# Technology-to-Market Summer Scholar Program

## Background

The Advanced Research Projects Agency-Energy (ARPA-E) is an agency within the U.S. Department of Energy that funds creative, out-of-the-box, transformational energy technologies that are too early stage for private investment. ARPA-E programs provide top energy researchers with funding, technical assistance, and tech-to-market guidance to radically improve U.S. energy security, energy efficiency, and environmental well-being. The driving question behind all ARPA-E programs is “*If it works, will it matter?*”

ARPA-E recruits summer scholars who have a unique combination of technical and business skills to assist in defining commercialization pathways for high-impact technology development programs. This internship opportunity offers experience in advancing the transition of cutting-edge energy technologies to market applications in a fast-paced environment.

## Opportunity

ARPA-E’s Summer Scholars Program is designed to prepare ARPA-E funded technologies to achieve maximum impact and return on investment for ARPA-E project teams, stakeholders, and our Nation’s taxpayers. This internship provides a unique opportunity to work under and interface with the ARPA-E Technology-to-Market team, the ARPA-E Program Directors, and ARPA-E Fellows. We are seeking graduate students interested in:

* Researching market trends, cross-industry collaboration opportunities, and go-to-market strategies
* Assisting in developing techno-economic analysis
* Performing stakeholder analysis to identify technology adopters and laggards
* Analyzing system reliability at varying levels or renewable penetration

Planned Projects:

* What does rollout of a Green Corridor look like for US centric supply chains?
* Agriculture Model Intercomparison Framework
* Ecosystem Services Valuation
* Land Use Implications of New Energy Technologies
* Market Assessment of the Electrified Aviation Space
* Investigate the Commercialization of Raw US Macroalgal products for Renewable Energy Generation, Agricultural Fertilizer and Rare-Earth Mineral Harvesting
* Assess Novel Deep-Sea Mining Techniques that Could Reduce the Potential Impact on the Environment and Reduce the Economies of Scale Required to Achieve Profitability
* Quantification of Carbon Fluxes in the Ocean
* Analyze How Reductions in Cost-To-Orbit May Enable New Industries
* Market Prospects for ARPA-E’s SEED and TINA Investments

Applicants should be prepared for deep immersion into the project and must be comfortable working independently. Job requirements include strong analytical, written and oral communication abilities.

The ideal candidate(s) will have a bachelor’s degree in a relevant field (e.g. electrical engineering, physics, material science, agriculture, economics, computer science, etc.), be in the midst of completing a graduate level degree, preferably M.S. or MBA.

Selected Summer Scholar(s) will be paid a weekly stipend and travel costs; typical length of stay ranges from 8-12 weeks. The position is based at ARPA-E’s headquarters in Washington, DC. This opportunity is available only to U.S. citizens.

## How to Apply

Highly motivated candidates should submit a CV, a cover letter, a writing sample, and two references at
https://arpa-e.energy.gov/career/job-opportunities.

Please note: If you are interested in more than one proposed project, please indicate in the body of your cover letter the specific projects you are interested in pursuing. A description of the individual projects is provided as a supplement to the job posting on the ARPA-E website located here: https://arpa-e.energy.gov/career/job-opportunities.

Questions can be directed via email to ARPA-E-jobs@hq.doe.gov with the words “Energy Scholars” in the subject heading.

All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability or veteran status.

Applications are due no later than **Sunday, January 30, 2022**, and will be processed on a rolling schedule. Interested parties are encouraged to apply early.

**Project Descriptions**

What does rollout of a Green Corridor look like for US centric supply chains?

There is an opportunity to gain a broader understanding on the role of Green Corridors in enabling carbon neutral will enable carbon neutral freight transportation technologies. ARPA-E is seeking a Summer Scholar to identify and assess market and policy incentives that could enable the Green Corridors that Freight Transportation would use. Critical questions that may be considered include:

* What fraction of total cost of various goods comes from shipping and how does a green corridor change that?
* What routes would be the most impactful?
* What goods are most likely to be prioritized?
	+ Elastic vs inelastic?
	+ Industrial vs consumer?
* What companies are most likely to help drive early adoption?
* How will companies realize value from green corridors?

Agriculture Model Intercomparison Framework

There is a wealth of data and modeling capabilities in agriculture and increasing interest in how the two can be enhanced and combined to inform the development of crop inputs, management strategies, and market incentives to realize the sector’s potential to contribute to global carbon drawdown. The volume and fragmentation of effort in the digital agriculture space threatens this realization, and with new datasets such as those to be produced via ARPA-E SMARTFARM technologies, there is a need to survey, compare, and test current methods of carbon intensity quantification.

ARPA-E is seeking a Summer Scholar to assist with surveying the most commonly used tools for feedstock carbon accounting (e.g. COMET FARM, DNDC, GREET FD-CIC, DAYCENT, etc.) with an emphasis on comparing them in terms of calibration and validation requirements, data inputs, parameterization, parameter sensitivities, and uncertainties. The Scholar will help ARPA-E understand the strengths and shortcomings of model-based CI quantification, explore uncertainty drivers, and identify the most impactful datasets to lower uncertainty in field-level carbon intensity quantification. Additional questions around data availability, cost, and security, will also be explored.

