Technology Commercialization Internship

FISCAL YEAR 2023 ANNUAL REPORT

Office of Technology Transitions

Greetings,

The U.S. Department of Energy (DOE) Office of Technology Transitions (OTT) hosted its third year of the Technology Commercialization Internship program with growing success. This annual report presents the program's latest data and successes since 2023.

The Technology Commercialization Internship immerses bright, young minds into the world-renowned DOE National Laboratory complex and provides hands-on entrepreneurship training. Undergraduate students from across the nation apply to participate in this 10-week summer opportunity. During the program, students get assigned to a DOE National Laboratory, plant, or site, and evaluate the market pathways for a cutting-edge clean energy technology.

In 2023, OTT hosted 15 interns through the program. For the 2023 internship, we expanded the program curriculum, raised the intern's pay, and added a travel stipend to further encourage on-site experiences. The interns contributed to projects ranging from improving user design of Artificial Intelligence to developing toxic gas detectors.

I had the pleasure of attending the in-person graduation week graciously hosted by Thomas Jefferson National Accelerator Facility, where I was beyond impressed by the final presentations. Our panel of judges gave first place recognition to Zoryah Gray for her project "Market analysis and customer discovery for upcycling of single-use plastic waste" at Argonne National Laboratory.

The Technology Commercialization Internship program is integral to our portfolio of workforce development programs and creates a pipeline of talent into DOE. We've had graduates of the program come back to work at DOE program offices and National Labs. For example, two students interned with two National Laboratories, one student is now a federal contractor, and another went on to work as a National Laboratory licensing associate. Investing in our future problem solvers is a necessity that I'll continue to back.

Dr. Vanessa Z. Chan

Chief Commercialization Officer
U.S. Department of Energy Director
Office of Technology Transitions

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About the Technology Commercialization Internship (TCI) Program

TCI Overview

The Office of Technology Transitions (OTT) Technology Commercialization Internship (TCI) Program was launched in 2021 and supports OTT's mission by training the next generation of entrepreneurs while simultaneously recruiting talent for the Department of Energy (DOE) and its National Laboratories to advance commercialization within the United States. The commercialization and scale-up of clean energy technologies required to meet our nation's climate goals requires many great minds, including those trained in bringing technologies to market. The TCI contributes to developing this workforce.

The internship is a unique paid opportunity for undergraduate STEM and business students to experience the DOE world-class National Laboratory system, boost their entrepreneurial thinking, and explore energy technology markets. Interns engage with National Laboratory mentors and learn about technologies at their partnered Laboratories. This internship focuses on the business side of technology commercialization where interns acquire skills such as customer discovery, value propositions development, and market sizing. Interns are also expected to apply these skills to their assigned technologies. The students explore and contribute to projects that lie at the intersection of business and technology like advanced manufacturing, climate science, artificial intelligence, earth and atmospheric science, ocean science, and more.

2023 Program Structure

The TCI is a ~10-week summer program during which interns focus on a technology-specific project and develop a commercialization plan for that lab-developed technology. The interns earn a weekly stipend, and no relocation is required. The 2023 program structure was remote, with the opportunity to visit their respective National Lab sites. OTT collaborated with The National Renewable Energy Laboratory (NREL) and Oak Ridge Institute for Science and Education (ORISE) to administer this OTT-funded program.

The interns are assigned a technology developed by their National Lab. They will explore market viability for the technology and help develop a commercialization plan. At the end of the program, interns travel to a participating National Lab for 3 days of closing events. The travel expenses are covered by the program. During closing week, students attend a National Laboratory tour, hear from commercialization experts in DOE, and present their final projects. The presentations are judged by a panel of technology commercialization experts based off their understanding of the technology and its commercialization potential. This may include the tech's ecosystem, market landscape, and competitive advantage. In Fiscal Year 2023, several improvements to the program included:

- An increased weekly stipend from $700 in 2022 to $850 in 2023.
- A $2,000 travel stipend for interns to visit their National Labs.
- Optional office hours with Energy I-Corps instructors.
- A feasibility study curriculum component.
- A group presentation option for final projects.
- A $2,000 stipend for National Labs which can be used for the intern's benefit.

