U.S. DEPARTMENT OF ENERGY

Small Business Innovation Research (SBIR) and
Small Business Technology Transfer (STTR) Programs

Topics

FY 2014

Phase I Release 2

October 28, 2013

Participating DOE Research Programs

- ~~Office of Electricity Delivery and Energy Reliability~~
- **Office of Energy Efficiency and Renewable Energy**
- ~~Office of Fossil Energy~~
- ~~Office of Fusion Energy Sciences~~
- ~~Office of Nuclear Energy~~

Please Note: **the Following Important Date(s) pertain to these Topics and the FY 2014 SBIR/STTR Phase I Release 2 Funding Opportunity Announcement (FOA).**

· **Topics Released:**	October 28, 2013
· **FOA Issued:**	November 25, 2013
· **Letter of Intent Due Date:**	December 16, 2013
· **Application Due Date:**	February 4, 2014
· **Award Notification Date:**	Late April 2014*
· **Start of Grant Budget Period:**	Early June 2014*

***Preliminary Dates Subject to Change**

TECHNOLOGY TRANSFER OPPORTUNITIES

Selected Selected topic and subtopics contained in this document are designated as Technology Transfer Opportunities (TTOs). The questions and answers below will assist you in understanding how TTO topics and subtopics differ from our regular topics.

What is a Technology Transfer Opportunity?
A Technology Transfer Opportunity (TTO) is an opportunity to leverage technology that has been developed at a participating Research Institution, such as a university or DOE National Laboratory. Each TTO will be described in a particular subtopic and additional information may be obtained by using the link in the subtopic to the Research Institution that has developed the technology. Typically, the technology was developed with DOE funding for either basic or applied research and is available for transfer to the private sector. The level of technology maturity will vary and applicants are encouraged to contact the appropriate Research Institution prior to submitting an application.

How would I draft an appropriate project description for a TTO?
For Phase I, you would write a project plan that describes the research or development that you would perform to establish the feasibility of the TTO for a commercial application. The major difference from a regular subtopic is that you will be able to leverage the prior R&D carried out by the Research Institution and your project plan should reflect this.

Am I required to show I have a sub-award with the university or National Lab that developed the TTO in my grant application?
No. Your project plan should reflect the most fruitful path forward for developing the technology. In some cases, leveraging expertise or facilities of a Research Institution via a sub-award may help to accelerate the research or development effort. In those cases, the small business may wish to negotiate with the Research Institution to become a sub-awardee on the application.

Is the Research Institution required to become a sub-awardee if requested by the applicant?
No. Collaborations with a Research Institution must be negotiated between the applicant small business and the Research Institution. The ability of a Research Institution to act as a subcontractor may be affected by existing or anticipated commitments of the research staff and its facilities.

Are there patents associated with the TTO?
The TTO will be associated with one or in some cases multiple patent applications or issued patents.

If selected for award, what rights will I receive to the technology?
Those selected for award under a TTO subtopic, will be assigned rights to perform research and development of the technology during their Phase I or Phase II grants. Please note that these are NOT commercial rights which allow you to license, manufacture, or sell, but only rights to perform research and development.

In addition, TTO awardees will be provided with, at the start of their Phase I grant, a no-cost, six month option to license the technology. It will be the responsibility of the small business to demonstrate adequate progress towards commercialization and negotiate an extension to the option or convert the option to a license. A copy of an option agreement template will be available by the Research Institution that owns the TTO.

How many awards will be made to a TTO subtopic?
We anticipate making a maximum of one award per TTO subtopic. This will insure that an awardee is able to sign an option agreement that includes exclusive rights in its intended field of use. If we receive applications to a TTO that address different fields of use, it is possible that more than one award will be made per TTO.

How will applying for an SBIR or STTR grant associated with a TTO benefit me?
By leveraging prior research and patents from a participating Research Institution you will have a significant "head start" on bringing a new technology to market. To make greatest use of this advantage it will help for you to have prior knowledge of the application or market for the TTO.

Is the review and selection process for TTO topics different from other topics?
No. Your application will undergo the same review and selection process as other applications.

FAST-TRACK (COMBINED PHASE I AND PHASE II)

The following is a brief summary of Fast-Track applications. Please refer to the Funding Opportunity Announcement for more detailed information about submitting a Fast-Track application.

Fast-Track grants are opportunities to expedite the decision and award of SBIR and STTR Phase I and II funding for scientifically meritorious applications that have a high potential for commercialization. Fast-Track incorporates a submission and review process in which both Phase I and Phase II grant applications are combined into one application and submitted and reviewed together. The Project Narrative portion of a Fast-Track application must specify clear, measurable goals and milestones that should be achieved prior to initiating Phase II work. If these milestones are not met in Phase I, authorization to proceed to Phase II may not be provided and the grant will discontinue following Phase I efforts. The work proposed for Fast-Track, assuming that it proceeds, should be suitable in nature for subsequent progress to non-SBIR/STTR funding in Phase III.

