U.S. DEPARTMENT OF ENERGY

ARPA-E Fiscal Year 2022 Annual Report

Report to Congress
November 2024

United States Department of Energy
Washington, DC 20585

Message from the Director

The mission of the Department of Energy Advanced Research Projects Agency-Energy (ARPA-E) is to enhance the economic and energy security of the United States. ARPA-E does this through the development of energy technologies and ensuring that the U.S. maintains a technological lead in developing and deploying advanced energy technologies. To fulfill this mission, ARPA-E maintains a dynamic funding portfolio where roughly one-third of programs turn over annually. ARPA-E supports project teams whose technologies advance the boundaries of science. The agency also helps those teams develop and strategically prepare to deploy their technologies.

In Fiscal Year (FY) 2022, ARPA-E announced a total of ten funding opportunities for up to $353.0 million in early-stage funding. ARPA-E issued seven funding opportunity announcements (FOAs). The agency also added three total Exploratory Topics to the Solicitation on Topics Informing New Program Areas funding opportunity and the Exploratory Topics funding opportunity. Both funding opportunities are multi-topic solicitations designed to support high-risk research and development (R&D) leading to the development of potentially disruptive new technologies. Topics under these FOAs will explore new areas of technology development that, if successful, could establish new program areas for ARPA-E, or complement the current portfolio of ARPA-E programs.

ARPA-E selected 135 projects in FY 2022 for a total of $309.1 million in funding. Each project ARPA-E selects is managed as part of either a focused program, OPEN program, or Exploratory Topic.

In addition to providing both financial and technical support to high-potential, high-impact R&D, ARPA-E provides commercialization guidance, called technology-to-market. ARPA-E tracks key early indicators that help illustrate how the agency's support drives commercial impact. This impact can include private-sector follow-on funding, new company formation, partnership with other government agencies, publications, inventions, and patents.

Many ARPA-E project teams have continued to advance their technologies toward market impact since being selected for agency support. As of September 2022, 131 new companies have been formed by ARPA-E projects, 289 patent licenses for new inventions have been reported from ARPA-E projects, 281 projects have partnered with other government agencies for further development, and 200 project teams have attracted more than $11 billion in private-sector follow-on funding to continue to advance the commercialization of their technology[1]. Additionally, ARPA-E has provided financial assistance awards for R&D to 26

[1] The 'Follow on Funding' value includes any commercial funding committed or received from other sources (e.g., private investors, venture capital, etc.) after effective date of ARPA-E award to support the ARPA-E-funded project or work that is directly or indirectly related to the ARPA-E funded project.

companies that were later acquired, merged, or made initial public offerings (IPO)[2] with market valuations worth $21.8 billion.

As of September 2022, ARPA-E projects have helped advance general scientific understanding and technological innovation through 6,257 peer-reviewed journal articles and 934 patents issued by the United States Patent and Trademark Office. These indicators demonstrate that ARPA-E's approach to selecting, funding, and actively managing early-stage energy R&D continues to advance state of the art energy, science, and engineering, and define new opportunities for commercialization.

Pursuant to statutory requirements, this report is being provided to the following Members of Congress:

- **The Honorable Joseph Manchin III**
  Chairman, Senate Committee on Energy and Natural Resources

- **The Honorable John Barrasso**
  Ranking Member, Senate Committee on Energy and Natural Resources

- **The Honorable Bernard Sanders**
  Chairman, Subcommittee on Energy
  Senate Committee on Energy and Natural Resources

- **The Honorable Josh Hawley**
  Ranking Member, Subcommittee on Energy
  Senate Committee on Energy and Natural Resources

- **The Honorable Cathy McMorris Rodgers**
  Chair, House Committee on Energy and Commerce

- **The Honorable Frank Pallone, Jr.**
  Ranking Member, House Committee on Energy and Commerce

- **The Honorable Frank Lucas**
  Chairman, House Committee on Science, Space, and Technology

- **The Honorable Zoe Lofgren**
  Ranking Member, House Committee on Science, Space, and Technology

[2] The total enterprise valuation number for public listing transactions, acquisitions, and company sales is reported separately from the 'follow on funding' number. This 'acquired, merged, and made initial IPO' number includes development capital and equity valuation minus cash on hand.

- **The Honorable Brandon Williams**
  Chairman, Subcommittee on Energy
  House Committee on Science, Space, and Technology

- **The Honorable Jamaal Bowman**
  Ranking Member, Subcommittee on Energy
  House Committee on Science, Space, and Technology

- **The Honorable Patty Murray**
  Chair, Senate Committee on Appropriations

- **The Honorable Susan Collins**
  Vice Chair, Senate Committee on Appropriations

- **The Honorable Patty Murray**
  Chair, Subcommittee on Energy and Water Development
  Senate Committee on Appropriations

- **The Honorable John Kennedy**
  Ranking Member, Subcommittee on Energy and Water Development
  Senate Committee on Appropriations

- **The Honorable Tom Cole**
  Chairman, House Committee on Appropriations

- **The Honorable Rosa DeLauro**
  Ranking Member, House Committee on Appropriations

- **The Honorable Chuck Fleischmann**
  Chairman, Subcommittee on Energy and Water Development, and Related Agencies
  House Committee on Appropriations

- **The Honorable Marcy Kaptur**
  Ranking Member, Subcommittee on Energy and Water Development, and Related Agencies
  House Committee on Appropriations

If you have any questions or need additional information, please contact me or Ms. Meg Roessing, Deputy Director for External Coordination, Office of Budget, Office of the Chief Financial Officer, at (202) 586-3128; Mr. Eric Delaney, Deputy Assistant Secretary for House Affairs, or Mr. Brian Eiler, Deputy Assistant Secretary for Senate Affairs, Office of Congressional and Intergovernmental Affairs, at (202) 586-5450.

Sincerely,

Dr. Evelyn N. Wang
Director
Advanced Research Projects Agency-Energy

Executive Summary

ARPA-E funds high-risk, high-potential energy innovation research and development (R&D). The agency's mission is to advance energy innovations that will create a more secure, affordable, and sustainable American energy future.

This report presents a summary of ARPA-E's funding activities during FY 2022 – to include both funding opportunity announcements (FOA) and project selections. ARPA-E FOAs are notices of new funding opportunities tied to a specific ARPA-E initiative (e.g., focused programs, OPEN solicitation, Exploratory Topics). Energy innovators with relevant ideas are encouraged to apply to the FOA. After a comprehensive review process, applicants are selected to perform R&D work under that funding opportunity. An agreement is then negotiated, including specific technical milestones, followed by execution of the award.

ARPA-E focuses on early-stage energy technologies that can be meaningfully advanced with modest funding over a defined period. ARPA-E's rigorous program design, competitive project selection process, and hands-on engagement provide America's energy innovators with funding, technical assistance, and market awareness. As an aspect of its due diligence, ARPA-E thoroughly reviews all applications and technologies to ensure that funding is provided to topics not likely to be pursued by industry, Federal agencies, or Department of Energy applied R&D programs.

In FY 2022, ARPA-E announced ten funding opportunities for up to $353.0 million[3] which covered a broad array of energy technologies including:

1. Up to $15.0 million through two Exploratory Topics[4] to identify and research new areas of technology for **Solicitation on Topics Informing New Program Areas**;[5]

2. Up to $45.0 million to support the development of technologies that can transform buildings into net carbon storage structures through **HESTIA** *(Harnessing Emissions into Structures Taking Inputs from the Atmosphere);*

3. Up to $100.0 million to provide further funding to previous ARPA-E awardees determined to be feasible for widespread commercialization domestically through **SCALEUP 2021** *(Seeding Critical Advances for Leading Energy technologies with Untapped Potential 2021)*;

[3] The amount listed is at the time of the funding opportunity was announced. The funding amount for the program is subject to change at the time of project selection or based on award negotiations and ongoing program management.

[4] In FY 2022, ARPA-E announced two Exploratory Topics within this solicitation: Topic V: Carbon Negative Building Materials and Topic W: Supporting Entrepreneurial Energy Discoveries (SEED).

[5] In 2019, ARPA-E issued the Solicitation on Topics Informing New Program Areas, an ongoing funding mechanism to explore R&D technology areas that could lead to the development of new ARPA-E program spaces.

4. Up to $4.0 million to projects aimed at developing software management solutions to address challenging power grid problems through **GO Competition Challenge 3** *(Grid Optimization Competition Challenge 3);*

5. Up to $44.0 million to develop commercially scalable technologies to enable greater domestic supplies of copper, nickel, lithium, cobalt, rare earth elements, and other critical elements through **MINER** *(Mining Innovations for Negative Emissions Resources);*

6. Up to $48.0 million to advance used nuclear fuel (UNF) recycling, reduce the volume of high-level waste requiring permanent disposal, and provide safe domestic advanced reactor fuel stocks through **CURIE** *(Converting UNF Radioisotopes Into Energy);*

7. Up to $45.0 million to expand domestic electric vehicle (EV) adoption by developing batteries that last longer, charge faster, perform efficiently in freezing temperatures, and have better range retention through **EVs4ALL** *(Electric Vehicles for American Low-carbon Living);*

8. Up to $10.0 million through one Exploratory Topic[6] to support high-risk R&D leading to the development of potentially disruptive new technologies across the full spectrum of energy application through **Exploratory Topics[7]**;

9. Up to $42.0 million to develop highly efficient and reliable cooling systems that will enable a new class of efficient power-dense computational systems, data centers, and modular systems through **COOLERCHIPS** *(Cooling Operations Optimized for Leaps in Energy, Reliability, and Carbon Hyperefficiency for Information Processing Systems).*

In FY 2022, ARPA-E selected 135 projects across seven funding opportunities to receive $309.1 million[8] in funding to support early-stage R&D:

1. Sixty-eight projects were selected to receive $175.0 million through **OPEN 2021***;*

2. Twelve projects were selected to receive $35.0 million through **REMEDY** *(Reducing Emissions of Methane Every Day of the Year);*

[6] In FY 2022, ARPA-E announced one Exploratory Topics within this solicitation: Topic A: Low-Energy Nuclear Reactions (LENR).
[7] In 2022, ARPA-E issued the Exploratory Topic funding opportunity, an ongoing funding mechanism to explore high-risk R&D leading to the development of potentially disruptive new technologies across the full spectrum of energy applications.
[8] The amount listed is at the time of the project selections. The funding amount for the program is subject to change based on award negotiations and ongoing program management.