Stay Tuned on the Latest TCI Updates

Learn more about the Technology Commercialization Internship (TCI) program on the OTT program landing page. Visit the ORISE TCI webpage for additional program details. To get the latest OTT program updates and opportunities, enter your email to sign up for our newsletter here.

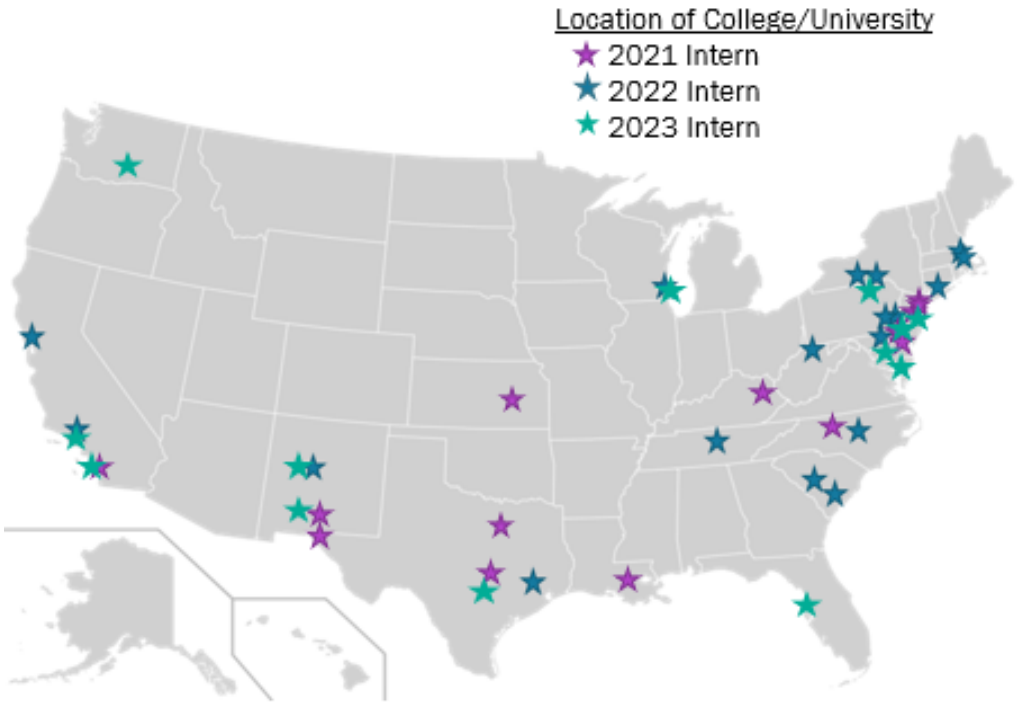
Program Data and Outcomes

The table below outlines key outcomes and impacts of the program since it was launched in 2021. This table is not all inclusive and only includes outcomes through FY23.

TCI Key Outcomes

Metric	FY23 Outcomes	Cumulative Outcomes (since program launch in 2021)
Number of interns	15	47(total interns in program)
Participating collegiate institutions	13	42
Number of states represented (based on the intern's home state or territory)	10	19
Percentage of interns from minority-serving institutions	67% (10 of 15)	38% (18 of 47)
Number of DOE National Laboratories, plants, and sites involved	8	13
Number of participants who come from a disadvantaged community as defined by Justice40 Note: MSIs are considered disadvantaged communities based on guidance from EJE but are not included in this metric.	33% (5 of 15)	40% (19 of 47)

TCI Participants Across the Country



Fiscal Year 2023 in Review

The TCI program began accepting applications in November 2022 and required applicants to submit a resume, transcript, and recommendation letter(s). The deadline for FY23 was February 15, 2023, and applications.

