

# Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR)

## Energy Independence and Security Act

### Annual Report

Fiscal Year 2018



Pursuant to the Energy Independence and Security Act of 2007 (Pub. L. No. 110-140) and Policy Directives issued by the SBA, Agencies must give high priority to small business concerns that participate in or conduct energy efficiency or renewable energy system R/R&D projects. Section 9(z) of the Small Business Act, 15 U.S.C. §638(z) requires that the annual report include a determination of whether the following priority described is being carried out: (A) ensure that such departments and agencies give high priority to small business concerns that participate in or conduct energy efficiency or renewable energy system research and development projects; and (B) include in the annual report to Congress under subsection (b)(7) a determination of whether the priority described in subparagraph (A) is being carried out.

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## FY18 Agency Compliance with the Energy Independence and Security Act of 2007 (EISA)

The Small Business Act, 15 U.S.C. §638(z), requires that the annual report include a determination of whether the priority described below is being carried out:

(A) ensure that such departments and agencies give high priority to small business concerns that participate in or conduct energy efficiency or renewable energy system research and development projects; and

(B) include in the annual report to Congress under subsection (b)(7) a determination of whether the priority described in subparagraph (A) is being carried out.

Pursuant to the Energy Independence and Security Act of 2007 (Pub. L. No. 110-140) and Policy Directives issued by the SBA, Agencies must give high priority to small business concerns that participate in or conduct energy efficiency or renewable energy system R/R&D projects. Agencies utilize a variety of approaches to comply with EISA and the Policy Directives. For some, such as the Department of Energy (DOE), these efforts are engrained in the Agency mission and therefore easy to assess in very tangible ways. Mechanisms commonly used by Agencies – aside from specifically adding energy related topics in solicitations – include adding that solicitation proposals address any energy efficiency or renewable energy aspects related to the small businesses’ technological approach, delivery or technological applicability and often provide such proposals a competitive advantage in the award selection process. Cross-Agency collaborations, outreach efforts, and other initiatives also become critical to assessing the collective achievements of the program rather than focusing on individual Agency performance. Each Agency’s Annual Report addresses EISA compliance by including: examples of SBIR/STTR projects related to energy efficiency or renewable energy; procedures and mechanisms used during the reporting fiscal year to give priority to energy efficiency and renewable energy projects in SBIR/STTR; and, specific actions taken to promote and support energy efficiency and renewable energy research projects.

This report is a compilation of all the Agencies’ FY18 efforts to comply with the Energy Independence and Security Act of 2007 (EISA).

## Department of Agriculture (USDA)

Examples of USDA SBIR Phase I awarded projects that contained Energy Efficiency and Alternative and Renewable Energy technologies are listed in the following table:

Award Title	USDA SBIR Phase I Awardee
On Demand Nitrate Production for Fertilizers	Luna Innovations Inc.
On-Farm Conversion of Solar Energy, Water, and Carbon Dioxide to Hydrocarbon Fuel	Giner, Inc.

The USDA SBIR program issues a request for application or program solicitation each fiscal year that lists 10 broad topic areas that encompass the full range of research and development priorities for USDA. From the beginning of the USDA SBIR program, topic areas have been discipline-specific, not technology specific. The 10 topic areas contained in the program solicitation are: Forests and Related Resources; Plant Production and Protection – Biology; Animal Production and Protection; Air, Water and Soils; Food Science and Nutrition; Rural and Community Development; Aquaculture; Biofuels and Biobased Products; Small and Mid-Size Farms; and Plant Production and Protection – Engineering. All of these technology areas have been supported and will continue to be supported.

The USDA SBIR Phase I and II Program Solicitation contains the following statement.

### **Energy Efficiency and Alternative and Renewable Energy**

In an effort to find alternatives to fossil fuels and to reduce overall energy usage, the USDA established research on energy efficiency and alternative and renewable energy as a high priority. Such research includes development of new energy crops, improved methods for producing biofuels, such as ethanol, butanol and biodiesel, producing hydrogen and other fuel gases from agricultural waste, and more efficient use of energy in agricultural production and in rural communities. Energy issues impact all aspects of agriculture and rural development and thus applications dealing with energy efficiency and alternative and renewable energy could be submitted to any of the topic areas.

## Department of Commerce (DOC)

### *National Institutes of Standards and Technology (NIST)*

In developing topics and subtopics and when reviewing applications, NIST gives high priority to small business concerns that participate in or conduct energy efficiency or renewable energy system R&D projects, consistent with Executive Order (EO) 13329 (<http://www.gpo.gov/fdsys/pkg/FR-2004-02-26/pdf/04-4436.pdf>) "Encouraging Innovation in Manufacturing," the Energy Independence and Security Act of 2007 (P.L. 110-140 § 1203(e), codified at 15 U.S.C. § 638(z)), and the Small Business Administration (SBA) SBIR Policy Directive, § 9, found at [http://www.sbir.gov/sites/default/files/sbir\\_pd\\_with\\_1-8-14\\_amendments\\_2-24-14.pdf](http://www.sbir.gov/sites/default/files/sbir_pd_with_1-8-14_amendments_2-24-14.pdf).

Standards for the Smart Grid, energy efficient lighting, photovoltaics, net-zero-energy buildings, and software for "smart" building are examples of **NIST** research areas related to energy use and conservation. NIST develops the testing, measurements, and reference materials needed to ensure the quality of energy related products and services and ensure fairness in the marketplace.

Award Title	NIST SBIR Phase II Awardee
Self-Configuring Residential Conditioned Air Zoning System for Low Energy Homes	Steven Winter Associates, Inc.

### *National Oceanic and Atmospheric Administration (NOAA)*

For FY2018, there were two SBIR Phase I awards in which the project (or its component) is related to energy efficiency or renewable energy.

