cost of its current process. A patient currently pays more than $10,000 for tumor imaging using deuterated glucose, and the CECIE team's goal is to get the patient's cost down to less than $1,000.

Larsen credits EIC with his new interest in the business world.

"It definitely sparked my entrepreneurial identity," he said. "This is something we could actually do—we could start a company. Now I have a better vision of how our technology impacts the world."

CUBES

Lab: Sandia National Laboratories

Funding Organization: Bioenergy Technologies Office

Cohort: 16

Waste Into Energy: Biofuels Offer a Greener Future

The Carbon Upcycled Bioproducts for Environmental Sustainability (CUBES) project, led by Carlos Quiroz-Arita and Nicholas Myllenbeck from SNL, participated in EIC Cohort 16, funded by the DOE Bioenergy Technologies Office (BETO). Through Energy I-Corps training and perspectives, the team was able to shift their research focus to one with promising market viability. Now, the team is advancing biofuel technologies that could help meet growing global demand for sustainable fuels and reduce greenhouse gas emissions.

Organic materials such as plants, agricultural waste, and even animal manure can be converted into usable biofuels such as ethanol, biodiesel, and biogas that can serve as alternatives to traditional fossil fuels. Because they come from renewable resources and can reduce greenhouse gas emissions, biofuels are considered more environmentally friendly.

Global demand for biofuels is projected to increase by nearly 30% by 2028. However, many biofuel technologies are limited by obstacles such as high production costs and low availability of feedstocks—the raw materials that can be used to produce energy. In addition, many biofuel technologies have not yet achieved net-zero or net-negative carbon emissions.

To bridge these gaps, Quiroz-Arita and Myllenbeck joined forces with industry mentor Paul Bryan to create the CUBES project, an effort to identify feedstocks and technologies that can not only perform efficiently on an industrial scale but also provide significant environmental benefits.

“We wanted to show that biofuel technologies can be economically viable and environmentally sustainable,” said Quiroz-Arita, who specializes in wastewater engineering and biorefineries and has industry experience in the conversion of biomass to biofuels and bioproducts through anaerobic reactors.

As part of EIC, the team interviewed 82 refineries, consultants, non-profit organizations, and farmers to gain insights into the market needs and pain points related to biofuels.

“Over 90% of our stakeholders told us that cellulosic biofuels—fuels produced from grass, wood, or crop leftovers—are not yet economically viable,” said Quiroz-Arita. “However, they also told us that cow manure is a reliable and low-cost feedstock, and some stakeholders call biogas a new gold rush.”

SNL researchers Carlos Quiroz-Arita and Nicholas Myllenbeck created the CUBES project, an effort to identify scalable feedstocks that can enable economically viable and environmentally beneficial biofuels. *Photo by Kira Vos*

Based on this feedback, the team shifted its focus to anaerobic digestion, a process that uses microbes to break down manure, turning it into biogas. This biogas can then be used as renewable natural gas to generate electricity and heat, or as sustainable aviation fuel (SAF).

The team completed EIC in May 2023 and thanks to funding from BETO, the U.S. Department of Defense’s (DOD) Defense Advanced Research Projects Agency, and internal Sandia investments, the team continues to work towards enabling economically viable and environmentally beneficial biofuels.

“EIC experience was pivotal in shaping the team’s approach to technology commercialization,” said Quiroz-Arita. “Every scientist should go through this program so that, before they invest research and development efforts in a new technology, they first identify their stakeholders’ needs.”

Quiroz-Arita and the CUBES team are reengineering anaerobic digesters with technology from Sandia that will help achieve BETO’s goals of producing 3 billion gallons of domestic SAF by 2030 and 35 billion gallons by 2050. In addition, the team’s work can help achieve DOE’s goal to displace more than 70% of greenhouse emissions.

The CUBES team continues its biofuels research and development, preparing new proposals and exploring further collaborations to bring its technologies to market. By staying attuned to industry needs and focusing on sustainable solutions, the CUBES project is well-positioned to contribute to the transition to a carbon-neutral economy.