OTT supports a diverse workforce and as a result used review criteria that included attending a Minority Serving Institution (MSI) and/or belonging to a community that falls within a Justice40 designated area of the United States. Learn more about how Justice40 supports disadvantaged communities.

In FY23, OTT received a record-breaking number of applicants (305), highlighting the demand for and value of the program. With help from ORISE, the TCI team was able to conduct outreach to many institutions across the country, including MSIs through email campaigns and webinars. Additionally, participants from FY22 went back to their home institutions and shared their experiences. The TCI ultimately supported 15 student interns in commercialization training and projects across the following seven National Laboratories and one site:

- Argonne National Laboratory
- Brookhaven National Laboratory
- Fermi National Accelerator Laboratory
- Kansas City National Security Campus
- Lawrence Berkeley National Laboratory
- National Renewable Energy Laboratory
- Sandia National Laboratory
- Thomas Jefferson National Accelerator Facility

For FY23, OTT capped the number of participants to 15 to offer the interns a higher weekly pay to remain competitive with other programs and to account for inflation.

2023 Technology Commercialization Internship Participants

The program kicked off on May 30, 2023. During the first week of the program, interns met with Chief Commercialization Officer and Director of OTT, Dr. Vanessa Chan, to talk about commercialization and OTT's mission. Based on feedback from last year, the interns were offered increased time with Energy I-Corps instructors through newly added instructor office hours, providing the opportunity to have a more hands-on experience and ask questions about their projects. Increased understanding of the basics significantly helped interns apply their newfound knowledge to their assigned National Laboratory technology.

Students were matched with projects based on a variety of factors, including their resume, major, geographical location, and more. A change from FY22 includes National Laboratory mentor input, where mentors were able to review resumes and applications. The National Laboratory mentors also provided the TCI team feedback on aligning candidates based on their interests.

Each project consists of a technology that students can apply their Energy I-Corps learnings to in real-time including customer discovery. Customer discovery is a big component of this internship, where students can talk to people in industry, academia, and consumers to understand the market and need for their technology. Additionally, customer discovery can generate contacts for the labs that may result in licensing opportunities. One example is Radeha Haque, a Sandia TCI participant from the FY23 cohort, who was able to initiate two potential licensing deals between two different customer discovery contacts she came across at Sandia National Laboratory. In some instances, interns gathered information that led them to believe that the market was limited or that there were no market adopters ready in their technology's field. Ultimately, all outcomes and information are useful because it lets researchers and laboratory staff know what the current conditions are in their technology's chosen market and may force them to pivot in a new direction. To summarize their findings, interns create a feasibility study with the aforementioned information that ultimately answers the question, "Is this technology feasible?"

Before the summer event, interns create an individual presentation to summarize their findings. Then, they present it to a panel of commercialization experts and are judged based on their understanding of the technology and its commercialization potential; this may include the technology's ecosystem, market landscape, and competitive advantage.

In FY23, a group pitch presentation was added to the required internship deliverables in addition to the feasibility study and individual presentation. The group presentation was a way for interns to exercise their team building skills and to become more familiar with OTT's Energy Technology University Prize (EnergyTech UP) program. Each team submitted a 200-word written summary addressing the energy technology to be leveraged in the business opportunity and a slide deck that summarized their business plan. Participants presented to the same panel of commercialization experts as they did for their individual presentations, and were judged based on the following criteria:

- What is the energy technology to be leveraged?
- Who will buy the product or service and why do they need it?
- Who is currently serving this market and how?
- What unmet market need will this technology help address?
- Who will benefit should this business succeed?
- What role will this business play in the energy transition?

For the first time, each of the eight participating National Labs received $2K per intern for mentor/principal investigator (PI) travel to the in-person closing event or in support of the internship more broadly. For example, the labs may pay mentors/PIs for their time, extend the internship duration, or support the intern to travel to a technology-relevant conference or lab visit.