Award Title	NOAA SBIR Phase I Awardee
Clean Energy from Air-Sea Temperature Differences	Seatrec, Inc.
Clean Energy Source to Power NOAA Long-term Observation and Monitoring Networks	Creare LLC

In addition and in order to promote energy efficiency or renewable energy in SBIR funded projects, NOAA utilizes them as tie-breakers during the evaluation of proposal. Per the FY2018 SBIR Phase I Solicitation (Page 36, Section 4.3), *"In the event of a "tie" between proposals, manufacturing-related projects as well as those regarding energy efficiency and renewable energy systems will receive priority in the award selection process."*

## Department of Defense (DOD)

### *Procedures and Mechanisms Used to Give Priority to Energy-Related Projects*

DoD employs a multitude of procedures and mechanisms to give priority to energy-related projects. DoD SBIR/STTR releases three solicitations per year and included in these solicitations are topics related to and promoting energy efficiency and renewable energy. Components include Energy and Power Technology focus areas, as well as, Power and Directed Energy focus areas as part of SBIR/STTR solicitations.

### *Actions Taken Toward Promoting and Supporting Energy Efficiency and Renewable Energy Projects*

DoD SBIR/STTR participating components promote energy efficiency and renewable energy projects through information sharing and networking via component specific websites. These websites bring together the small business community, researchers, Programs of Record, and prime contractors for possible collaboration for new and ongoing SBIR/STTR projects. Another successful method for promoting energy efficiency and renewable energy projects is through collaboration with various stakeholders. These groups provide unique insights into alternative fuels, energy efficiency, and power generation as they relate to reducing logistic requirements and meeting Army and DoD goals.

Components also track and report SBIR/STTR success stories through these same websites, as well as brochures such as the Army Commercialization Brochure. These brochures are an excellent opportunity for organizations and small businesses to share information about their SBIR/STTR projects and the success of their projects. These brochures are typically distributed at conferences providing exposure to these exceptional SBIR/STTR projects.

Additional component specific examples of actions taken toward promoting and supporting energy efficiency and renewable energy are found below:

- a. The Defense Advanced Research Projects Agency (DARPA) recently continues to use the Materials for Transduction (MATRIX) program to develop new transductional materials, reducing significant size, weight, and power (SWAP) for military devices and systems. MATRIX takes a systems approach that integrates state-of-the-art materials science, predictive modeling methods, and domain-specific expertise to rapidly validate and optimize new functional architectures that offer transformative defense-related capabilities. Potential applications include:
  1. Thermoelectrics – Energy transfer, thermal management, and refrigeration
  2. Multiferroics – Enhanced sensors, actuation, micro-power generation, tunable RF and microwave field engineering
  3. Phase-Change Materials – Fast switching and sensor application
- b. The Missile Defense Agency (MDA) SBIR/STTR programs, in support of the Ballistic Missile Defense System, continue to explore new ways for promoting and facilitating energy efficiency and renewable energy products. Examples of MDA SBIR/STTR projects related to energy include long-term electronics power sources, advanced reserve battery technologies, lithium oxyhalide battery separator material, low-cost green propellant, and green monopropellant thruster technology maturation.

- c. The Army SBIR program is collaborating with the National Defense Center for Energy and Environment (NDCEE) to encourage continued research efforts for promising SBIR projects in the areas of the environment, safety and occupational health, and energy performance and efficiency. The programs are sharing information about applicable SBIR activities and encourage transition activities with the NDCEE. The Army has an ongoing Phase II Enhancement/Commercialization Readiness Program (CRP) project co-funded by the Army SBIR program and the NDCEE for a Sulfur-Tolerant Solid Oxide Fuel Cell Stack effort sponsored by the Army's Tank Automotive Research, Development, and Engineering Center (TARDEC).

## Education Department (ED)

### *Examples of ED SBIR and STTR projects related to Energy Efficiency and Renewable Energy*

The ED SBIR Program uses a contracts mechanism to provide up to \$1,100,000 in funding (\$200,000 for Phase I; \$900,000 for Phase II) to small business firms and partners for the research and development (R&D) of commercially viable education technology products for use by students and teachers in education and in special education settings.

At ED SBIR in FY2018, the program topic areas permitted proposals for the development of products to promote student learning and teacher instruction in areas of STEM, which includes energy efficiency and renewable energy. In FY2018, several proposals focused on science projects related to energy efficiency and renewable energy.

Within the ED SBIR portfolio, examples of projects directly focusing on student learning in the area of energy efficiency and renewable energy systems are as follows:

With a 2015 Phase II award that concluded in 2018, Strange Loop Games developed Eco, a multi-player game to teach ecology and prepare middle schools students to be environmentally literate citizens, including learning about energy. To play the game, students enter a shared online world featuring a simulated ecosystem of plants and animals. Students co-create a civilization by measuring, modeling, and analyzing the underlying ecosystem. Students advocate for proposed plans to classmates and make decisions as a group. Cooperation and science-based decision making activities occur in order to prevent the destruction of the environment. The game includes teacher resources to support the alignment of game play to learning goals, and implementation.

### *Procedures and mechanisms ED used during the reporting fiscal year to give priority in the SBIR/STTR programs to Energy Efficiency and Renewable Energy projects*

At ED/IES SBIR in FY2018, the program topic areas permitted proposals for the development of products to promote student learning and teacher instruction in areas of STEM, which includes energy efficiency and renewable energy. Several proposals focused on science projects related to energy efficiency and renewable energy. The ED SBIR program will continue to consult with SBA and the other Federal SBIR programs regarding how to best give priority to energy efficiency and renewable energy.

Specific actions ED SBIR agency has taken to promote and support energy efficiency and renewable energy research projects include:

- 1) The ED SBIR program supports energy efficiency and renewable energy within priorities and topics in solicitations.
- 2) The ED SBIR program promotes energy efficiency and renewable energy initiatives at conferences and meetings.
- 3) The ED SBIR program tracks and report success stories demonstrating the impact of the SBIR programs on energy-related projects.
- 4) The ED SBIR program will consider new or additional initiatives/efforts to coordinate with other programs that support energy efficiency and renewable energy.