DFI

Lab: Sandia National Laboratories

Funding Organization: Vehicle Technologies Office

Cohort: 13

Finding the Right Mix To Make Engines Cleaner

Diesel fuel, used to fuel vehicles, heavy machinery, and generators, produces harmful emissions, like particulate matter (soot) and nitrogen oxides, when burned. This EIC team, funded by DOE's VTO, focused on lowering harmful emissions. Team Ducted Fuel Injection (DFI) participated in Cohort 13.

DFI technology for diesel engines can be understood by considering a Bunsen burner. When the tube is removed from a Bunsen burner and lit, a tall, orange flame appears due to soot produced during combustion. However, attaching the tube and maintaining the same gas flow rate results in a short, blue flame.

"The flame is blue because it's not producing any soot," said Chuck Mueller, a distinguished member of the technical staff at SNL. "Inside today's diesel engines, four to nine sprays inject fuel directly into the combustion chamber, like Bunsen burners without their tubes attached. DFI transforms those sprays into Bunsen-like flames, resulting in substantially lower soot emissions."

Mueller says improving diesel engines is important because they are used in many applications that face major challenges on the path to lower life cycle CO_2 emissions. For example, heavy-duty off-road equipment, locomotives, and ships often operate in locations where recharging infrastructure does not exist. Therefore, if these applications did want rechargeable energy, they would need massive, expensive battery packs, the production of which would result in the release of huge amounts of CO_2. DFI technology is a promising alternative.

"We need to use all the tools we have to mitigate climate change," Mueller said. "Where electrification isn't practical, we can switch to fuels with lower life cycle CO_2 emissions, such as those made from plants or from CO_2 captured from the atmosphere."

Mueller brought SNL's DFI technology through EIC in 2021 and values the experience.

"It's a crash course in starting your own business," he said. "Not only learning about the business aspects of getting your technology into the market but also making connections with others in the energy ecosystem that enable you to move forward."

The DFI team smiles in a test cell with a John Deere 6-cylinder, 9-liter DFI engine. From left to right: Ryan Ogren (John Deere), Kirby Baumgard (entrepreneurial lead and Sandia consultant), and Chuck Mueller (principal investigator, Sandia). *Photo courtesy of Chuck Mueller*

A year after graduating from EIC, Mueller and Entrepreneurial Lead, Kirby Baumgard successfully assembled a team including John Deere, Cummins, the Coordinating Research Council, and Clean Fuels Alliance America. They signed a cooperative research and development agreement to create a DFI research consortium that now has 20 participating organizations.

"We've been moving DFI up the technology readiness level ladder," Mueller said. "We've been focused on testing it for the first time in a multicylinder engine from John Deere. What we've recently found is that DFI gives us 65% lower soot, 50% lower nitrogen oxides, and 70% lower life cycle CO_2 emissions. This is just the first try at a production-engine retrofit—we fully expect even better performance from an optimized, dedicated DFI engine."

The recent tests used different types of fuels, including ultralow sulfur diesel fuel, renewable diesel, biodiesel, and a 50-50% blend of renewable diesel and biodiesel. This testing was made possible because of follow-on DOE funding: the DFI team won a three-year DOE Base Annual Appropriations Technology Commercialization Fund award in 2022, selected by VTO.

Mueller says the benefits and lessons of the EIC program are too numerous to list.

"A big one was learning to identify the beachhead application to turn your idea into reality," Mueller said. "It's also been helpful in providing an overview of the whole technology commercialization process. We simply don't get that training in graduate school as scientists or engineers."

HALO

Lab: National Renewable Energy Laboratory

Funding Organization: Solar Energy Technologies Office

Cohort: 4

Advancing High-Performance Solar Cells Through Lower-Cost Manufacturing Innovations

The HALO team, funded by the DOE Solar Energy Technologies Office (SETO), focused on developing solar cells more efficiently. The NREL team participated in Cohort 4 after developing Hydride Vapor Phase Epitaxy (HVPE) to fabricate high-performance solar cells at a lower cost. Since participating in EIC in 2016, the HVPE team has been awarded more than $40 million in funding.

“EIC was the absolute best professional development I’ve ever done in my life,” Principal Scientist Aaron Ptak said. “It was incredibly intensive, but it was completely worth it. I would do it again and recommend others do as well.”