2023 TCI participants touring Thomas Jefferson National Laboratory

Also, new to the program in 2023, OTT provided a $2K travel stipend to each intern to visit their assigned laboratories. At lab visits, interns had the opportunity to tour the facility and its equipment, learn about other projects, engage with lab staff in person, and gain hands-on laboratory experience. Fourteen interns utilized this stipend to visit their lab in 2023 (apart from one intern who was local to their laboratory).

DOE Chief Commercialization Officer and Director of OTT Dr. Vanessa Z. Chan speaking at the TCI closing event.

August 8, 2023, marked the start of the in-person closing event. All interns, mentors/PIs, lab staff and leadership, and OTT staff and leadership were invited to attend. The 2023 event was held at the Thomas Jefferson National Accelerator Facility (Jefferson Lab) in Newport News, VA. The interns were able to tour the facility, hear from lab and OTT staff, and present their final deliverables. Read more here: Empowering the Next Generation: 15 Interns Graduate from OTT's 2023 Technology Commercialization Internship Program.

The top three winners for individual presentations included:

- **1st Place:** Zoryah Gray for the project "Market analysis and customer discovery for upcycling of single-use plastic waste" at Argonne National Laboratory
- **2nd Place:** Johnathan Russell for project "Feasibility of wind interconnection standard platform (WISP)" at Sandia National Laboratory
- **3rd Place:** Radeha Haque for project "Commercial and Industrial Customer Discovery for Edge-Connect Hermetic Headers and Connectors" at Sandia National Laboratory

The first-place winner and runner-up for group presentations included:

- **1st Place:** Team members Antonia Tahia Ginsberg-Klemmt, Arunabh Sarmah, and Alex Gutierrez Diaz for project "GISMO Power"
- **Runner-Up:** Team members Nathan Mitchell, Obehi Ehigie, and Meghana Karthic for project "Aeromine"

Learn more about all 2023 projects in the Appendix: Fiscal Year 2023 Intern Projects.

A TCI Success Story

OTT-Sandia Intern Scores Two Potential Licensing Agreements through Customer Discovery

A 2023 Intern, Radeha Haque, was handed a very challenging technology to work with. Her project was centered around a technology with a low technology readiness level (TRL) and an associated non-disclosure agreement which limited her ability to promote the technology. Despite these challenges, Radeha conducted 15 customer interviews in the niche field of hermetic edge connect headers and corresponding connectors. Hermetic edge connectors are glass to metal connecting materials that turbine manufacturers and renewable energy manufacturers use to overcome technical challenges such as their systems working in high heat temperatures. Radeha's technical understanding of the technology benefitted her greatly during her interviews. She was able to parlay that technical knowledge to gather valuable market information for the Sandia technical team. Two of Radeha's interviews have led to follow-up conversations with the Sandia licensing team to further explore how Sandia may be able to commercialize this technology. Since Sandia is early in discussions with the two companies, the company names are confidential.

Appendix: 2023 Intern Projects

Intern: Kerat Bangar

Project: Community-Engaged Tech Transfer

The intern studied federal research in decarbonization and climate change and gained an in-depth understanding of federal tech transfer mechanisms as they relate to community-engaged tech transfer. The intern worked directly on technologies related to prognosis and health management (PHM) of a photovoltaic (PV) system. A PV PHM system can eliminate long-standing issues associated with detecting performance reduction in PV systems. The PV PHM system can utilize an ANN model with meteorological and power input data to facilitate alert generation in the event of a performance reduction without the need for information about the PV PHM system components and design. Comparisons between system data and the PHM model can provide scheduling of maintenance on an as-needed basis. The PHM can also provide an approach for monitoring system/component degradation over the lifetime of the PV system.

Intern: Nathan Boyce Mitchell

Project: Mechanized Exfoliator and Automatic 2D Materials Transfer and Layering System

One of the challenges in two-dimensional (2D) material research and manufacturing is the facile fabrication of high quality raw 2D material flakes, such as graphene monolayers generated from graphite bulk crystals. So far, the best quality monolayers are fabricated using manual mechanical exfoliation methods. While this method is very simple and handy; the yield is low, the generated material quality is highly unpredictable, and it depends on the proficiency of human operator as well as inherent irregularity of the process. To address this, Brookhaven researchers have developed a roll-to-roll mechanized exfoliation platform capable of generating ultrathin nanosheets from layered materials and automatic 2D materials transfer and layering systems for stacking the exfoliated layers.