3. Eleven projects were selected to receive $36.0 million through **ONWARDS** *(Optimizing Nuclear Waste and Advanced Reactor Disposal Systems);*

4. Twenty-six projects were selected to receive $24.1 million through three Exploratory Topics under the **Solicitation on Topics Informing New Program Areas** funding opportunity[9]; and

5. Eighteen projects were selected to receive $39.0 million through **HESTIA** *(Harnessing Emissions into Structures Taking Inputs from the Atmosphere).*

In FY 2022, ARPA-E Program Directors, (1) provided awardees with hands-on engagement and technical guidance and (2) engaged diverse communities to identify gaps where ARPA-E funding could lead to new programs. ARPA-E also continued to provide awardees with practical training and critical business information as part of the agency's Technology-to-Market program. This support equips performers with a clear understanding of market needs to guide technical development and help their projects succeed in the marketplace.

[9] In 2019, ARPA-E issued the Solicitation on Topics Informing New Program Areas, an ongoing funding mechanism to explore R&D technology areas that could lead to the development of new ARPA-E program spaces. In FY 2022, ARPA-E selected projects for three Exploratory Topics within this solicitation including Topic U: Sulfur Hexafluoride-Free Grid, Topic V: Carbon Negative Building Materials, and Topic W: Supporting Entrepreneurial Energy Discoveries (SEED).

ARPA-E Fiscal Year 2022
Annual Report to Congress

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I. Legislative Language

This report is in response to the requirements set forth in the America COMPETES Act, Public Law 110-69, section 5012(g)(1)(2007) as amended, which has been codified as 42 U.S.C. § 16538(h)(1), wherein it is stated:

> *"…the Director shall provide to the relevant authorizing and appropriations committees of Congress a report describing projects supported by ARPA-E during the previous fiscal year."*

ARPA-E focuses on early-stage energy technologies that can be meaningfully advanced with modest funding over a defined period. ARPA-E's rigorous program design, competitive project selection process, and hands-on engagement provide America's energy innovators with funding, technical assistance, and market awareness. Each year, ARPA-E thoroughly reviews all applications and technologies to ensure that funding is provided to topics not likely to be pursued by industry, Federal agencies, or Department of Energy (DOE) applied research and development (R&D) programs.

II. Fiscal Year 2022 Appropriation

The Consolidated Appropriations Act, 2022 included $450 million in fiscal year "FY" 2022 funds for ARPA-E.

III. Funding Opportunity Announcements

In FY 2022, ARPA-E announced 10 funding opportunities[10] for up to $353.0 million in R&D funding and awarded an additional $90.0 million in supplemental funding of existing awards. The technology programs created by these solicitations provide a unique bridge from basic science to early-stage technology. They draw from the latest scientific discoveries and will help create a viable path to commercial implementation through firm grounding in the economic realities and changing dynamics of the marketplace.

[10] Including Solicitation on Topics Informing New Program Areas (Topic V: Carbon Negative Building Materials and Topic W: Supporting Entrepreneurial Energy Discoveries), HESTIA, SCALEUP 2021, GO Competition Challenge 3, MINER, CURIE, EVs4ALL, Exploratory Topics (Topic A: Low-Energy Nuclear Reactions), and COOLERCHIPS.

The table below summarizes the funding opportunities announced in FY 2022. The funding amounts detailed below reflect the potential funding amount at the time of the announcement. The funding amounts may change at the time of project selections.

Table 1: Summary of ARPA-E Funding Opportunities in FY 2022

Program	Funding Opportunity Announcement Date	Funding Opportunity FY	Funding Amount at Time of Announcement ($ Million)[11]	Project Selection Date	Project Selection FY	Number of Projects [12]	Funding Amount at Time of Project Selection ($ Million)[13]
Solicitation on Topics Informing New Program Areas (Topic V)[14]	11/8/2021	FY 2022	$5.0	3/31/2022	FY 2022	2	$5.0
HESTIA[15]	11/8/2021	FY 2022	$45.0	6/13/2022	FY 2022	18	$39.0
Solicitation on Topics Informing New Program Areas (Topic W)[16]	2/1/2022	FY 2022	$10.0	7/11/2022	FY 2022	20	$9.7
SCALEUP 2021	12/16/2021	FY 2022	$100.0	11/22/2022	FY 2023	8	$100.0
GO Competition Challenge 3	2/16/2022	FY 2022	$4.0	12/8/2022	FY 2023	10	$3.7
MINER	2/24/2022	FY 2022	$44.0	10/7/2022	FY 2023	16	$39.0
CURIE	3/15/2022	FY 2022	$48.0	10/5/2022	FY 2023	12	$38.0
EVs4ALL	5/3/2022	FY 2022	$45.0	1/10/2023	FY 2023	12	$42.0
Exploratory Topics: Topic A (LENR)	9/13/2022	FY 2022	$10.0	2/17/2023	FY 2023	8	$10.0
COOLERCHIPS	9/22/2022	FY 2022	$42.0	5/9/2023	FY 2023	15	$40

[11] Funding levels shown in this column are the amounts at the time of the funding opportunity announcement. The funding amounts are subject to change at the time of the project selection.
[12] Number of projects in this column are at the time of the project selection. The number of projects is subject to change based on award negotiations and ongoing program management.
[13] Funding levels shown in in this column are as of the date of the project selection. The funding amounts are subject to change based on award negotiations and ongoing program management.
[14] This funding opportunity is also included in Table 2 of Section IV: Project Selections, because the funding opportunity was announced in FY 2022 and the project selections occurred in FY 2022.
[15] This funding opportunity is also included in Table 2 of Section IV: Project Selections, because the funding opportunity was announced in FY 2022 and the project selections occurred in FY 2022.
[16] This funding opportunity is also included in Table 2 of Section IV: Project Selections, because the funding opportunity was announced in FY 2022 and the project selections occurred in FY 2022.

The following is a summary of ARPA-E's funding opportunities announced in FY 2022:

From November 8, 2021 through February 1, 2022, ARPA-E announced two Exploratory Topics under the **Solicitation on Topics Informing New Program Areas.** Topic V, Carbon Negative Building Materials, announced up to $5.0 million in funding. Topic W, Supporting Entrepreneurial Energy Discoveries (SEED), announced up to $10.0 million in funding.

Topic V focuses on Carbon Negative Building Materials. The projects seek to develop new life cycle assessment (LCA) frameworks and tools that quickly and effectively analyze the life cycle impacts of building materials and whole-building designs. The projects will also inform HESTIA program awardees on how to further improve environmental performance metrics. Topic W focuses on Supporting Entrepreneurial Energy Discoveries (SEED). The projects focus on disruptive concepts in energy-related technologies within small businesses, including collaborations with universities and national labs.

ARPA-E issued the Solicitation on Topics Informing New Program Areas in 2019, as a flexible, simplified, ongoing funding mechanism for smaller efforts that do not fit the typical focused program model. This opportunity is used to fund disruptive R&D seedlings, provide resource teams to support focused programs, and investigate topic areas in which a full focused program may later be developed. The ability to respond to needs in a quick and agile manner enables ARPA-E to better support focused programs while constantly pursuing innovation in new areas.

On November 8, 2021, ARPA-E announced up to $45.0 million in funding for Harnessing Emissions into Structures Taking Inputs from the Atmosphere **(HESTIA)**.

The HESTIA program aims to support the development of technologies that cancel out embodied emissions while transforming buildings into net carbon storage structures. HESTIA projects will develop and demonstrate building materials and whole-building designs from a wide range of potential feedstocks. The feedstocks are net carbon negative on a life-cycle basis by using atmospheric CO_2 in the production process. HESTIA projects will facilitate the use of carbon negative materials in building construction by optimizing materials chemistries and matrices, manufacturing, and building designs in a cost-effective manner.

On December 16, 2021, ARPA-E announced up to $100.0 million in funding for Seeding Critical Advances for Leading Energy technologies with Untapped Potential 2021 **(SCALEUP 2021)**.

The SCALEUP program allows promising ARPA-E projects to address the "scaling gap" and retire technical risks associated with productization, manufacturing, and deployment in real energy systems. SCALEUP is a first-of-its-kind initiative, supporting the scaling of high-risk and disruptive new technologies across the full spectrum of energy applications. The goal of the program is to translate the performance achieved at the lab-and bench-scale to commercially viable versions of the technology.

On February 16, 2022, ARPA-E announced up to $4.0 million in funding for Grid Optimization Challenge 3 **(GO Competition Challenge 3)**.