Ecosystem Services Valuation

There is growing recognition of the potential for the bioeconomy to significantly contribute to global carbon drawdown and management, but a critical gap exists between the broad consensus on the benefits of broader ecosystem services (provisioning, regulating, supporting and social) and the economic, societal and other streams of value attributed to these services beyond provisioning (feedstock yield and quality). Incentivizing the transition of the bioeconomy from one that is, at best, carbon neutral, to one that is carbon negative, requires new frameworks for the identification, internalization, valuation and value-transfer to support the full range of ecosystem services provided by the sector: provisioning, regulating, supporting, and social.

ARPA-E is seeking a Summer Scholar to survey the anticipated ecosystem services impacts of a decarbonized - and eventually carbon negative – bioeconomy, with an emphasis on prioritizing (i) those most tightly linked with and/or impacted by the current emphasis on carbon regulation, (ii) those most easily measured and translated to economic value. The Scholar will help ARPA-E understand the broader impacts of carbon drawdown within the bioeconomy, the most promising means of quantifying those impacts, and opportunities for valuing ecosystem services within existing market frameworks.

Land Use Implications of New Energy Technologies

There is an urgent need to rapidly decarbonize the economy while building an entirely new industry focused on carbon removal. Both transitions are massive in scale and will place additional demands on the land sector, compounding the challenge of delivering 50% more food output by 2050 while mitigating the impacts of climate change on yields. In light of the dramatic shifts ahead, there is an opportunity to rethink the dynamics of the food-energy-water nexus in a future where abundant, low-carbon electricity and new energy technologies enable new strategies for indoor vertical farming. Such strategies could enable the shift of commodity crop production from uncontrolled, outdoor growth environments to controlled indoor environments, thereby eliminating many of the yield-reducing factors such as growth medium deficiencies, temperature swings, and supply chain losses.

ARPA-E is seeking a Summer Scholar to explore the land use, productivity, transportation, storage, processing, and market implications of indoor vertical farming systems for commodity crops, with an emphasis on energy use, carbon intensity, and production cost.  The Scholar will help ARPA-E (i) quantify the energy and emissions drivers of outdoor and indoor commodity production, and (ii) explore potential R&D needs and white space to inform new program topics.

Market Assessment of the Electrified Aviation Space

ARPA-E is seeking a Summer Scholar to complete a market assessment of the electrified aviation space with a size range covering drones /unmanned aerial vehicles (UAV) through single-aisle commercial aircraft, though with a key focus on the nearer-term applications, including UAV, urban air mobility (UAM), automated freight aircraft, and potential DOD applications. The scope of this analysis would cover any electric powertrain concept (battery, fuel cell, engines, or a combination thereof) and any carbon-neutral fuel (H2, SAF, bio-LNG, NH3, etc.). The work would include identification of the following:

* Market incumbents
* Emerging players
* Value propositions for transporting passengers vs. goods (or a mix)
* Investment landscape (split by value chain)
* Potential commercialization pathways for current ARPA-E aviation portfolio.

Investigate the Commercialization of Raw US Macroalgal products for Renewable Energy Generation, Agricultural Fertilizer and Rare-Earth Mineral Harvesting

ARPA-E is seeking a Summer Scholar to:

* Develop an understanding of the possible valorization pathways for the chemical derivatives of raw macroalgal crops; and
* Investigate commercialization pathways of ocean ‘biomining’ – extracting rare-earth elements from seawater using macroalgae.

Assess Novel Deep-Sea Mining Techniques that Could Reduce the Potential Impact on the Environment and Reduce the Economies of Scale Required to Achieve Profitability

ARPA-E is seeking a Summer Scholar to:

* Perform techno-economic analysis of proposed new deep-sea mining techniques;
* Consider environmental impact mitigation and develop strategies to accommodate deep-sea ecosystems and biodiversity; and
* Investigate profitable polymetallic nodule refinement at smaller scales than currently performed.

Quantification of Carbon Fluxes in the Ocean

Accurate quantification of carbon fluxes in the ocean is essential if we are to understand the value of future anthropogenic carbon sequestration systems. These will give value to ocean carbon removal systems in a future carbon market. ARPA-E is seeking a Summer Scholar to:

* Investigate the range of carbon sensing systems available today, and consider new technologies that may advance our ability to resolve dynamic carbon concentrations in the ocean;
* Perform a techno-economic analysis on projected sensing technologies and the maximum permissible costs of carbon flux monitoring in order to maintain profitability at a given price point;
* Research the ocean biogeochemical modeling approaches required in order to predict the success and value of ocean carbon dioxide removal techniques. Report on environmental (geographical, seasonal, etc.) limitations that may limit success; and
* Consider approaches to enhance the social license of marine carbon dioxide removal.

Analyze How Reductions in Cost-To-Orbit May Enable New Industries

Reductions in cost-to-orbit may enable new industries such as autonomous mining in space (lunar and near-earth asteroid), revolutionizing the critical mineral supply chain and opening doors to interplanetary colonization. ARPA-E is seeking a Summer Scholar to:

* Conduct an analysis of technological developments required;
* Consider the energy generation, harvesting and storage budgets required to deploy equipment, harvest and return valuable minerals to points of use, earth or otherwise; and
* Investigate the techno-economic feasibility of such an industry, and speculate on enabling price points.

Market Prospects for ARPA-E’s SEED and TINA Investments

ARPA-E is seeking a Summer Scholar to analyze the full scope of ARPA-E’s SEED and TINA projects and identify how they fit into ARPA-E spectrum of programs and the wider ecosystem. Analysis will include:

* Assess market opportunities; and
* Identify the competitive landscape and path to commercialization for these projects.