Ptak and David Young's technology for solar applications has been supported by SETO since 2013, building upon a process initially developed throughout the 1980s and 90s by using less-expensive starting materials more efficiently and deposit solar cells at much higher rates.

Since their time in EIC, the team has won nearly $42 million in follow-on funding, coming mostly from the DOD, along with awards from the Advanced Research Projects Agency-Energy, SETO, and others.

“It’s a crucial part of the research process to get out and talk to real people and understand their problems,” Ptak said. “Researchers don’t know everything. We’re smart people, but we get insulated from the real world. EIC taught us not to be afraid of picking up the phone and calling someone. Asking a question and giving someone space to answer is a hugely important skill.”

In May 2023, Principal Investigator Aaron Ptak gave an overview of NREL’s D-HVPE Reactor Lab to Secretary of Energy Jennifer Granholm. *Photo by Werner Slocum, NREL*

He believes this skill led to many of the grants his team earned over the past 8 years. This funding helped get HVPE ready for licensing, but its commercialization journey is not over yet.

Bill Hadley, a senior licensing executive in NREL’s Technology Transfer Office, helps transfer research from the lab to industry partners. He explained that while DOD is very interested in the HVPE technology, the federal government cannot manufacture products.

“We’re looking for partners who can fabricate these solar cells, but that involves a major investment in a whole new manufacturing process,” Hadley said. “We’ve shown proof of concept on a small scale, and we have the prototype reactor that interested parties can soon see in action before they sign anything.”

Hadley believes having Ptak involved in conversations with potential licensees is invaluable, and he attributes this skill to EIC.

“EIC trains our inventors to think like entrepreneurs,” Hadley said. “The training and exposure that EIC provides paves the road for our inventors to begin thinking about commercializing their technologies.”

MIA

Lab: Oak Ridge National Laboratory

Funding Organization: Office of Nuclear Energy

Cohort: 17

Creating More Confidence in Artificial Intelligence

Ugur Mertyurek, a nuclear scientist from ORNL, participated in EIC 17 funded by DOE's NE and used the program to pivot the main value proposition of his mutual information analytics (MIA) technology. While he was initially focused on improving reactor simulations, after speaking directly with individuals in industry, Mertyurek discovered that what the market actually needed was greater confidence in artificial intelligence (AI) decision-making. Less than one year after graduating from EIC, the team was able to secure 3 years of DOE follow-on funding for their new value proposition, execute a research license to an industry partner, and work toward demonstrations with interested companies.

The MIA technology filters out irrelevant data to ensure AI systems use only the most accurate and relevant information for predictions. This process helps AI focus on the critical data and make better, bias-free decisions. In this way, the technology enhances the reliability of AI applications across fields even beyond nuclear.

In fall 2023, Mertyurek and his team completed EIC, which marked a pivotal moment in reshaping MIA's business model.

"When we started the program, our vision was totally different than when we graduated," Mertyurek said. "Initially, we aimed to provide more accurate reactor simulations and maintenance predictions. Toward the end of EIC, we realized this is not what the market needs. The people we talked to really needed greater confidence in decision-making."

Through interviews with stakeholders, Mertyurek gained valuable insights that refined his approach and established important industry connections.

The MIA team at the kickoff for Energy I-Corps Cohort 17. From left to right: Atul Karve and Walid Metwally, industry mentors; Hany Abdel-Khalik, entrepreneurial lead; and Ugur Mertyurek, principal investigator. *Photo by Kira Vos*

"We were taught how to conduct the interviews—do not give information, try to extract it instead," he said. "It helped us reshape our business model as well as make contacts for the future."

Since completing the program, the MIA team has achieved significant success in securing follow-on funding and developing licensing opportunities. Notably, MIA received $2.2 million in funding from the DOE's NA-22 Data Science Program to support 3 years of research aimed at improving the accuracy of AI systems across various DOE programs.

MIA has also licensed their system to CovertDefenses, a consulting and research firm, to help develop it into a market-ready product. The current research license allows CovertDefenses to use MIA's technology as it further develops it, with plans to transition to a full commercial license.