The GO Competition aims to accelerate the development of transformational methods related to the electric power grid. Additionally, this competition seeks to identify innovative power system optimization and control methods that will accelerate the development and adoption of emerging technologies. Furthermore, innovative solutions identified by the GO Competition will enable increased grid flexibility, reliability, and resilience. They will also significantly increase energy security, provide greater energy efficiency, and substantially reduce the costs of integrating emerging technologies and resources into the electric power system in the United States.

The GO Competition Challenge 3 focuses on the security-constrained optimal power flow (SCOPF) problem. It is part of a continuing effort that began in GO Competition Challenges 1 and 2, to successfully discover, develop, and test innovative and disruptive software solutions for critical energy challenges and to overcome existing barriers. Challenge 3 will focus on multiperiod dynamic markets including advisory models for extreme weather events, day-ahead markets, and the real-time markets with an extended look-ahead. These problems will include active bid-in demand and topology optimization.

On February 24, 2022, ARPA-E announced up to $44.0 million in funding for Mining Innovations for Negative Emissions Resources **(MINER)**.

The MINER program seeks to increase the U.S domestic supplies of copper, nickel, lithium, cobalt, and other rare earth elements. These minerals are critical during the transition to clean sources of energy, such as wind or solar. The MINER program will fund technology research that increases the mineral yield while decreasing the required energy, and subsequent emissions, to mine and extract these energy-relevant minerals. Specifically, the program will investigate the potential CO_2-reactive ores to unlock net-zero or net-negative emission technologies.

At the conclusion of this program, there will be a portfolio of commercially demonstratable technologies that can realize the following benefits:

- Increase energy-relevant mineral yield by capturing desired minerals in CO_2-reactive mineralogy.
- Recover any remaining mineral value by reprocessing existing CO_2-reactive rock, soil layers, or tailings deposits.
- Carbon-negative pathways by developing ore-to-metal reactions to carbonate CO_2-reactive ore.
- Decrease mineral processing energy and reduce minerals tailing losses by 50%.

On March 15, 2022, ARPA-E announced up to $48.0 million in funding for Converting UNF Radioisotopes Into Energy **(CURIE)**.

The U.S. has accumulated approximately 86,000 metric tons of used nuclear fuel (UNF) from light-water reactors (LWRs), a value that increases by approximately 2,000 tons per year. This UNF is destined for permanent disposal even though more than 90% of its energy remains. Reprocessing UNF to recover reusable actinides and recycling them into new fuel for advanced reactors (ARs) would improve fuel utilization and drastically reduce the volume of waste requiring permanent disposal.

CURIE seeks to develop innovative separations technologies, material accountancy, and online monitoring technologies, as well as designs for a reprocessing facility. These impactful energy technologies will enable group recovery of actinides for AR feedstocks, incorporate in situ process monitoring, minimize waste volumes, enable a 1¢/kilowatt-hour (kWh) fuel cost for AR fuels, and maintain disposal costs in the range of 0.1¢/kWh. Innovative technologies that enable the secure, economical reprocessing of the nation's LWR UNF could substantially reduce the volume, heat load, and radiotoxicity of waste requiring permanent disposal while providing a valuable and sustainable fuel feedstock for advanced fast reactors.

On May 3, 2022, ARPA-E announced up to $45.0 million in funding for Electric Vehicles for American Low-carbon Living **(EVs4ALL)**.

The key to EV adoption is reliable, inexpensive batteries that can charge fast as well as provide improved performance and range retention in cold weather compared to state-of-the-art commercial options. ARPA-E's EVs4ALL program will increase EV market share by developing next-generation battery technologies to significantly improve EV affordability, convenience, reliability, and safety.

Program objectives for batteries to accomplish this mission include:

- Achieving a charge rate equivalent to 5–15 minutes to restore 80% of cell capacity.
- Reducing low-temperature battery performance losses by at least 50%.
- Retaining a minimum of 90% capacity after the battery has delivered 200,000 miles of equivalent and cumulative range.
- Identifying a compelling pathway to a cost of < $75/kWh at commercial scale.
- Implementing new and existing protocols to verify safety of new battery chemistries and cell designs.

On September 13, 2022, ARPA-E announced up to $10.0 million in funding for one Exploratory Topic – Topic A: Low Energy Nuclear Reactions – under the **Exploratory Topics** funding opportunity.

Projects selected within the LENR Exploratory Topic will pursue hypotheses-driven approaches toward producing publishable evidence of LENR in top-tier scientific journals. This Exploratory Topic will do this by testing/confirming specific hypotheses, rather than focusing only on

replication. Projects within this topic will also work on verifying control of experimental variables and triggers, supporting more comprehensive diagnostics and analysis, and improving access to broader expertise and capabilities on research teams.

On September 22, 2022, ARPA-E announced up to $42.0 million in funding for Cooling Operations Optimized for Leaps in Energy, Reliability, and Carbon Hyperefficiency for Information Processing Systems **(COOLERCHIPS)**.

The COOLERCHIPS program will develop transformational, highly efficient, and reliable cooling technologies for data centers. The target for COOLERCHIPS is to reduce total cooling energy expenditure to less than 5% of a typical data center's IT load at any time and in any U.S. location for a high-density compute system. A data center's total cooling energy is the energy needed to ensure that all heat generated from its IT and non-IT loads is rejected. Reducing data center cooling energy will reduce the operational CO_2 footprint of data center operations.

COOLERCHIPS technologies will achieve these goals by dramatically reducing the thermal resistance of heat rejection. This will allow for coolants to exist at temperatures much closer to operating temperatures of the latest generation of chips (targeting <10°C difference between chip and coolant). This will result in more efficient heat removal from the facility. The program will develop solutions for high volumetric compute density systems of >80kW/m3, equivalent to about >3kW per server. COOLERCHIPS aims to be commercially competitive with current state-of-the-art solutions by offering a lower total cost of ownership without compromising data center reliability and availability.

IV. Project Selections

In FY 2022, ARPA-E selected 135 projects across seven funding opportunities[17] for a total of $309.1 million in funding.

The OPEN 2021, REMEDY, ONWARDS, and Solicitation on Topics Informing New Program Areas (Topic U) funding opportunities were issued in FY 2021 with projects selected in FY 2022. The Solicitation on Topics Informing New Program Areas (Topic V and Topic W) and HESTIA funding opportunities were issued in FY 2022 with projects selected in FY 2022.

The table below summarizes the projects selected in FY 2022.

[17] Including OPEN 2021, REMEDY, ONWARDS, Solicitation on Topics Informing New Program Areas (Topic U: Sulfur Hexafluoride-Free Grid, Topic V: Carbon Negative Building Materials, and Topic W: Supporting Entrepreneurial Energy Discoveries), and HESTIA.

Table 2: Summary of ARPA-E Projects Selected in FY 2022							
Program	**Funding Opportunity Announcement Date**	**Funding Opportunity FY**	**Funding Amount at Time of Announcement ($Million)[18]**	**Project Selection Date**	**Project Selection FY**	**Number of Projects [19]**	**Funding Amount at Time of Project Selection ($ Million)[20]**
OPEN 2021	2/11/2021	FY 2021	$100.0	2/14/2022	FY 2022	68	$175.0
REMEDY	4/8/2021	FY 2021	$35.0	12/2/2021	FY 2022	12	$35.0
ONWARDS	5/19/2021	FY 2021	$40.0	3/10/2022	FY 2022	11	$36.0
Solicitation on Topics Informing New Program Areas (Topic U)	5/21/2021	FY 2021	$10.0	10/5/2021	FY 2022	4	$9.4
Solicitation on Topics Informing New Program Areas (Topic V)[21]	11/8/2021	FY 2022	$5.0	3/31/2022	FY 2022	2	$5.0
HESTIA[22]	11/8/2021	FY 2022	$45.0	6/13/2022	FY 2022	18	$39.0
Solicitation on Topics Informing New Program Areas (Topic W)[23]	2/1/2022	FY 2022	$10.0	7/11/2022	FY 2022	20	$9.7

Below is a summary and details of projects selected in FY 2022:

From October 5, 2021, through July 11, 2022, ARPA-E selected twenty-six Exploratory Topic projects to receive $24.1 million under the **Solicitation on Topics Informing New Program Areas (Topics U–W)**.

Four of these projects were selected to receive $9.4 million through Topic U: Sulfur Hexafluoride-Free Grid. Two of these projects were selected to receive $5.0 million through

[18] Funding levels shown in this column are the amounts at the time of the funding opportunity announcement. The funding amounts are subject to change at the time of the project selection.
[19] Number of projects in this column are at the time of the project selection. The number of projects is subject to change based on award negotiations and ongoing program management.
[20] Funding levels shown in in this column are as of the date of the project selection. The funding amounts are subject to change based on award negotiations and ongoing program management.
[21] This funding opportunity is also included in Table 1 of Section III: Funding Opportunity Announcements, because the funding opportunity was announced in FY 2022 and the project selections occurred in FY 2022.
[22] This funding opportunity is also included in Table 1 of Section III: Funding Opportunity Announcements, because the funding opportunity was announced in FY 2022 and the project selections occurred in FY 2022.
[23] This funding opportunity is also included in Table 1 of Section III: Funding Opportunity Announcements, because the funding opportunity was announced in FY 2022 and the project selections occurred in FY 2022.

Topic V: Carbon Negative Building Materials. Twenty of these projects were selected to receive $9.7 million through Topic W: Supporting Entrepreneurial Energy Discoveries (SEED).

ARPA-E issued the Solicitation on Topics Informing New Program Areas in 2019, as a flexible, simplified, ongoing funding mechanism used as needed for smaller efforts that do not fit the typical focused program model. This flexible opportunity is used to fund exploratory and disruptive R&D seedlings, provide resource teams that support focused programs, and investigate topic areas in which a full focused program may later be developed. This ability to respond to needs in a quick and agile manner enables ARPA-E to better support focused programs while constantly pursuing innovation in new areas.