## Department of Energy (DOE)

### Examples of DOE SBIR and STTR projects related to Energy Efficiency and Renewable Energy

Topic Title	Subtopic Title	Grantee	Project Title
6. ADVANCED MANUFACTURING I	a. Intelligent Systems for Materials Design and Discovery	Accustrata, Inc., 11900 Parklawn Dr. Suite 203, Rockville, MD 20852-2669	Combinatorial Discovery of Heterogeneous Catalysts Utilizing Emission Spectroscopy and Advanced Machine Learning
6. ADVANCED MANUFACTURING I	b. Novel Energy-Efficient Dewatering Methods for Cellulosic Nanomaterials	Faraday Technology, Inc., 315 Huls Drive, Englewood, OH 45315-8983	Electro-dewatering of Cellulosic Nanomaterials
6. ADVANCED MANUFACTURING I	Novel Energy-Efficient Dewatering Methods for Cellulosic Nanomaterials	Physical Optics Corporation, 1845 West 205th Street, Torrance, CA 90501-1510	Dielectrophoretic Enhancement of Dewatering
6. ADVANCED MANUFACTURING I	b. Novel Energy-Efficient Dewatering Methods for Cellulosic Nanomaterials	TDA Research, Inc., 12345 W. 52nd Ave., Wheat Ridge, CO 80033-1916	A New Process for Energy-efficient Dewatering Methods for Cellulosic Nanomaterials
6. ADVANCED MANUFACTURING I	c. Thermal Process Intensification for Productivity Improvements	3D Array Technology LLC, 1392 STORRS RD. ATL R102, Storrs, CT 06269-4213	Microwave irradiation intensified process for scalable functional device assembly
6. ADVANCED MANUFACTURING I	c. Thermal Process Intensification for Productivity Improvements	Boston Electrometallurgical Corporation, 6 C Gill St., Woburn, MA 01801-1721	Energy-Saving Process for Extraction of Vanadium
6. ADVANCED MANUFACTURING I	c. Thermal Process Intensification for Productivity Improvements	Compact Membrane Systems, Inc., 335 Water Street, Newport, DE 19804-2410	18.08 Integrated Membrane Reactor for Enhancing Thermal & Chemical Reactors
6. ADVANCED MANUFACTURING I	c. Thermal Process Intensification for Productivity Improvements	Sep-All LLC, 3115 Almond Road, Ames, IA 50014-4624	Low-heat process for the production of high-value micro- and nano-materials from metallic wastes
6. ADVANCED MANUFACTURING I	d. TECHNOLOGY TRANSFER OPPORTUNITY: Process for the Synthesis of Precision Nanoparticles	Voxel, Inc., 15985 NW Schendel Avenue Suite 200, Beaverton, OR 97006-6703	Precision Nanoparticles for High Performance Devices
7. ADVANCED MANUFACTURING II: ATOMICALLY PRECISE MANUFACTURING	a. Molecular Machine Advances	Covalent, 4616 W. Sahara Avenue, Suite 562, Las Vegas, NV 89102-3654	High Yield, Atomically Precise Chemical Activation

8. BIOENERGY	Biofuels and Bioproducts from Wet Organic Waste Streams at Relevant Scales	Emergy LLC, 9700 Cass Ave Bldg 362, Lemont, IL 60439-4815	8a, Industrial Process Optimization of High-Value Byproducts from Novel Fungi-Based Food and Beverage Wastewater Treatment Technology
8. BIOENERGY	a. Biofuels and Bioproducts from Wet Organic Waste Streams at Relevant Scales	Media and Process Technology Inc, 1155 William Pitt Way, Pittsburgh, PA 15238-1368	Ceramic Membrane Enhanced Two-Stage Hydrothermal Liquefaction for Simultaneous Biofuels and Biochemicals from Liquid Wastes
8. BIOENERGY	a. Biofuels and Bioproducts from Wet Organic Waste Streams at Relevant Scales	SarTec Corporation, 617 Pierce Street, Anoka, MN 55303-1601	8a. Hydrothermal Catalysis to Flow Process Brown Grease into Biofuels and Biochemicals
8. BIOENERGY	a. Biofuels and Bioproducts from Wet Organic Waste Streams at Relevant Scales	TDA Research, Inc., 12345 W. 52nd Ave., Wheat Ridge, CO 80033-1916	Highly Efficient Modular Anaerobic Membrane Bioreactor (AnMBR) for Biofuel Production from Wet Organic Waste Streams
8. BIOENERGY	b. Rewiring Biomass Conversion: Novel Strategies to Substantially Enhance Biomass Carbon Conversion Efficiency	Bio-Missions LLC, 7666 Deer Park Way, Reynoldsburg, OH 43068-9708	An integrated process for butanol production from cellulosic biomass and CO <sub>2</sub> using engineered clostridia in a linear immobilized bioreactor
8. BIOENERGY	b. Rewiring Biomass Conversion: Novel Strategies to Substantially Enhance Biomass Carbon Conversion Efficiency	Faraday Technology, Inc., 315 Huls Drive, Englewood, OH 45315-8983	8b: Scaling Bioelectrochemical Biomass Conversion Technologies
8. BIOENERGY	b. Rewiring Biomass Conversion: Novel Strategies to Substantially Enhance Biomass Carbon Conversion Efficiency	Industrial Microbes, Inc., 1250 45th St Ste 330, Emeryville, CA 94608-2924	8B. High-Efficiency Conversion of Biomass into Chemicals using Fermentation and Electroreduction
8. BIOENERGY	b. Rewiring Biomass Conversion: Novel Strategies to Substantially Enhance Biomass Carbon Conversion Efficiency	Lygos, 1248 Eighth St, Berkeley, CA 94710-1413	Two-phase production of an organic acid with CO <sub>2</sub> sequestration
8. BIOENERGY	c. Algae Breeding	Global Algae Innovations, Inc., 4473 Pahee St, Suite T, Lihue, HI 96766-2037	Development of the breeding strategies for <i>Nitzschia</i> sp.
8. BIOENERGY	c. Algae Breeding	Global Algae Innovations, Inc., 4473 Pahee St, Suite T, Lihue, HI 96766-2037	Development of a breeding system in <i>Chlamydomonas moewusii</i> for improved production strains