Intern: Renee Ella Catanach

Project: Transportation Sealing Monitor

The goal of this project is to adapt an existing Sandia National Laboratory-developed application, a transportation sealing monitor, to accomplish two objectives within any transportation setting: (1) provide knowledge of when a sealed container has been breached and, (2) provide knowledge of the precise location of a given shipment in real-time. The transportation sealing monitor has potential to increase security for shipping containers with vehicles over the interstate or across oceans with vessels. The intern supported market research to determine how to package this application into a product that can be sold commercially.

Intern: Obehi Sydney Ehigie

Project: Fine Wire NDE

The intern conducted market research on non-destructive evaluation (NDE) of fine wires as a market sector. This included: interview Thomas Jefferson National Laboratory inventors and complete any missing data regarding laboratory IP, develop communications material concerning relevant Thomas Jefferson National Laboratory IP, interviewing prospective early adopters, and document customer processes and pain points develop customer segmentation and value proposition hypotheses. The intern also developed communications materials regarding commercialization potential.

Intern: Antonia Tahia Ginsberg-Klemmt

Project: LBNL Patent Portfolio Project- *IR Spectral Microscope Stage (IRSMS) & e Autonomous Imbibition Microfluidics device (AIMs)*

Lawrence Berkeley National Laboratory (LBNL) has a large patent portfolio in the field of bioanalysis, but much of the intellectual property hasn't been licensed. This project assisted LBNL licensing managers by assessing the portfolio's market potential and commercial feasibility, with an end goal to determine whether the IP would be licensed or has potential to be turned into a commercial business.

Intern: Jonathan Troy Coleman Gorum

Project: Energy, Equity, and Environmental Justice (EEEJ) Clean-Energy

The intern analyzed existing literature about current approaches and best practices to meaningfully incorporate Energy, Equity, and Environmental Justice (EEEJ) into energy-related research, development, and deployment projects. Activities included creating new engagement mechanisms with communities and developing pathways to deploy clean energy technologies with an eye towards EEEJ.

Intern: Zoryah Lavern Gray

Project: Market analysis and customer discovery for upcycling of single-use plastic waste

Less than 5% of US plastic waste is recycled annually. Aeternal Upcycling's catalytic upcycling technology, developed as part of the iCOUP EFRC at Argonne National Laboratory, can convert hard-to-recycle plastic waste into valuable and in-demand chemicals, such as waxes, lubricants and surfactants. By commercializing this technology, Aeternal Upcycling aims to provide sustainable end-of-life solutions for plastic waste and low-emissions alternatives to key chemical feedstocks. This intern participated in market analysis and customer discovery on upstream plastic waste acquisition and/or downstream product sales.

Intern: Alex Gutierrez Diaz

Project: Market Analysis and Partner Identification for National Security Technologies

The intern was presented with a short list of available technologies that have recently been patented or are patent pending, including Secure Printed Circuits, New Applications in Additive Manufacturing, and Innovative Electronic Products. Focusing on at least one of the listed technologies, the intern communicated with inventors to better understand the underlying technology and potential and carried out a market analysis for potential commercial applications. Market sizes, regulatory hurdles, and potential commercial partners were considered and presented.

Intern: Radeha Ahmed Haque

Project: Commercial and Industrial Customer Discovery for Edge-Connect Hermetic Headers and Connectors

The Sandia National Laboratory (Sandia) developed a novel hermetically sealed set of edge-connect headers and connectors. Sandia's header and connector technology is significantly smaller and lighter than traditionally available connectors and can maintain a hermetically sealed connection in more extreme environments. The intern participated in developing a detailed cost-analysis of this improved header and connector technology as compared to what is commercially available; reviewing market segments and identification of market entry in the non-defense space; and identifying capability gaps of existing commercially available technology. Simultaneously, the intern learned about the commercial, industrial and defense header and connector markets as well as where difficulties can exist when a new technology enters the market. The intern also learned how to evaluate potential partners for a certain technology.