Additionally, Mertyurek is working with General Electric to demonstrate MIA's capability on the company's reactor core monitoring system with the potential for a commercial license on the horizon. Other vendors have also shown interest, signaling a promising future for the technology.

"These are just baby steps for the technology, but they will open up possibilities," Mertyurek said. "New customers will be more willing to try new systems, new methodologies, and new technologies once we've shown MIA can increase confidence in reactor predictions."

Teaching Team

The Teaching Team brings the EIC Training Cohort curriculum to life. EIC instructors are truly the backbone of the program and provide the time, energy, and intensity needed to successfully shepherd 12–18 teams through each cohort. Instructors bring critical industry expertise to the program and introduce the language of innovation and commercialization to the participating teams. By leveraging deep technical backgrounds and advanced business experience, instructors bring their industry knowledge to each session—sharing lessons learned while incorporating program elements, professional development, and commercialization pathways. Instructors leverage their business and startup experience to the benefit of the EIC teams through instruction, one-on-one advisory sessions, presentation coaching, stakeholder discovery review, team building, and network expansion.

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Nakia Melecio
Senior Research Faculty,
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Jean Redfield
CFO and Cofounder,
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Tom Teynor
CEO, Bell Plumbing and Heating

Program Team

The Program Team operates behind the scenes, ensuring the seamless execution of EIC's mission to educate and empower National Lab researchers. These dedicated administrators play a pivotal role in shaping the program's success, providing invaluable support to participating teams, instructors, National Lab technology transfer offices, and DOE program offices. Leveraging their expertise in logistics, coordination, and execution, the EIC Program Team contributes to the transformative journey of researchers as they navigate the realms of innovation and commercialization.

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Thank You!

Thank you to the DOE, NNSA, program offices, National Laboratories, sites, and plants, instructors, and all who have made EIC possible. We have accomplished so much together!

19 cohorts* completed as of **Fall 2024**

21 offices within DOE and NNSA contributing funds to EIC teams and projects

including **242** teams from **13** National Labs

Teams have conducted more than **17,500** stakeholder discovery interviews with organizations like Google, Amazon, Shell, Ford, World Bank, Breakthrough Energy, John Deere, Chevron, Samsung, Lowes, Johns Manville, LEGO, U.S. Army, Tesla, GM, Dow Chemical, 3M, Whirlpool, GE, and Home Depot.

245+ industry mentors and instructors involved

*Includes pilot program cohort

For more information, visit: energyicorps.energy.gov

Acronyms

AMO	Advanced Manufacturing Office
AMMTO	Advanced Materials and Manufacturing Technologies Office
ANL	Argonne National Laboratory
BETO	Bioenergy Technologies Office
BTO	Building Technologies Office
CECIE	Controlled Equilibrium Catalytic Isotope Exchange
CEO	chief executive officer
CESER	Cybersecurity Research, Development, and Demonstration
DOE	U.S. Department of Energy
EERE	Office of Energy Efficiency and Renewable Energy
EIC	Energy I-Corps
EM	Office of Environmental Management
FECM	Fossil Energy and Carbon Management
FNAL	Fermi National Accelerator Laboratory
FY	fiscal year
GTO	Geothermal Technologies Office
HFTO	Hydrogen and Fuel Cell Technologies Office
IEDO	Industrial Efficiency and Decarbonization Office
INL	Idaho National Laboratory
LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratory
NAWI	National Alliance for Water Innovation
NE	Office of Nuclear Energy
NETL	National Energy Technology Laboratory
NNSA	National Nuclear Security Administration
NREL	National Renewable Energy Laboratory
NSF	National Science Foundation
OE	Office of Electricity
ORNL	Oak Ridge National Laboratory
OTT	Office of Technology Transitions
PNNL	Pacific Northwest National Laboratory
SETO	Solar Energy Technologies Office
SC	Office of Science
SC-BES	Office of Science-Basic Energy Sciences
SLAC	SLAC National Accelerator Laboratory
SRNL	Savannah River National Laboratory
SNL	Sandia National Laboratories
VTO	Vehicle Technologies Office
WETO	Wind Energy Technologies Office
WPTO	Water Power Technologies Office
WWPTO	Wind and Water Power Technologies Office

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