8. BIOENERGY	d. Solid-Liquid Separations for Algal Systems	Global Algae Innovations, Inc., 4473 Pahee St, Suite T, Lihue, HI 96766-2037	Zobi® based processes for ultra-low energy algal harvesting and dewatering
8. BIOENERGY	d. Solid-Liquid Separations for Algal Systems	Molecule Works Inc., 2447 Robertson drive, Richland, WA 99354-5310	Concentration and dewatering of micro-algal cultures with high throughput ceramic/metal membranes
9. BUILDINGS	a. Innovations in Opaque Building Envelope Performance	Ashwin-ushas Corporation, 9 Red Coach Ln, Holmdel, NJ 07733-1138	Electrochromic Auto-Darkening Windows for Buildings for Energy Conservation Based on Unique Conducting Polymers and Already Demonstrated in Sunglasses
9. BUILDINGS	a. Innovations in Opaque Building Envelope Performance	EA Membranes LLC, 2021 Harwyn Rd, Wilmington, DE 19810-3870	Topic 9a: Adaptive Weather Resistant Barrier for Building Envelopes to Control Moisture Ingression and Increase Energy Efficiency
9. BUILDINGS	a. Innovations in Opaque Building Envelope Performance	Inventwood LLC., 7014 Hunter Ln, Hyattsville, MD 20782-1149	Lightweight and Thermally Insulating Nanowood
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	InnoSense LLC, 2531 West 237th Street Suite 127, Torrance, CA 90505-5245	Nanomaterials-Enabled Transparent Conductive Film
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	OLEDWorks LLC, 1645 Lyell Ave Suite 140, Rochester, NY 14606-2331	Printed Anodes and Internal Extraction Layers on Flexible Glass to Create Cost Effective High Efficacy Bendable OLED Lighting Panels
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	Tetramer Technologies, L.L.C., 657 South Mechanic St., Pendleton, SC 29670-1808	Topic 9b Transparent Conductive Anodes for Solid-State Lighting
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	BuildSimHub Inc., 247 Eddie Lewis Dr., Wexford, PA 15090-1545	An Innovative Energy Model Development and Management System Using GIT
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	Energy Analytics LLC, 14 Brookview Circle, Canton, CT 06019-2027	M&V and EPC Process Automation
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	GARD Analytics, 1334 N Walnut Ave, Arlington Heights, IL 60004-4664	Simulating Buildings While the Design is Still in the Architect's Imagination
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	Golden Analytics LLC, 3411 Putnam St, Falls Church, VA 22042-3727	Building Energy Calibration based on Parameter Estimation and Machine Learning
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	Ladybug Tools LLC, 414 Water Street, Apt 2113, Baltimore, MD 21202-3273	CAD-Integrated Web-Based Building Performance Simulation Platform

9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	Maalka, New York, 335 Madison Ave, 4th Floor HUB, NY 10017-4675	Portfolio Level Energy-Efficiency Simulation (PLES) Platform
9. BUILDINGS	b. Transparent Conductive Anodes for Solid-State Lighting	Vistar Energy, 1641 Abilene Cir., Rocklin, CA 95765-5450	XeroHome – A Whole-Building Energy Modeling Based Targeting Tool for Residential Energy Retrofits
10. FUEL CELLS	a. Smart Tanks for Hydrogen Storage	ADA Technologies, Inc., 11149 Bradford Road, Littleton, CO 80127-4200	10a Thermally Conductive 700 bar Composite Tank for Hydrogen Storage
10. FUEL CELLS	a. Smart Tanks for Hydrogen Storage	Strategic Analysis, Inc., 4075 Wilson Blvd, Suite 200, Arlington, VA 22203-2141	Phase Change Material Subsystem for Temperature Reduction during Fast Fill
10. FUEL CELLS	a. Smart Tanks for Hydrogen Storage	TDA Research, Inc., 12345 W. 52nd Ave., Wheat Ridge, CO 80033-1916	Highly Efficient Smart Tanks for Hydrogen Storage
10. FUEL CELLS	c. Non-destructive Evaluation Technologies for Steels	Luna Innovations Incorporated, 301 1st Street SW, Suite 200, Roanoke, VA 24011-1921	10c: Detection of Micron-Scale Flaws Through Nonlinear Wave Mixing
11.GEOTHERMAL	a. TECHNOLOGY TRANSFER OPPORTUNITY: Low Enthalpy Geothermal Forward Osmosis	Porifera Inc., 1575 Alvarado St., San Leandro, CA 94577-2640	An Efficient PFO-SPS System for Concentration of Brines and Wastewater Using Low Enthalpy Geothermal Heat
11.GEOTHERMAL	b. Dispatchable Geothermal Operations	Mainstream Engineering Corporation, 200 Yellow Place, Rockledge, FL 32955-5327	Topic 11b: Thermal Energy Storage for Dispatchable Geothermal Power
11.GEOTHERMAL	b. Dispatchable Geothermal Operations	Tech4Imaging LLC, 4171 Fairfax Dr., Columbus, OH 43220-4524	Non-Invasive Operations Tool for Dispatchable Geothermal Wells
11.GEOTHERMAL	b. Dispatchable Geothermal Operations	TerraCOH Inc, 6125 Blue Circle Drive, Hopkins, MN 55343-9043	CO2 Plume Geothermal (CPG™) – Innovative, Dispatchable Geothermal Power Production Using Non-Water Working Fluids
12. SOLAR	a. TECHNOLOGY TRANSFER OPPORTUNITY: Devices and Methods for De-Energizing a Photovoltaic System	InnoSys, Inc., 2900 South Main Street, Salt Lake City, UT 84115-3516	Devices and Methods for De-Energizing a Photovoltaic System
12. SOLAR	b. Cybersecurity for Solar Energy Devices	Fend, LLC, 5885 6th St, Falls Church, VA 22041-2538	Low-Cost, Plug-and-Play Data Diodes for Solar Equipment Cybersecurity
12. SOLAR	b. Cybersecurity for Solar Energy Devices	Idaho Scientific, 199 N Capitol Blvd Suite 304, Boise, ID 83702-5964	Secure processor for solar generation and distribution equipment