Example Solicitation on Topics Informing New Program Areas Topic W project: Metalx Biocycle – "Synthetic Biology Approach to Critical Metal Extraction from Waste Electronic Components to Ensure a Robust Supply of Critical Materials for Clean Energy" – El Paso, TX ($500,000).

Metalx Biocycle aims to enable the recycling of critical metals from electronic waste (e-waste) at a cost that is competitive against extraction via conventional mining. Most e-waste ends up in landfills where it causes serious environmental issues; and conventional extraction methods rely on inefficient, expensive, energy intensive processes. The Metalx Biocycle team will leverage biological processes to efficiently extract, concentrate, and purify critical metals and rare earth elements from e-waste and low-grade mineral ores. They plan to develop a biological recovery platform that provides fossil fuel-free metal reclamation and minimizes environmental impact, ensuring a secure closed-loop life cycle for critical metals in the U.S.

On December 2, 2021, ARPA-E selected 12 projects to receive $35.0 million through **REMEDY** *(Reducing Emissions of Methane Every Day of the Year).*

The REMEDY program addresses methane emissions from domestic oil, gas, and coal value chains. Today these fossil fuels account for 78% of U.S. primary energy. Successful technologies will provide domestic energy producers and U.S. energy consumers economic and environmental benefits. REMEDY is a research program to reduce methane emissions from three sources in the oil, gas, and coal value chains:

1. Exhaust from 50,000 natural gas-fired lean-burn engines. These engines are used to drive compressors, generate electricity, and increasingly repower ships.
2. The estimated 300,000 flares required for safe operation of oil and gas facilities.
3. Coal mine ventilation air methane (VAM) exhausted from 250 operating underground mines.

Example REMEDY project: University of Michigan – "REMEDY using SABRE (Reducing Emissions of Methane Every Day of the Year using Systems of Advanced Burners for Reduction of Emissions)" – Ann Arbor, Michigan ($2,278,401).

The University of Michigan and Southwest Research Institute will use state-of-the-art methods to eliminate methane emissions from oil and gas (O&G) flares, vents, and other equipment. The team will quantitatively characterize high- and low-volume methane sources at an actual O&G field site. The approach will demonstrate Systems of Advanced Burners for Reduction of Emissions (SABRE) technology for high-efficiency (> 99.5%) methane conversion of the high- and low-volume sources of methane. The SABRE approach leverages site resources and customizes flare technology to local equipment needs. The system is based on developing and demonstrating novel burner concepts to meet a range of gas conditions at O&G sites. These conditions include high- and low-pressure sources of methane emissions, high and low volumetric flow rates, and changeable wind speeds. The team will create SABRE burner designs using machine learning informed by extensive experimental data and high-fidelity computational fluid dynamics modeling. The team will apply its additive manufacturing expertise for fast prototyping of flare burners.

On February 14, 2022, ARPA-E selected 68 projects to receive $175.0 million through **OPEN 2021**, the agency's fifth OPEN solicitation.

In addition to its focused programs, which are targeted at specific technical areas, ARPA-E issues periodic OPEN programs approximately every three years. ARPA-E uses OPEN programs to identify high-potential projects that address the full range of energy-related technologies, including areas that are outside the current ARPA-E portfolio. The objective of an ARPA-E OPEN program is to support some of America's top energy innovators as they work on the development of potentially disruptive new technologies across the full spectrum of energy applications.

Example OPEN 2021 project: Sublime Systems – "Electrochemical Upcycling for Low-CO_2 Materials Production" – Weston, Massachusetts ($3,594,384).

Sublime Systems will develop the first platform technology that uses electrochemistry to upcycle waste products and low-value minerals into valuable, CO_2-neutral materials. The technology consists of an impurity-tolerant renewable electricity-powered electrochemical reactor. It generates strong acids and bases to separate, extract, and purify the elements contained in the input materials. The focus is on recovering magnesium, silica, and valuable metals from waste products (coal bottom ash and demolition waste concrete) and highly abundant but low-value mafic or ultramafic rocks. The process can produce starting materials for cements and several metals that can be used as CO_2-free alternatives to conventional materials. Sublime Systems' technology is the first integrated solution for using low-value minerals and wastes to produce valuable materials while preventing environmental contamination and decreasing greenhouse gas emissions.

On March 13, 2021, ARPA-E selected 11 projects to receive $36.0 million through **ONWARDS** *(Optimizing Nuclear Waste and Advanced Reactor Disposal Systems).*

The next generation of advanced nuclear reactors (AR) is currently being developed to enhance the safety, reduce the cost, and increase the efficiency of nuclear power generation. The future deployment of ARs will ensure that the U.S. meets its goals of greenhouse gas (GHG) reduction and facilitates U.S. energy security and global thought leadership in advanced nuclear energy. To enable the growth of advanced nuclear energy, the ONWARDS program seeks to develop and demonstrate breakthrough technologies that will facilitate a 10x reduction in AR waste volume generation or repository footprint. In addition, ONWARDS aims to advance development of high-performance AR waste forms while maintaining exemplary safeguards standards and global back-end costs in the accepted range of $1/megawatt-hour.

Challenges associated with disposal pathways of waste threaten the development and deployment of the next generation of ARs. The development of technologies that enable the final disposition and improve the disposal impact of AR used nuclear fuel (UNF) will facilitate the growth of advanced nuclear energy, which is vitally important to meeting GHG emission goals.

Example ONWARDS project: Oklo – "Enabling the Near-Term Commercialization of an Electrorefining Facility to Close the Metal Fuel Cycle" – Santa Clara, California ($3,999,836).

Oklo aims to commercialize a state-of-the-art nuclear fuel recycling facility within the next few years. The facility would produce fuel for Oklo's metal-fueled fast reactors, closing the advanced reactor fuel cycle and changing the economic paradigm for advanced fission with a commercial-scale fuel recycling facility.

This project will optimize the four-unit operations currently required for producing uranium (U) and U/transuranic (TRU) fuel materials in an electrorefining facility. These operations are (1) electrorefining to recover U and U/TRU alloys, (2) salt/metal product separation, (3) lanthanide waste drawdown, and (4) active metal waste removal by fractional crystallization. Next-generation processes designed to enable remote operation will optimize operations. Concurrent with the technology development, Oklo's project will also focus on establishing the licensing basis for the facility and developing the final waste disposal solution. This technology is expected to reduce waste by more than an order of magnitude compared with a no-reprocessing baseline.

On June 13, 2022, ARPA-E selected 18 projects to receive $39.0 million through **HESTIA**.

The HESTIA program aims to support the development of technologies that cancel out embodied emissions while transforming buildings into net carbon storage structures. HESTIA projects will develop and demonstrate building materials and whole-building designs from a wide range of potential feedstocks that are net carbon negative on a life-cycle basis by using atmospheric CO_2 in the production process. The HESTIA projects should span a range of possible feedstocks, materials, building elements, and building types. HESTIA teams will facilitate the use of carbon negative materials in building construction by optimizing materials chemistries and matrices, manufacturing, and building designs in a cost-effective manner.

Example HESTIA project: National Renewable Energy Laboratory (NREL) – "Cutting the Carbon from Insulation Cellulose-Mycelium Composite Material" – Fairbanks, Alaska ($2,476,145).

The National Renewable Energy Laboratory (NREL) will develop cost-effective, bio-based insulation by fabricating net CO_2-negative cellulose-mycelium composites. The NREL team will combine foamed cellulose with mycelium, the root network fungi, to create a new class of high-performing, carbon-capturing, and storing foams and composites. The team will develop thermally and acoustically insulating mycelium-cellulose composites that (a) capture and store carbon, (b) are locally manufactured, (c) are cost-competitive with carbon-positive synthetic and mineral materials, (d) are antimicrobial, and (e) are targeted toward building energy retrofits. The team's technology leverages abundant cellulose from beetle-killed conifers and small dimensional woody biomass.

Table 3 summarizes ARPA-E's programs to date. A full list of the projects selected during FY 2022 can be found in Appendix I. Additional information related to these projects is on ARPA-E's website: http://arpa-e.energy.gov.

Table 3: ARPA-E Programs to Date

Funding Year	PROGRAM NAME	NUMBER OF PROJECTS[24]	FUNDING AMOUNT ($ Million)[25]
PRIOR TO FY 2022	OPEN 2009	41	$174.0
	Batteries for Electrical Energy Storage in Transportation (BEEST)	12	$38.0
	Innovative Materials and Processes for Advanced Carbon Capture Technologies (IMPACCT)	15	$40.0
	ElectroFuels	13	$48.0
	Agile Delivery of Electrical Power Technology (ADEPT)	14	$38.0
	Building Energy Efficiency Through Innovative Thermodevices (BEETIT)	17	$38.0
	Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS)	15	$40.0
	Plants Engineered To Replace Oil (PETRO)	10	$56.0
	High Energy Advanced Thermal Storage (HEATS)	15	$37.0
	Rare Earth Alternatives in Critical Technologies (REACT)	14	$39.0
	Green Electricity Network Integration (GENI)	15	$43.0

[24] Number of projects listed are at the time of project selection. The number of projects is subject to change based on award negotiations and ongoing program management.
[25] Funding amounts listed are at the time of project selection. The funding amounts are subject to change based on award negotiations and ongoing program management.