Intern: Adrian John Hernandez

Project: Commercial and Industrial Customer Discovery on New Small, Low-Cost, Toxic Gas Sensor Platform

Sandia has developed patent pending technologies related to capture and detection of toxic gases for improving public health. The intern to helped jumpstart the process of engaging the broad Commercial Industry interested in developing this sensor platform for home and industrial use. Activities included assessing the market segments, potential market entry, and identifying potential barriers is crucial toward finding companies that might be interested in utilizing this technology.

The intern determined and evaluated market segments and unmet needs in the commercial and industrial spaces, examined potential barriers to entry, and developed a go-to-market plan. The intern not only learned about the commercial and industrial sensor markets, but they also learned about these businesses, their practices, and how difficult it is to enter an existing and well-established marketplace.

Intern: Meghana Karthic

Project: Open-source embedded AI at the edge

Fermi National Accelerator Laboratory developed an open-source, user-friendly, accessible workflow called hls4ml to deploy cutting-edge AI techniques for embedding intelligence within efficient electronics hardware to enable smart sensing for scientific applications. This technology has potential applications across many different application areas. The intern assessed the market and developed market plans to best to deploy this technology for society/industry needs.

Intern: Abhimanyu Khandelwal

Project: Industry Production Partnerships for Defense System

The intern worked with Sandia Laboratory staff to build a strategy that helps facilitate a "prototype to production outside Sandia" model for work within RF and Electronic Systems. The intern played a critical role in developing the strategy and putting the processes in place to 1) identify pathways to accelerate the RDD&D continuum, and 2) identify and capture partnership needs and market pull, looking towards transitioning the system to industry for scale up and thus enabling Sandia to focus on fundamental research and providing exquisite solutions for hard engineering problems.

This project allowed Sandia to focus on how to better initiate projects with an eye on the end goal, including transferring out the design to a production/industry partner.

Intern: Tina Memarian

Project: Targeted Antibody Therapeutics

Sandia National Laboratory identified and engineered highly potent SARS-CoV-2 antibodies with prophylactic and therapeutic efficacy against SARS-CoV-2 in a rodent model of severe infection and disease. These antibody therapies can be used as the foundation for a commercial partner to move forward through their pipeline. This project involved conducting a market assessment to identify potential licensees, customer discovery and recommending paths to commercialization.

Intern: Arunabh Bikash Sarmah

Project: Community-Engaged Tech Transfer

This intern learned about federal research in decarbonization and climate change and gain an in-depth understanding of federal tech transfer mechanisms as they relate to community-engaged tech transfer. The intern worked on technologies related to providing prognosis and health management (PHM) of a photovoltaic (PV) system. A PV PHM system can eliminate long-standing issues associated with detecting performance reduction in PV systems. The PV PHM system can utilize an ANN model with meteorological and power input data to facilitate alert generation in the event of a performance reduction without the need for information about the PV PHM system components and design. Comparisons between system data and the PHM model can provide scheduling of maintenance on an as-needed basis. The PHM can also provide an approach for monitoring system/component degradation over the lifetime of the PV system.

Intern: Salvador Ayala

Project: Hydropower Landscape Analysis

Hydropower and pumped storage hydropower (PSH) are traditional technologies that have an untapped potential to support increased power grid integration. However, given their long history and complexity, there are challenges to transforming the industry and promoting the investments and updates required. To support U.S. goals for a clean energy future, an increased understanding of the challenges faced by the industry and a more direct engagement with the private sector and market participants is required. This project utilized the intern to better understand the current market and investment requirements for hydropower across the value chain – including interconnection, supply chain, off-take agreements, and generation assets. The intern focused specifically on value chain components, e.g. supply chain or off-take agreements, and explored how hydropower can leverage other industries or vice versa.