12. SOLAR	b. Cybersecurity for Solar Energy Devices	Operant Solar, 52 Mission Circle STE 201, Santa Rosa , CA 95409-5371	Field Gateway Distributed Transaction Ledger for Utility-Scale Solar
12. SOLAR	b. Cybersecurity for Solar Energy Devices	Physical Optics Corporation, 1845 West 205th Street, Torrance, CA 90501-1510	12b. Intelligent Solar Energy Devices Cybersecurity System
12. SOLAR	b. Cybersecurity for Solar Energy Devices	Smart Information Flow Technologies, 319 1st Ave. North Suite 400, Minneapolis, MN 55401-1689	SolarGuard
12. SOLAR	c. Peer-to-peer Energy Transactions	Blake-Philips, 2413 Nashville Road, Suite 203 Box B4, Bowling Green, KY 42101-4101	Smart Meter Based Peer to Peer Transactions for Solar Energy Prosumers
12. SOLAR	c. Peer-to-peer Energy Transactions	ecoLong LLC, 42 Stonebriar Drive, Slingerland, NY 12159-3662	12c Advanced Peer to Peer Transactive Energy Platform with Predictive Optimization
12. SOLAR	c. Peer-to-peer Energy Transactions	Indiana Tool & Mfg. Co., Inc., 6100 Michigan Road, Plymouth, IN 46563-7798	SolarChain P2P: A Blockchain-based Transaction Platform for Distributed Solar Energy Trading
12. SOLAR	c. Peer-to-peer Energy Transactions	Intertie Incorporated, 2656 Bridgeway, Suite B, Sausalito, CA 94965-1400	Peer-to-Peer Transaction Software Platform that Maximizes Distributed Solar Value by Optimizing Power Flow between Storage, Electric Vehicles, Site & Grid
12. SOLAR	c. Peer-to-peer Energy Transactions	Introspective Systems LLC, 148 Middle St. Suite 1D, Portland, ME 04101-4123	A Fractal Graph Approach to Peer-to-Peer Energy Transactions
12. SOLAR	d. Research in Autonomous and Augmented Systems to Reduce Solar LCOE	Acme Express, Inc., 3821 Prospect Avenue, Cleveland, OH 44115-2758	Racking System for Commercial Solar Arrays
12. SOLAR	d. Research in Autonomous and Augmented Systems to Reduce Solar LCOE	Intelli-Products Inc., PO Box 18757, Asheville, NC 28814-0757	Fully-Automated PV Array Assembly System
12. SOLAR	d. Research in Autonomous and Augmented Systems to Reduce Solar LCOE	Sunvapor Inc, 2324 Second Street, Livermore, CA 94550-3254	Metrology-assisted robotic mirror alignment for parabolic trough collectors
13. VEHICLES	a. Electric Drive Vehicle Batteries	Beltech, 3440 S Dearborn St, Chicago, IL 60616-5074	Enable Dendrite-Free Lithium Anodes in High Energy Batteries for Electric Vehicles
13. VEHICLES	a. Electric Drive Vehicle Batteries	CAMX Power LLC, 35 Hartwell Avenue,	Low Cost 5V Spinel Cathode for Electric Vehicle Batteries with Enhanced Cycle Life

		Lexington, MA 02421-3102	
13. VEHICLES	a. Electric Drive Vehicle Batteries	Cuberg, Inc., 99 E. Middlefield Rd. #14, Mountain View, CA 94043-3833	High-Performance Electrolyte for Rechargeable Lithium Metal Batteries
13. VEHICLES	a. Electric Drive Vehicle Batteries	Glacigen Materials, Inc., 288 Pronghorn Trail Suite 2, Bozeman , MT 59718-7064	Low Tortuosity Electrodes Enabling High Specific Energy Li-Ion Batteries
13. VEHICLES	a. Electric Drive Vehicle Batteries	Navitas Advanced Solutions Group, LLC, 4880 Venture Drive, Ann Arbor, MI 48108-9959	High voltage lithium ion battery with improved life and safety
13. VEHICLES	a. Electric Drive Vehicle Batteries	TDA Research, Inc., 12345 W. 52nd Ave., Wheat Ridge, CO 80033-1916	Ionic Liquid-Nanoporous Polymer Hybrid Electrolyte Membranes for Vehicle Lithium Ion Batteries
13. VEHICLES	a. Electric Drive Vehicle Batteries	Triton Systems, Inc., 200 Turnpike Road, Chelmsford, MA 01824-0660	SEI Stabilization of Si Anodes via Conducting Polymer Encapsulation
13. VEHICLES	a. Electric Drive Vehicle Batteries	Xiletric, 151 Martine St ATMC RM 125-1, Fall River, MA 02723-1514	New Coulometry Technique for Li-ion Battery Durability Analysis
13. VEHICLES	b. Exploratory Low Cost Motor Designs for Electric Drive Vehicles	Magnetic Power-Motion, LLC, 4008 Doe Creek Dr., Floyds Knobs, IN 47119-9652	13b Low Cost, Power Dense, Axial Gap, Rare-Earth-Free PM Motor for Electric Drive Vehicles
13. VEHICLES	c. Research on Energy Efficiency in Emerging Mobility Systems	Traffic Worx LLC (dba Xtelligent), 525 S Hewitt St, Los Angeles, CA 90013-2217	Next Generation Intelligent Traffic Signals for the Multimodal, Shared, and Automated Future
14. WIND	b. Innovations in Utility-Scale Performance (1MW or larger)	Aquanis, Inc., 42 Ladd Street Suite 104, East Greenwich, RI 02818-4361	Development of a Wind Turbine Blade Surface Coating to Reduce Damage due to Lightning
14. WIND	c. Other	LCDrives Corp., 65 Main St Peyton Hall Box 21, Potsdam, NY 13676-4039	Novel medium speed wind turbine generator
15. WATER	a. Development of Environmentally-Acceptable Lubricants for Hydropower Applications	Polnox Corporation, 225 Stedman Street, Unit 23, Lowell, MA 01851-2792	Development of Environmentally Acceptable Lubricants for Hydropower Applications
15. WATER	a. Development of Environmentally-Acceptable Lubricants for Hydropower Applications	Tetramer Technologies, L.L.C., 657 South Mechanic St., Pendleton, SC 29670-1808	Topic 15a Biodegradable Lubricant from Esterified Propoxylated Glycerol