Table 3: ARPA-E Programs to Date			
Funding Year	**PROGRAM NAME**	**NUMBER OF PROJECTS[24]**	**FUNDING AMOUNT ($ Million)[25]**
	Solar Agile Delivery of Electrical Power Technology (Solar ADEPT)	7	$12.0
	Methane Opportunities for Vehicular Energy (MOVE)	13	$42.0
	Advanced Management and Protection of Energy Storage Devices (AMPED)	15	$34.0
	OPEN 2012	66	$171.0
	Innovative Development in Energy-related Applied Science (IDEAS)	59	$28.0
	Robust Affordable Next Generation Energy Storage Systems (RANGE)	22	$45.0
	Reducing Emissions using Methanotrophic Organisms for Transportation Energy (REMOTE)	16	$48.0
	Modern Electro/Thermochemical Advancements in Light metals Systems (METALS)	19	$45.0
	Full-Spectrum Optimized Conversion and Utilization of Sunlight (FOCUS)	14	$35.0
	Strategies for Wide Bandgap, Inexpensive Transistors for Controlling High Efficiency Systems (SWITCHES)	14	$36.0
	Reliable Electricity Based on Electrochemical Systems (REBELS)	13	$37.0
	Cycling Hardware to Analyze and Ready Grid-Scale Electricity Storage (CHARGES)	2	$6.5
	Delivering Efficient Local Thermal Amenities (DELTA)	11	$32.0
	Methane Observation Networks with Innovative Technology to Obtain Reductions (MONITOR)	12	$39.0
	Accelerating Low-cost Plasma Heating and Assembly (ALPHA)	9	$31.0
	Advanced Research In Dry cooling (ARID)	15	$33.0
	Generators for Small Electrical and Thermal Systems (GENSETS)	14	$37.0
	Transportation Energy Resources from Renewable Agriculture (TERRA)	6	$38.0
	Traveler Response Architecture using Novel Signaling for Network Efficiency in Transportation (TRANSNET)	5	$15.0
	Micro-scale Optimized Solar-cell Arrays with Integrated Concentration (MOSAIC)	11	$26.0
	OPEN 2015	39	$124.0
	Network Optimized Distributed Energy Systems (NODES)	12	$35.0

Table 3: ARPA-E Programs to Date			
Funding Year	**PROGRAM NAME**	**NUMBER OF PROJECTS[24]**	**FUNDING AMOUNT ($ Million)[25]**
	Generating Realistic Information for the Development of Distribution And Transmission Algorithms (GRID DATA)	7	$11.0
	Single-Pane Highly Insulating Efficient Lucid Design (SHIELD)	14	$27.0
	Integration and Optimization of Novel Ion-Conducting Solids (IONICS)	16	$37.0
	Next-Generation Energy Technologies for Connected and Automated On-Road Vehicles (NEXTCAR)	11	$35.0
	Rhizosphere Observations Optimizing Terrestrial Sequestration (ROOTS)	10	$36.0
	Renewable Energy to Fuels Through Utilization of Energy-Dense Liquids (REFUEL)	16	$33.0
	ENergy-efficient Light-wave Integrated Technology Enabling Networks that Enhance Dataprocessing (ENLITENED)	9	$25.0
	Power Nitride Doping Innovation Offers Devices Enabling SWITCHES (PNDIODES)	7	$6.9
	Creating Innovative and Reliable Circuits Using Inventive Topologies and Semiconductors (CIRCUITS)	21	$30.0
	Macroalgae Research Inspiring Novel Energy Resources (MARINER)	18	$22.0
	Saving Energy Nationwide in Structures with Occupancy Recognition (SENSOR)	15	$20.0
	Innovative Natural-gas Technologies for Efficiency Gain in Reliable and Affordable Thermochemical Electricity-generation (INTEGRATE)	8	$16.0
	Modeling-Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration (MEITNER)	6	$14.0
	Duration Addition to electricitY Storage (DAYS)	10	$28.0
	Building Reliable Electronics to Achieve Kilovolt Effective Ratings Safely (BREAKERS)	8	$21.0
	High Intensity Thermal Exchange through Materials and Manufacturing Processes (HITEMMP)	15	$29.2
	OPEN 2018 (and related OPEN+ cohorts)	77	$202.8
	Aerodynamic Turbines Lighter and Afloat with Nautical Technologies and Integrated Servo-control (ATLANTIS)	13	$26.0
	Solicitation on Topics Informing New Program Areas (Topics A – K)	67	$69.7
	Grid Optimization (GO) Competition Challenge 1	10	$3.4

Table 3: ARPA-E Programs to Date			
Funding Year	**PROGRAM NAME**	**NUMBER OF PROJECTS[24]**	**FUNDING AMOUNT ($ Million)[25]**
	Design Intelligence Fostering Formidable Energy Reduction and Enabling Novel Totally Impactful Advanced Technology Enhancements (DIFFERENTIATE)	23	$15.0
	Environmental Security Technology Certification Program (ESTCP)	4	$3.2
	Performance-based Energy Resource Feedback, Optimization, and Risk Management (PERFORM)	12	$30.5
	Generating Electricity Managed by Intelligent Nuclear Assets (GEMINA)	9	$27.0
	Breakthroughs Enabling THermonuclear-fusion Energy (BETHE)	16	$35.0
	FLExible Carbon Capture and Storage (FLECCS)	12	$11.5
	Aviation-class Synergistically Cooled Electric-motors with iNtegrated Drives (ASCEND)	9	$14.5
	Range Extenders for Electric Aviation with Low Carbon and High Efficiency (REEACH)	9	$20.0
	SCALEUP "Fast Track"	2	$24.0
	Systems for Monitoring and Analytics for Renewable Transportation Fuels from Agricultural Resources and Management (SMARTFARM)	6	$16.5
	Galvanizing Advances in Market-Aligned Fusion for an Overabundance of Watts (GAMOW)	14	$29.0
	Rapid Encapsulation of Pipelines Avoiding Intensive Replacement (REPAIR)	10	$33.0
	Solicitation on Topics Informing New Program Areas (Topics L – R)	29	$31.0
	Submarine Hydrokinetic and Riverine Kilo-megawatt Systems (SHARKS)	11	$35.0
	Ultrahigh Temperature Impervious Materials Advancing Turbine Efficiency (ULTIMATE)	17	$16.0
	Energy and Carbon Optimized Synthesis for the Bioeconomy (ECOSynBio)	15	$35.0
	Seeding Critical Advances for Leading Energy technologies with Untapped Potential 2019 (SCALEUP 2019)[26]	7	$47.0
	Solicitation on Topics Informing New Program Areas (Topics S & T)	25	$13.6
	Renewable Energy to Fuels through Utilization of Energy-dense Liquids Integration and Testing (REFUEL + IT)	1	$10.0

[26] This excludes the SCALEUP "Fast Track."

Table 3: ARPA-E Programs to Date			
Funding Year	**PROGRAM NAME**	**NUMBER OF PROJECTS[24]**	**FUNDING AMOUNT ($ Million)[25]**
	Next-Generation Energy Technologies for Connected and Automated On-Road Vehicles Phase II (NEXTCAR Phase II)	4	$18.0
FY 2021 FOA / FY 2022 SECLECTION	OPEN 2021	68	$175.0
	Reducing Emissions of Methane Every Day of the Year (REMEDY)	12	$35.0
	Optimizing Nuclear Waste and Advanced Reactor Disposal Systems (ONWARDS)	11	$36.0
	Solicitation on Topics Informing New Program Areas (Topic U)	4	$9.7
FY 2022	Solicitation on Topics Informing New Program Areas (Topics V & W)	22	$14.7
	Harnessing Emissions into Structures Taking Inputs from the Atmosphere (HESTIA)	18	$39.0
FY 2022 FOA / FY 2023 SELECTION	Seeding Critical Advances for Leading Energy technologies with Untapped Potential 2021 (SCALEUP 2021)	8	$100.0
	Grid Optimization Competition Challenge 3 (GO Competition Challenge 3)	10	$3.7
	Mining Innovations for Negative Emissions Resource Recovery (MINER)	16	$39.0
	Converting UNF Radioisotopes into Energy (CURIE)	12	$38.0
	Electric Vehicles for American Low-carbon Living (EVs4ALL)	12	$42.0
	Exploratory Topics (Topic A)	8	$10.0
	Cooling Operations Optimized for Leaps in Energy, Reliability, and Carbon Hyperefficiency for Information Processing Systems (COOLERCHIPS)	15	$40.0

V. ARPA-E Energy Innovation Summit

ARPA-E held its 12th ARPA-E Energy Innovation Summit from May 23–25, 2022, at the Gaylord Rockies Convention Center, outside of Denver, Colorado.

The ARPA-E Energy Innovation Summit is the premier energy innovation conference and technology showcase that brings together experts from different technical disciplines and professional communities to think about America's energy challenges in new and innovative

ways. The Summit offers a unique, three-day program aimed at highlighting the boldest, most audacious ideas that could have the biggest impact.

Summit attendees had the opportunity to watch high-level speakers and thought leaders on the Summit's Main Stage, engage in dynamic breakout panels, participate in focused networking opportunities, and explore the Technology Showcase. The Summit's popular Technology Showcase featured presentations, displays, prototypes, and demonstrations from ARPA-E performers and a highly select group of other companies, stakeholders, and research organizations.

2022 ARPA-E Energy Innovation Summit Highlights include:

- More than 2,100 registered attendees from 49 states and 12 countries.
- More than 300 exhibitor booths displaying transformational technologies from ARPA-E awardees and other innovative companies.
- More than 100 speakers and keynote addresses, including Cabinet Secretaries, Chief Executive Officers, and entrepreneurs working to design the energy systems and technologies of the future.
- Twenty-seven government agencies including representatives from DOD, DOE, and other civilian, state, and international agencies.
- Over 100 registered students, both in-person and virtually, from 25 states and 40 universities.