*Procedures and mechanisms DOE used during the reporting fiscal year to give priority in the SBIR/STTR programs to Energy Efficiency and Renewable Energy projects*

The Department of Energy has an Office of Energy Efficiency and Renewable Energy (EERE), <https://www.energy.gov/eere/office-energy-efficiency-renewable-energy>. The mission of EERE is to create and sustain American leadership in the transition to a global clean energy economy. Its vision is a strong and prosperous America powered by clean, affordable, and secure energy. The strategic goals of EERE to achieve its mission are provided below.

EERE aims to achieve the following strategic goals:

1. Accelerate the development and adoption of sustainable transportation technologies.  
*Through [improvements in engine efficiency](#), vehicle [weight reduction](#), [battery performance](#), drop-in biofuels, [fuel cell](#) performance, and reduced [biofuel](#) and [hydrogen](#) production costs, EERE can meet this goal. This includes supporting [advanced vehicles and alternative fuels](#).*
2. Increase the generation of electric power from renewable sources.  
*Through reducing the cost of [hydropower](#) and [solar](#), [wind](#), [wave](#) and [tidal](#), and [geothermal](#) power, EERE can increase renewable generation.*
3. Improve the energy efficiency of our homes, buildings, and industries.  
*EERE has set milestones for providing energy savings of 25%–50% by 2020–2030. By developing new materials, technologies and processes for American [homes](#), [buildings](#), and [industry](#), EERE will implement minimum [energy performance standards](#), improve [building energy codes](#), and support [home weatherization](#).*
4. Stimulate the growth of a thriving domestic clean energy manufacturing industry.  
*Through reducing the life-cycle energy consumption of EERE-targeted manufactured goods by 50% by 2025, EERE will encourage the manufacture of clean energy technologies in the United States.*
5. Enable the integration of clean energy into a reliable, resilient, and efficient electricity grid.  
*Through new [grid-support technologies](#), as well as standards, test procedures, sensors, communication protocols, cyber security, and resilience these technologies need, EERE can meet clean energy goals.*
6. Lead efforts to improve federal sustainability and implementation of clean energy solutions.  
*Through [EERE technical support to all federal agencies](#) and federal agency access to [third-party financing](#), EERE can help federal agencies to be early leaders in deploying clean energy.*
7. Enable a high-performing, results-driven culture through effective management approaches and processes. *Through enhancing and maintaining EERE's workforce and establishing clear plans to deliver on [EERE's mission](#), the organization will see a high-performing culture.*

## Department of Health and Human Services (HHS)

### *Examples of HHS SBIR and STTR projects related to Energy Efficiency and Renewable Energy*

In FY 2018, there were no new awards made that relate to energy efficiency or renewable energy.

### *Procedures and mechanisms HHS used during the reporting fiscal year to give priority in the SBIR/STTR programs to Energy Efficiency and Renewable Energy projects*

In direct response to the Independence and Security Act of 2007, HHS has, in previous years, developed targeted funding opportunity announcements (FOAs) focused on soliciting project ideas related to energy efficiency or renewable energy systems research and development (R&D). Presently, the most recent FOAs have expired in 2012. HHS may utilize this targeted approach in future years again as appropriate to encourage participation and application submission from small businesses in this important targeted area.

### *Specific actions HHS has taken to promote and support Energy Efficiency and Renewable Energy Research projects*

In addition to releasing targeted FOAs such as mentioned above, the HHS investigator-initiated funding model lends itself to receiving applications from the small business community throughout the year under NIH's annual Omnibus grant solicitations with several standard submission due dates. Under these solicitations, small business applicants can propose projects related to energy efficiency or renewable energy systems for Phase I, Phase II and Fast-Track options under the SBIR and STTR programs within the mission of HHS.



## Department of Homeland Security (DHS)

No special action was taken by DHS SBIR in this area.

## Department of Transportation (DOT)

There were no Phase I or Phase II Topics and Awards that address energy efficiency or renewable energy.

As part of the DOT's Call for Topics, DOT includes on the Topic Submission form a question asking if the project is related to energy efficiency or renewable energy and include the following statement: *SBIR agencies are encouraged to give high priority to small business concerns that participate in or conduct energy efficiency or renewable energy system R&D projects. This information is provided to SBA.*

## Environmental Protection Agency (EPA)

### *Examples of EPA SBIR and STTR projects related to Energy Efficiency and Renewable Energy*

In FY 2018, EPA awarded 17 new SBIR Phase I awards and 5 new Phase II awards. One Phase I award promote energy efficiency and renewable energy related initiatives under Pub. L. No. 110-140. This award (listed below) is for a technology that generates renewable energy and/or has improved energy efficiency over traditional technologies.

Award Title	EPA SBIR Phase I Awardee
A Green Rooftop System for Commercial Buildings with Superior Energy Efficiency	Ximax Technologies

### *Procedures and mechanisms EPA used during the reporting fiscal year to give priority in the SBIR/STTR programs to Energy Efficiency and Renewable Energy projects*

EPA's SBIR Program includes energy as an overall criterion in selecting which environmental technologies it funds because EPA cares about the lifecycle environmental impacts of the technology and energy demand and usage are major factors in the environmental impact of a technology.

Specific language from the FY 2018 Phase I solicitation addressing lifecycle and energy is as follows and is used repeatedly in outreach about the program:

*Proposals should also address the lifecycle environmental impacts of the technology, including (if applicable) minimizing resource use, minimizing toxicity of materials, efficient use of water and energy, minimizing pollution, and minimizing the impacts of disposal.*

### *Specific actions EPA has taken to promote and support Energy Efficiency and Renewable Energy Research projects*

EPA's SBIR program continues to emphasize energy efficiency and renewable energy related topics and priorities at national, regional and state SBIR conferences and includes energy efficiency and renewable energy as criteria for other topic areas including air and climate, water, and manufacturing. Emphasis has been placed on opportunities for small businesses to submit new technology proposals which emphasize energy efficiency (and therefore reduction of carbon emissions) in almost all topic areas in the EPA solicitation. This is emphasized as a way to demonstrate the lifecycle environmental benefits of the proposed technology.

## National Aeronautics and Space Administration (NASA)

### *Examples of NASA SBIR and/or STTR projects related to Energy Efficiency and Renewable Energy*

For FY 2018 NASA's SBIR/STTR program had specific subtopics that actively solicit for technology in energy generation and storage in the form of photovoltaics, advanced batteries, and nuclear technology, the topics include:

- A1.03 Low Emissions/Clean Power - Combustion Technology/Emissions Measurement Techniques
- A1.07 Electrified Aircraft Propulsion & Concepts
- A2.01 Flight Test and Measurement Technologies
- H1.01 Mars Atmosphere ISRU for Mission Consumables
- H4.01 Advanced Space Suit Portable Life Support System (PLSS)
- H5.01 Mars Surface Solar Array Structures
- H8.01 ISS Utilization and Microgravity Research
- S3.01 Power Generation and Conversion
- S3.03 Power Electronics and Management, and Energy Storage
- S4.04 Extreme Environments Technology
- Z1.03 Surface Power Generation
- Z8.01 Cubesat Propulsion Systems
- Z9.01 Small Launch Vehicle Technologies and Demonstrations
- T3.02 Intelligent/Autonomous Electrical Power Systems

Examples of Phase I awards made in FY 2018 from these subtopics include:

<b>Project Title</b>	<b>Contract Number</b>	<b>Firm Name</b>
TBC with High Temperature Phase Stability for Low Emission-High Efficiency Gas Turbine Engines	80NSSC18P1884	Thermatin Industries, LLC
Plasma-Assisted Active Combustion Control as an Enabling Technology for N+3 Combustors	80NSSC18P1885	FGC Plasma Solutions
Low Emission Lean Fully Premixed (LFP) Injector/Combustor Development	80NSSC18P1886	CFD Research Corporation
Advanced Rotor Coils for Conduction Cooled Superconducting Multi-Megawatt Motors for Aircraft Propulsion	80NSSC18P1896	Hyper Tech Research, Inc.
Less Iron and More Switches Increase Range	80NSSC18P1897	Continental Controls and Design
Integrated High Frequency Electric Propulsor for Turbo-Electric Aircraft	80NSSC18P1898	Hinetics, LLC
Bi2212 Superconductors for High-Power Density Motors for Aero Propulsion	80NSSC18P1899	Solid Material Solutions, LLC
An Early and In-Situ Cell Failure Detection and Reconditioning System for Lithium-Ion Batteries	80NSSC18P1905	X-wave Innovations, Inc.
Redox Tolerant Cathode for Solid Oxide Electrolysis Stacks	80NSSC18P1940	OxEon Energy, LLC
Safe, High Energy Batteries for Space Suits	80NSSC18P1959	Nohms Technologies

Webbed Solar Array	80NSSC18P1967	TentGuild Engineering Company
Articulating Solar Panel Energy System (ASPEN)	80NSSC18P1969	ROCCOR, LLC
ISS Electrospray Production of Photovoltaics	80NSSC18P1992	Nanosonic, Inc.
High Yield, High Efficiency Epitaxial Lift-Off Solar Cells for LLT Applications	80NSSC18P2065	MicroLink Devices, Inc.
5 Watt per Kilogram Tritium Betavoltaic	80NSSC18P2067	City Labs, Inc.
Lightweight and Affordable Solar Array System for NASA Solar Electric Propulsion Science Missions	80NSSC18P2068	Deployable Space Systems, Inc.
Compact High Efficiency GaN-based PPU	80NSSC18P2070	Busek Company, Inc.
Autonomous Modular Digital Controllers for Long Duration Space Flights	80NSSC18P2071	AK Circuit Corporation
High Thermally Conductive and Electrically Insulative Thermal Interface Materials	80NSSC18P2072	Skyhaven Systems, LLC
High Energy Density Lithium-Sulfur Battery with Improved Cycle Life	80NSSC18P2073	Giner, Inc.
Advanced High Frequency High Voltage Power Converter	80NSSC18P2074	QorTek, Inc.
High Temperature, High Energy Density and High Efficiency Capacitors for Aerospace Exploration	80NSSC18P2093	Powdermet, Inc.
Intelligent, Autonomous, Distributed Vehicle and Electrical Power System Management	80NSSC18P2129	Stottler Henke Associates, Inc.
Intelligent Power Source Reliability Monitoring and Failure Mitigation System	80NSSC18P2130	Alphacore, Inc.
Fission Stirling Converter	80NSSC18P2160	American Superconductor Corporation
Reduced Shielding, Rugged, Scalable-Electrical Power Converter for Fission-Power Systems	80NSSC18P2162	QorTek, Inc.
Modular Xenon Micro Electric Propulsion System	80NSSC18P2218	ExoTerra Resource, LLC
Modular Rocket Engine Electric Pumps	80NSSC18P2231	Florida Turbine Technologies, Inc.