VI. Conclusion

In FY 2022, ARPA-E announced ten funding opportunities which covered a broad array of energy technologies:

1. **Solicitation on Topics Informing New Program Areas**: two Exploratory Topics[27] identifying and researching new areas of technology.

2. **HESTIA:** supporting the development of technologies that can transform buildings into net carbon storage structures.

3. **SCALEUP 2021:** scaling up promising energy technologies to the pre-pilot stage of the path to market and ultimately realizing commercial impact.

4. **GO Competition Challenge 3:** developing software management solutions to address real-world power grid conditions.

[27] Topic V: Carbon Negative Building Materials and Topic W: Supporting Entrepreneurial Energy Discoveries (SEED).

5. **MINER:** developing commercially scalable technologies that will enable greater domestic supplies of copper, nickel, lithium, cobalt, rare earth elements, and other critical elements.

6. **CURIE:** advancing UNF recycling, reducing the volume of high-level waste requiring permanent disposal, and providing safe domestic advanced reactor fuel stocks.

7. **EVs4ALL:** developing electric vehicle (EV) batteries that last longer, charge faster, perform efficiently in freezing temperatures, and have better range retention.

8. **Exploratory Topics:** supporting high-risk R&D leading to the development of potentially disruptive technologies.

9. **COOLERCHIPS:** developing highly efficient and reliable cooling systems that will enable a new class of efficient power-dense computational systems, data centers, and modular systems.

In FY 2022, ARPA-E selected **135** projects across seven funding opportunities for a total of $309.1 million in funding:

1. **OPEN 2021:** supporting energy innovators as they work on the development of potentially disruptive new technologies across the full spectrum of energy applications.

2. **REMEDY:** developing technologies to reduce methane emissions in the oil, gas, and coal industries.

3. **ONWARDS:** increasing the deployment, and use of, nuclear power as a reliable source of clean energy and limiting the amount of waste produced from ARs.

4. **Solicitation on Topics Informing New Program Areas:** three Exploratory Topics[28] to identify and research new areas of technology.

5. **HESTIA:** supporting the development of technologies that can transform buildings into net carbon storage structures.

The statutory goals of ARPA-E are to:

1. Enhance economic and energy security of the United States through the development of energy technologies that –
    a. Reduce imports of energy from foreign sources;
    b. Reduce energy-related emissions, including greenhouse gases;

[28] Topic U: Sulfur Hexafluoride-Free Grid, Topic V: Carbon Negative Building Materials, and Topic W: Supporting Entrepreneurial Energy Discoveries (SEED).

   c. Improve the energy efficiency of all economic sectors;
   d. Provide transformative solutions to improve the management, clean-up, and disposal of radioactive waste and spent nuclear fuel; and
   e. Improve the resilience, reliability, and security of infrastructure to produce, deliver, and store energy.
2. Ensure that the U.S. maintains a technological lead in developing and deploying advanced energy technologies.

ARPA-E will continue to catalyze and accelerate the development of transformational energy technologies that could enable a more secure and affordable energy future in America and achieve ARPA-E's statutory goals. ARPA-E will maintain the use of its successful model to select projects through "focused" programs, "open" solicitations, and "Exploratory Topics", quickly and effectively leveraging new scientific discoveries and market developments. In addition, ARPA-E will track and evaluate the success of awardee technologies after their participation in a funding program to assess the transformative effects of ARPA-E's investments more clearly.

VII. Appendix I: Projects Selected in FY 2022

Additional information on these projects is available on the ARPA-E website: http://arpa-e.energy.gov.

Appendix 1: Projects Selected in FY 2022[29]				
Program	**Lead Organization**	**Project Title**	**Location**	**ARPA-E Funding**
HESTIA	Aspen Products Group	High Performance, Carbon Negative, Building Insulation	Marlborough, MA	$1,152,476
HESTIA	BamCore	Maximizing Carbon Negativity in Next Generation Bamboo Framing Materials	Ocala, FL	$2,230,060
HESTIA	Biomason	SOTERIA - Carbon Negative Bioconcrete Unit Production Concept	Durham, NC	$1,812,118
HESTIA	Clemson University	An Entirely Wood Floor System Designed for Carbon Negativity, Future Adaptability, and End of Life De/re/Construction	Clemson, SC	$1,042,934
HESTIA	National Renewable Energy Laboratory (NREL)	High-Performing Carbon-Negative Concrete Using Low Value Byproducts from Biofuels Production	Golden, CO	$1,749,935
HESTIA	National Renewable Energy Laboratory (NREL)	Cutting the Carbon from Insulation Cellulose-Mycelium Composite Material	Fairbanks, AK	$2,476,145
HESTIA	Northeastern University	4C2B: Century-scale Carbon-sequestration in Cross-laminated Timber Composite Bolted-steel Buildings	Boston, MA	$3,150,000
HESTIA	Oak Ridge National Laboratory (ORNL)	Renewable, Carbon-negative Adhesives for OSB and Other Engineered Woods	Oak Ridge, TN	$1,098,000
HESTIA	Oregon State University (OSU)	Cellulose Cement Composite (C3) for Residential Construction	Corvallis, OR	$2,500,000
HESTIA	Pacific Northwest National Laboratory	The Circular Home: Development and Demonstration of a Net-Negative-Carbon, Reusable Residence	Richland, WA	$2,627,466
HESTIA	Purdue University	Strong and CO_2 Consuming Living Wood for Buildings	West Lafayette, IN	$958,245

[29] Organizations selected and funding amounts listed are at the time of project selection. The final funding amounts, organizations selected, project titles, and location are subject to change based on award negotiations and ongoing program management.

Appendix 1: Projects Selected in FY 2022[29]				
Program	**Lead Organization**	**Project Title**	**Location**	**ARPA-E Funding**
HESTIA	SkyNano Technologies	CO_2mposite: Recycling of CO_2, Carbon Fiber Waste, and Biomaterials into Composite Panels for Lower Embodied Carbon Building Materials	Knoxville, TN	$2,000,000
HESTIA	Texas A&M University	Hempcrete 3D Printed Buildings for Sustainability and Resilience	College Station, TX	$3,742,496
HESTIA	The State University of New York (SUNY) at Buffalo	Modular Design and Additive Manufacturing of Interlocking Superinsulation Panel from Bio-based Feedstock for Autonomous Construction	Buffalo, NY	$2,179,852
HESTIA	University of Colorado, Boulder (CU-Boulder)	A Photosynthetic Route to Carbon-Negative Portland Limestone Cement	Boulder, CO	$3,193,063
HESTIA	University of Pennsylvania	High Performance Building Design with 3D-printed Carbon Absorbing Funicular Structures	Philadelphia, PA	$2,407,390
HESTIA	University of Tennessee, Knoxville (UT)	Lignin-derived Carbon Storing Foams for High Performance Insulation	Knoxville, TN	$2,557,383
HESTIA	University of Wisconsin-Madison (UW-Madison)	Carbon-Negative Ready-mix Concrete Building Components Through Direct Air Capture	Madison, WI	$2,256,250
ONWARDS	Brigham Young University (BYU)	Two-Step Chloride Volatility Process for Reprocessing Used Nuclear Fuel from Advanced Reactors	Provo, UT	$900,217
ONWARDS	Citrine Informatics	Novel Phosphate Waste Forms to Enable Efficient Dehalogenation and Immobilization of Salt Waste	Redwood City, CA	$3,103,770
ONWARDS	Deep Isolation	UPWARDS: Universal Performance Criteria and Canister for Advanced Reactor Waste Form Acceptance in Borehole and Mined Repositories Considering Design Safety	Berkeley, CA	$3,608,399
ONWARDS	General Electric (GE) Global Research	Resonance Absorption Densitometry for Materials Assay Security Safeguards (RADMASS)	Niskayuna, NY	$4,499,463
ONWARDS	Idaho National Laboratory (INL)	Traveling Molten Zone Refining Process Development for Innovative Fuel Cycle Solutions	Idaho Falls, ID	$2,076,343

Appendix 1: Projects Selected in FY 2022[29]				
Program	**Lead Organization**	**Project Title**	**Location**	**ARPA-E Funding**
ONWARDS	Oklo	Enabling the Near-Term Commercialization of an Electrorefining Facility to Close the Metal Fuel Cycle	Santa Clara, CA	$4,000,000
ONWARDS	Orano Federal Services	Off-Gas Treatment Process for Conditioning and Recycling Facilities	Charlotte, NC	$2,249,573
ONWARDS	Rensselaer Polytechnic Institute (RPI)	Metal-Halide Perovskites as Innovative and Cost-Effective Fluoride Salt Waste Forms	Troy, NY	$607,505
ONWARDS	Rutgers University	Pioneering a Cermet Waste Form for Disposal of Waste Streams from Advanced Reactors (PACE-FORWARD)	New Brunswick, NJ	$4,000,007
ONWARDS	Stony Brook University	MATRICY: Matrix Engineered TRISO Compacts Enabling Advanced Reactor Fuel Cycles	Stony Brook, NY	$3,400,000
ONWARDS	TerraPower	Chloride-Based Volatility for Waste Reduction and/or Reuse of Metallic-, Oxide- and Salt-Based Reactor Fuels	Bellevue, WA	$8,550,000
OPEN 2021	Argonne National Laboratory (ANL)	Advanced Facility Design and AI/ML Enabled Safeguards to Establish Secure, Economical Recycling of Fast Reactor Fuels	Lemont, IL	$3,600,000
OPEN 2021	Argonne National Laboratory (ANL)	A Zero-Emission Process for Direct Reduction of Iron by Hydrogen Plasma in a Rotary Kiln Reactor	Lemont, IL	$1,200,000
OPEN 2021	Argonne National Laboratory (ANL)	Non-neutron Transmutation of Used Nuclear Fuel	Lemont, IL	$3,000,000
OPEN 2021	California Institute of Technology (CalTech)	A Hybrid Electrochemical and Catalytic Compression System for Direct Generation of High-Pressure Hydrogen at 700 Bar	Pasadena, CA	$2,200,000
OPEN 2021	Carnegie Mellon University (CMU)	Ionomer-Free Electrodes for Ultrahigh Power Density Fuel Cells	Pittsburgh, PA	$3,220,310
OPEN 2021	Chilldyne	Helical Turbulator for Robust Nucleate Boiling Cold Plate	Carlsbad, CA	$773,990
OPEN 2021	Columbia University	High Capacity Electrolyzers Based on Ultrathin Proton-Conducting Oxide Membranes	New York, NY	$3,375,712
OPEN 2021	Columbia University	Lithium-Ion Bobbin Cells for Grid Scale Energy Storage	New York, NY	$1,498,533

Appendix 1: Projects Selected in FY 2022[29]				
Program	**Lead Organization**	**Project Title**	**Location**	**ARPA-E Funding**
OPEN 2021	Copernic Catalysts	In-Silico Heterogeneous Catalyst Design for GHG Reduction via Bulk Chemicals	Cambridge, MA	$3,579,694
OPEN 2021	Cornell University	Field-Focused Load-Leveled Dynamic Wireless Charging System for Electric Vehicles	Ithaca, NY	$1,425,000
OPEN 2021	Cornell University	Advancing a Low Carbon Built Environment with Inherent Utilization of Waste Concrete and CO_2 via Integrated Electrochemical, Chemical and Biological Routes (ADVENT)	Ithaca, NY	$2,500,000
OPEN 2021	Dimensional Energy	3D-Printed 1000°C Silicon-Carbide Thermocatalytic CO_2 Reactor with High Carbon Conversion and Energy Efficiencies	Ithaca, NY	$3,100,104
OPEN 2021	Eden GeoPower	Electro-Hydraulic Fracturing for Enhanced Geothermal Systems	Somerville, MA	$3,796,672
OPEN 2021	Fervo Energy	FervoFlex: Long duration in-reservoir energy storage and load-following, dispatchable geothermal generation	Houston, TX	$4,500,000
OPEN 2021	Foro Energy	Eliminating Methane Emissions from Abandoned Oil and Gas Wells	Houston, TX	$3,750,000
OPEN 2021	General Electric (GE) Global Research	Lifted-Flame Combustion for High-Hydrogen Reheat Gas Turbines	Greenville, SC	$1,572,108
OPEN 2021	General Electric (GE) Global Research	Manufacturing High-Yield Investment Castings with Minimal-Energy	Greenville, SC	$2,696,056
OPEN 2021	Georgia Institute of Technology (Georgia Tech)	Surfactant-Free Multiphase Forming of Fiber Composite Products for Significant Reduction in Energy and CO_2 Emission	Atlanta, GA	$2,161,071
OPEN 2021	HighT-Tech	Scalable Manufacturing of High-Entropy Alloy Catalysts for Ammonia Oxidation	College Park, MD	$2,994,607
OPEN 2021	Hinetics	Cryogen-Free Ultra-High Field Superconducting Electric Motor	Champaign, IL	$5,761,467
OPEN 2021	HRL Laboratories	Surface Laser Architected Magnets (SLAM)	Malibu, CA	$2,661,888

Appendix 1: Projects Selected in FY 2022[29]				
Program	**Lead Organization**	**Project Title**	**Location**	**ARPA-E Funding**
OPEN 2021	IBM T.J. Watson Research Center	Systems Two Phase Cooling	Yorktown Heights, NY	$2,629,666
OPEN 2021	Illinois Institute of Technology (IIT)	Direct Conversion of Flue Gas to Value-Added Chemicals Using a Carbon-Neutral Process	Chicago, IL	$1,885,932
OPEN 2021	Los Alamos National Laboratory (LANL)	Advanced Manufacturing of High-Entropy Alloys as Cost-Effective Plasma Facing Components for Fusion Power Generation	Los Alamos, NM	$3,114,700
OPEN 2021	Makai Ocean Engineering	Remotely Installed Anchorages for Floating Offshore Wind and Other Offshore Renewables Cost Reduction	Waimanalo, HI	$849,951
OPEN 2021	Massachusetts Institute of Technology (MIT)	8" GaN-on-Si Super Junction Devices for Next Generation Power Electronics	Cambridge, MA	$4,521,601
OPEN 2021	Massachusetts Institute of Technology (MIT)	Nitrogen Fertilizer: New Strategies for Low-energy, Low-emission Production and Use	Cambridge, MA	$2,256,346
OPEN 2021	Massachusetts Institute of Technology (MIT)	Liquid Immersion Blanket: Robust Accountancy (LIBRA)	Cambridge, MA	$3,062,320
OPEN 2021	National Renewable Energy Laboratory (NREL)	Incorporating Record-Breaking Catalysts in Electrospun Bipolar Membranes for Low-Cost Carbon Capture via Salt Splitting	Golden, CO	$3,337,668
OPEN 2021	National Renewable Energy Laboratory (NREL)	ReSOURCE: The Carbon Negative Biorefinery of the Future	Golden, CO	$3,508,800
OPEN 2021	National Renewable Energy Laboratory (NREL)	Repurposing Infrastructure for Gravity Storage using Underground Potential energy (RIGS UP)	Golden, CO	$2,700,000
OPEN 2021	Nokia of America	Delivering Energy & Exergy Efficiency in the Converged 5G RAN/Edge Compute Network	Murray Hill, NJ	$2,106,380
OPEN 2021	North Carolina State University (NC State)	Intensified Alkenyl Benzenes Production via Modular Redox Dehydrogenation	Raleigh, NC	$1,862,109
OPEN 2021	North Carolina State University (NC State)	Microgrid Control/Coordination Co-Design (MicroC3)	Raleigh, NC	$4,828,980

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OPEN 2021	Northeastern University	High-Performance and Miniature Greenhouse Gas Sensor for Drone-based Remote Sensing	Boston, MA	$2,141,022
OPEN 2021	Oak Ridge National Laboratory (ORNL)	Precipitation Strengthened Ni-Based Alloys for Liquid Salt Containment and Transport in Energy Systems	Oak Ridge, TN	$2,400,000
OPEN 2021	Pacific Northwest National Laboratory	Autonomous Intelligent Assistant (AutonomIA): Resilient and Energy-Efficient City-wide Transportation Operations	Richland, WA	$4,242,075
OPEN 2021	Palo Alto Research Center (PARC)	CACTUS: CO_2 Aerogel Capture Towards Utilization and Sequestration	Palo Alto, CA	$2,090,000
OPEN 2021	Parallel Systems	Transformative Rail Architecture to Decarbonize Freight	Culver City, CA	$4,438,897
OPEN 2021	Perlumi Chemicals	Novel Biological Carbon Fixation Pathway to Increase Plant Yield	Berkeley, CA	$1,487,064
OPEN 2021	Polymath Research	Longer Wavelength Lasers for Inertial Fusion Energy with Laser-Plasma Instability Control: Machine Learning Optimum Spike Trains of Uneven Duration and Delay (STUD Pulses)	Pleasanton, CA	$2,012,032
OPEN 2021	Pratt & Whitney	Hydrogen Steam and Inter-Cooled Turbine Engine (HySITE)	East Hartford, CT	$3,822,026
OPEN 2021	Precision Combustion (PCI)	Additively Manufactured Electrochemical-Chip Based Scalable Solid Oxide Fuel Cells	North Haven, CT	$1,540,224
OPEN 2021	Princeton University	Economical Proton-Boron11 Fusion	Princeton, NJ	$1,499,953
OPEN 2021	Rio Tinto Services	Assessment of the CO_2 Mineralization Potential of Tamarack's Ultramafic Bowl-Shaped Intrusion	Tamarack, MN	$2,222,203
OPEN 2021	Siemens	PICo-Design: Protection-Inverter Co-Design for 100% Renewable Power Systems	Princeton, NJ	$4,000,000
OPEN 2021	SixPoint Materials	Vertical GaN Photoconductive Semiconductor Switch for HVDC Breakers	Buellton, CA	$1,782,000