In addition, the following Phase II awards were made:

<b>Project Title</b>	<b>Contract Number</b>	<b>Firm Name</b>
Low AC-Loss Superconducting Cable Technology for Electric Aircraft Propulsion	80NSSC18C0080	Hyper Tech Research, Inc.
A Software Toolkit to Accelerate Emission Predictions for Turboelectric/Hybrid Electric Aircraft Propulsion	80NSSC18C0159	Combustion Research and Flow Technology
Game-Changing Photovoltaic Flexible Blanket Solar Array Technology with Spectrolab Flexsheets	80NSSC18C0066	Deployable Space Systems, Inc.
Radiation Tolerant >35% Efficient Phosphide-Based Multi-Junction Solar Cells with Epitaxial Lift-Off	80NSSC18C0096	MicroLink Devices, Inc.

Cathode for Electric Space Propulsion Utilizing Iodine as Propellant	80NSSC18C0068	e-beam, Inc.
Iodine Hollow Cathode	80NSSC18C0108	Plasma Controls, LLC
GaN-Based High Power High Frequency Wide Range LLC Resonant Converter	80NSSC18C0125	SET Group, LLC
Lightweight High Energy Density Capacitors for NASA AMPS and PPU's	80NSSC18C0126	Sigma Technologies International, Inc.
Highly Efficient, Durable Regenerative Solid Oxide Stack	80NSSC18C0111	Precision Combustion, Inc.
Bifunctional Membrane for High Energy, Long Shelf Life Li-S Batteries	80NSSC18C0099	Navitas Advanced Solutions Group, LLC
Linear Acoustic Nuclear Conversion Engine (LANCE)	80NSSC18C0100	Nirvana Energy Systems, Inc.
Dynamically Reconfigurable Electrical Power System (EPS) with Integrated Thermal Management and High Voltage Capability for Small Spacecraft	80NSSC18C0182	QorTek, Inc.
Demonstration of Autonomous Differential Throttle-based Flight Control for Aircraft with Distributed Electric Propulsion	80NSSC18C0216	Empirical Systems Aerospace, Inc.
Distributed Electric Propulsion Aircraft Comprehensive Analysis and Design Tool	80NSSC18C0217	Continuum Dynamics, Inc.
Superconducting Coils for Small Nuclear Fusion Rocket Engines	80NSSC18C0218	Princeton Satellite Systems
Autonomous Power Controller for Mission Critical Microgrids	80NSSC18C0219	PC Krause and Associates, Inc.

*Procedures and mechanisms NASA used during the reporting fiscal year to give priority in the SBIR/STTR programs to Energy Efficiency and Renewable Energy projects*

NASA searches—via various wide-ranging research endeavors (including SBIR/STTR) — for novel concepts and technologies that provide advanced capabilities at ever improving levels of efficiency in missions and projects across all Mission Directorates. At the heart of NASA’s needs are advanced technologies for energy/power generation and storage – touching areas from photovoltaics, batteries, to nuclear technology for space exploration. NASA missions require maintaining power far from the Earth, for long periods of time, with no means of repair or refueling. Further, NASA technology must be resilient to survive the launch environment, as well as be light enough to be launched by existing launch vehicles.

Therefore, there is no special priority required for technology associated with energy efficiency, as it is a critical thrust to all of NASA's missions.

*Specific actions NASA has taken to promote and support Energy Efficiency and Renewable Energy Research projects*

There are a variety of NASA projects associated with renewable energy – projects associated with green aviation, environmental protection, clean energy, and sustainable systems. Information about these projects, in areas of biofuels, solar energy, and wind energy, can be found here: <http://www.nasa.gov/centers/ames/greenspace/index.html>. NASA's efforts in the area of energy innovation associated with responses to climate change can be found here: [http://climate.nasa.gov/energy\\_innovations](http://climate.nasa.gov/energy_innovations)

## National Science Foundation (NSF)

### *Examples of NSF SBIR and STTR projects related to Energy Efficiency and Renewable Energy*

The following tables lists several NSF SBIR/STTR Phase I/Phase II FY18 Renewable Energy and Energy Efficiency Related Project Examples:

Project Title	Contract Number	Firm Name
Air-breathing electrochemical devices for long-duration grid-scale energy storage	1819740	Form Energy, Inc. / dba Baseload Renewables, Inc.
Interface for connecting high temperature solar collectors to legacy thermal systems	1747222	Skyven Technologies, LLC

In addition, the following Phase II awards were made:

Project Title	Contract Number	Firm Name
HI-LIGHT - Solar Thermal Chemical Reactor Technology for Converting CO2 to Hydrocarbons	1831166	Dimensional Energy Inc.
High-Purity Extraction of PET from Textile Waste	1830987	Ambercycle, Inc.
Quantum Dot-Tinted Glass Luminescent Solar Concentrator Windows	1758697	UbiQD, Inc.
Electrochemical Acoustic Tools for the Analysis of Batteries	1831080	Feasible, Inc.

### *Procedures and mechanisms NSF used during the reporting fiscal year to give priority in the SBIR/STTR programs to Energy Efficiency and Renewable Energy projects*

Research in energy efficiency and renewable energy systems was a significant component of all of our FY2018 SBIR/STTR funding announcements, with specific energy-focused subtopics in the topics of Chemical Technologies, Electronic Hardware, Robotics and Wireless Technologies, Advanced Materials and Instrumentation, Advanced Manufacturing and Nanotechnology and Photonic Devices. We've also done outreach to many groups focused on the energy space, with one example being our attendance and participation at the 2018 ARPA-E Energy Innovation Summit.

### *Specific actions NSF has taken to promote and support Energy Efficiency and Renewable Energy Research projects*

The NSF's merit review process has two primary criteria. One of these is "broader impact," and the outcomes of almost all renewable energy and energy efficiency projects are well-aligned with this criterion. This important program criterion has resulted in the program funding a broad spectrum of energy efficiency and renewable energy projects without compromising the quality standards or technical criteria of the program. In FY2018, NSF SBIR/STTR supported 96 projects where energy efficiency and/or renewable energy were a major thrust of the proposal. These projects included awards focused on new technology in solar power, wind power, hydropower, biomass, renewable and bio-based fuels, vehicle light weighting, energy-efficient infrastructure, smart homes, industrial process energy efficiency, large-scale energy storage (via batteries and more exotic means) and energy efficiency in industrial settings.