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OPEN 2021	Stanford University	Additive Manufacturing of Amorphous Metal Soft Magnetic Composites	Stanford, CA	$1,900,000
OPEN 2021	Sublime Systems	Electrochemical Upcycling for Low-CO_2 Materials Production	Somerville, MA	$3,596,590
OPEN 2021	Synteris	Breaking the Board: Bringing 3-Dimensional Packaging and Thermal Management to Power Electronics	Baltimore, MD	$2,746,501
OPEN 2021	Texas Tech University	Semiconductor Fast Neutron Detectors	Lubbock, TX	$1,789,998
OPEN 2021	The Ohio State University	Vehicle Traction Electric Machines Enabled by Novel Composite Magnetic Powder Material and Electrophoretic Deposition Insulation Material	Columbus, OH	$2,405,076
OPEN 2021	University of California, Berkeley (UC Berkeley)	Ultra-Light-weight Bidirectional DC-DC Converters for Electric Aircrafts	Berkeley, CA	$1,195,345
OPEN 2021	University of California, Berkeley (UC Berkeley)	Integrated System for Electromicrobial Production of Butanol from Air-Captured CO_2	Berkeley, CA	$1,953,397
OPEN 2021	University of California, Berkeley (UC Berkeley)	Mesh Network of Soil Sensors for Greenhouse Gas Monitoring of Biofuel Agriculture	Berkeley, CA	$2,148,991
OPEN 2021	University of California, Los Angeles (UCLA)	AMENDER: Seawater Mediated Electrochemical Carbon Dioxide Removal	Los Angeles, CA	$1,000,000
OPEN 2021	University of California, Santa Barbara (UC Santa Barbara)	Quantifying the Potential and Risks of Large-scale Macroalgae Cultivation and Purposeful Sequestration as a Viable CO_2 Reduction (CDR) Strategy	Santa Barbara, CA	$2,897,686
OPEN 2021	University of Delaware (UD)	Energy Efficient Manufacturing of Lightweight Composite Architected Structures for Transportation Vehicles	Newark, DE	$2,500,000
OPEN 2021	University of Houston	Mini-PulPS: Miniaturized Pulsed Power Systems for Mission Critical Applications	Houston, TX	$965,028
OPEN 2021	University of Houston	Lithium- and Transition Metal-Free High-Energy Fast-Charging Batteries	Houston, TX	$3,400,000

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OPEN 2021	University of Illinois, Urbana-Champaign (UIUC)	Green Light Emitting Diodes for the Ultimate Solid-State Lighting	Champaign, IL	$750,000
OPEN 2021	University of Illinois, Urbana-Champaign (UIUC)	Ultra-Efficient and Ultra-Rapid Electro-Thermal Pulse Deicing, Defrosting, and Desnowing for Renewable Energy and Electrified Aircraft Systems	Champaign, IL	$3,000,000
OPEN 2021	University of Maryland (UMD)	Fast Charging, Solid-State, Roll-to-Roll Processed Li Metal Batteries Enabled by Intercalated Ions in Cellulose Molecular Channels	College Park, MD	$2,600,000
OPEN 2021	University of Michigan	Battery Separator for Completely Stopping Dendrite	Ann Arbor, MI	$950,000
OPEN 2021	University of Tennessee, Knoxville (UT)	Microfluidic Alpha Spectrometer for Materials Accountancy and Control in Liquid-Fueled Molten Salt Reactors	Knoxville, TN	$2,418,576
OPEN 2021	University of Washington (UW)	Harvesting Infrared Light to Improve Photosynthetic Biomass Production	Seattle, WA	$1,347,122
OPEN 2021	VEIR	High Current 10kV DC Superconducting Transmission Lines and Grid Architecture	Woburn, MA	$3,332,942
OPEN 2021	Virginia Polytechnic Institute and State University (Virginia Tech)	Substation in a Cable for Adaptable, Low-cost Electrical Distribution (SCALED)	Blacksburg, VA	$2,938,389
REMEDY	Advanced Cooling Technologies	Swiss-roll Flare Gas Incinerator	Lancaster, PA	$3,300,000
REMEDY	Cimarron Energy	Flare and Control for Ultra High Destruction and Removal Efficiency	Houston, TX	$1,000,000
REMEDY	Colorado State University (CSU)	Lean-burn Natural Gas Engine System to Achieve Near-zero Crankcase Methane Emissions from Existing and Future Engine Fleet	Fort Collins, CO	$1,500,000
REMEDY	INNIO Waukesha Gas Engines	Ultra Low Methane Slip Reciprocating Engine	Waukesha, WI	$2,230,693
REMEDY	Johnson Matthey	Catalytic Oxidation of Ventilation Air Methane	Audubon, PA	$4,346,015
REMEDY	MAHLE Powertrain	Methane Oxidation Catalysts for Lean-burn Natural Gas Engines	Plymouth, MI	$3,257,089

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REMEDY	Marquette University	Prechamber Enabled Mixing Controlled Combustion of Natural Gas for Ultra-Low Methane Emissions from Lean-Burn Engines	Milwaukee, WI	$3,975,058
REMEDY	Massachusetts Institute of Technology (MIT)	Ventilation Air Methane Abatement via Catalytic Oxidation (VAMCO) with Machine-Learning Enhanced Sensing and Feedback Controls	Cambridge, MA	$2,020,903
REMEDY	Precision Combustion (PCI)	Destruction of VAM Using a Modular Catalytic Element System	North Haven, CT	$3,720,317
REMEDY	Texas A&M University	Reducing Emission of Methane through Advanced Radical Kinetics and Adaptive Burning in Large Engines (REMARKABLE)	College Station, TX	$2,824,814
REMEDY	University of Michigan	REMEDY using SABRE (Reducing Emissions of Methane Every Day of the Year using Systems of Advanced Burners for Reduction of Emissions)	Ann Arbor, MI	$2,881,762
REMEDY	University of Minnesota (UMN)	Plasma-assisted In-situ Reforming of Flare Gases to Achieve Near-Zero Methane Emissions	Minneapolis, MN	$2,141,876
Solicitation on Topics Informing New Program Areas (Topic U: SF_6 FREE)	General Electric (GE) Grid Solutions	Development of an Eco-friendly Outdoor HVAC Power Circuit Breaker to Reduce Dependence on SF_6 Technology in the U.S. Electrical Grid	Charleroi, PA	$2,259,041
Solicitation on Topics Informing New Program Areas (Topic U: SF_6 FREE)	Georgia Tech Research Corporation	TESLA: Tough and Ecological Supercritical Line Breaker for AC	Atlanta, GA	$3,428,827
Solicitation on Topics Informing New Program Areas (Topic U: SF_6 FREE)	Toshiba International Corporation	Novel Approaches Toward Improved Thermal Interruption Performance of CO_2+O_2 Natural Origin Gas Mixtures for Replacement of SF_6 in High Voltage Equipment	Houston, TX	$990,713

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Solicitation on Topics Informing New Program Areas (Topic U: SF_6 FREE)	University of Connecticut	Detection and Fixation - A Lifecycle-management Framework Towards an SF_6-Free Green Power Network	Storrs, CT	$2,734,381
Solicitation on Topics Informing New Program Areas (Topic V: Carbon Negative Building Materials)	University of California, Davis (UC Davis)	Carbon-Negative Buildings Assessment and Tool (CaNBAT)	Davis, CA	$1,500,000
Solicitation on Topics Informing New Program Areas (Topic V: Carbon Negative Building Materials)	University of Washington (UW)	Parametric Open Data for Life Cycle Assessment	Seattle, WA	$3,744,303
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Advanced Ionics	Simplified Steam Electrolysis: Hydrogen for Hard-to-Abate Industries	Milwaukee, WI	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Artimus Robotics	Low-cost Electronics for Pressure-Agnostic Actuators Driving Bio-Inspired Vehicles for Deep Sea Mining	Boulder, CO	$200,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	AtmosZero	Heat Pump to Decarbonize Industrial Steam	Fort Collins, CO	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Captura	Development of Thin Film Composite Hollow Fiber Membranes for Direct Ocean Capture	Pasadena, CA	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Enegis	Ambient Seismic Imaging Technology for Low Cost and Effective Geothermal Resource Exploration, Development, and Management	Bend, OR	$499,997

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Solicitation on Topics Informing New Program Areas (Topic W: SEED)	GaNify	High-Performance and Manufacturable Medium Voltage Power Diodes	State College, PA	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Gencores	Digital and Cost-Efficient Production of Hybrid Polymethacrylimide Foam Cores for Radical Lightweighting of Light-Duty Vehicles	Somerville, MA	$494,015
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Heimdal	Improving Ocean CO_2 Capture with Bipolar Membrane Electrodialysis of Seawater	Kailua-Kona, HI	$498,208
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Impact Cooling	High Density Cooling System for Ultra-Low PUE Data Centers	Fort Collins, CO	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Inlyte Energy	The Salt and Iron Path to Renewables Integration	Berkeley, CA	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Invizyne Technologies	Simplifying Reactor Setup for Cell-Free Biofuel Production	Los Angeles, CA	$496,177
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Media and Process Technology (MPT)	Supercritical Fluid Based Wet Substrate Dewatering without Evaporation	Pittsburgh, PA	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Metalx Biocycle	Synthetic Biology Approach to Critical Metal Extraction from Waste Electronic Components to Ensure a Robust Supply of Critical Materials for Clean Energy	El Paso, TX	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Molten Industries	Biogas to Renewable Fuels via Thermal Reforming	Stanford, CA	$499,866

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Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Osmoses	Efficient Recovery of Dilute Helium Gas Using Molecular Sieve Membranes	Cambridge, MA	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	pH Matter	Type V Vessel-Aided Electrochemical Compression for Ultra-High-Pressure Electrolysis	Columbus, OH	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Stoicheia	Discovery Platform for Low-Ir Anode Catalysts in PEM Electrolyzers	Skokie, IL	$495,528
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Sylvatex	Breakthrough Process to Manufacture Very Low-cost LFP Cathode for Li-ion Batteries	San Francisco, CA	$500,000
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Verne	Decoupling High-Density Hydrogen from the Liquid Hydrogen Infrastructure: Catalyst-Filled Heat Exchangers for Modular Cryo-Compressors	San Francisco, CA	$499,684
Solicitation on Topics Informing New Program Areas (Topic W: SEED)	Zephyr Innovations	Air Conditioning via Liquid Desiccant Dehumidification	Somerville, MA	$499,611