For a specific R&D effort, applicants may submit either a Phase I application or a Fast-Track application, but not both. If both Phase I and Fast-Track applications are submitted, the application with the most recent submission date and time to Grants.gov will be evaluated. A project selected for Fast-Track funding which fails to meet its objectives may not later apply for Phase II funding. All topics are open to Fast-Track grant applications, unless otherwise noted with “No Fast-Track” in the title.

PROGRAM AREA OVERVIEW: OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

The Office of Energy Efficiency and Renewable Energy (EERE) is at the center of creating the clean energy economy today. EERE leads the U.S. Department of Energy's efforts to develop and deliver market-driven solutions for energy-saving homes, buildings, and manufacturing; sustainable transportation; and renewable electricity generation.

The EERE mission is to strengthen America's energy security, environmental quality, and economic vitality in public-private partnerships in order to enhance energy efficiency and productivity; bring clean, reliable and affordable energy technologies to the marketplace; and make a difference in the everyday lives of Americans by enhancing their energy choices and their quality of life. EERE's role is to invest in high-risk, high-value research and development that is critical to the Nation's energy future and would not be sufficiently conducted by the private sector acting on its own.

EERE's Technology Offices all have multiyear plans, detailed implementation processes and have demonstrated impressive results. To access this information for a particular office, click here and then click on the boxes checked for it.

Program activities are conducted in partnership with the private sector, state and local governments, DOE National Laboratories, and universities. EERE also works with stakeholders to develop programs and policies to facilitate the deployment of advanced clean energy technologies and practices.

For additional information regarding the EERE priorities, click here.

2. ADVANCED MANUFACTURING

Maximum Phase I Award Amount: **$150,000**	*Maximum Phase II Award Amount:* **$1,000,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **NO**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **NO**

The Advanced Manufacturing Office (AMO) (www1.eere.energy.gov/manufacturing/) partners with industry, small business, universities, and other stakeholders to identify and invest in emerging technologies with the potential to create high-quality domestic manufacturing jobs and enhance the global competitiveness of the United States.

Grant applications are sought in the following subtopics:

a. Manufacturing Improvements of Aluminum Nitride (Aln) for Wide Bandgap Semiconductor Power Devices

Wide Bandgap semiconductors (WBGS) – with Bandgap greater than 3 eV, such as silicon carbide (SiC) and gallium nitride (GaN) -- already commercialized in solid-state lighting applications — offer the opportunity for dramatic efficiency improvements in a variety of power electronic applications including industrial process and motor drives. Compared to today's silicon (Si) based technologies, devices using WBGS can operate at higher temperatures (e.g. function at ambient temperatures higher than 150^{o}C without external cooling), withstand greater voltages (>10's of kV) over time, and switch at much higher frequencies (10's of kHz to 10's of MHz). Industrial-scale motors, for example, which consume 69% of the electricity used in industry, could achieve reductions of up to 40% of consumption per motor by adoption of variable speed drive enabled by WBG-based semiconductor power devices.

While SiC and GaN-based power devices have matured and are now being commercialized for adoption in end-systems, the research in aluminum nitride (AlN) is still relatively recent. The wide bandgap of AlN, of ~6.1 eV, offers considerable advantages over GaN and SiC semiconductors such as higher breakdown field strength that permits higher voltage devices. AlN wafers are already available in 30 mm diameter from several sources, and AlN-based light emitting diodes (LED) with wavelengths between 200 – 300 nm are already being commercialized for water purification and other purpose. Schottky devices (for example using AlN and at 10 kV) could be as much as 5x smaller than a similarly rated SiC Schottky diodes at 10-25 kV. A number of challenges, however, need to be overcome in wafer manufacturing before AlN diodes can be manufactured. These include lack of conducting substrates, doping control during the boule and epitaxial growths, relatively deep donor and acceptor levels, ion-implantation and subsequent activation of donor and acceptor impurities.

Ion-implantation of donor and acceptor impurities and subsequent thermal activation is a basic building block for any semiconductor power device, which requires high dose implants to form ohmic contacts, floating guard rings and junction termination extension (JTE) regions, and grid for junction barrier Schottky (JBS) diodes. While research reports of Cd, Ag and Si ions are available, in order to manufacture AlN epilayers on bulk AlN substrates for use by device manufacturers, more comprehensive studies are needed.

<u>An area of particular interest is: Processes for ion-implantation and activation of donor and acceptor impurities</u>

Grant applications are sought that make improvements in ion-implantation and activation of donor and acceptor impurities in AlN epilayers on bulk AlN substrates and improved formation of ohmic contacts to both n+ and p+ implanted regions. Proposed work would conduct comprehensive studies of implantation of various species at elevated temperatures followed by activation at higher temperatures using a cap layer to preserve the surface quality, measurement of temperature dependent hall mobility and carrier concentrations, donor and acceptor energy levels and residual damage especially in high dose implants.

Questions – contact: Marina Sofos, marina.sofos@hq.doe.gov.

b. Rapid Heat Treatment of Metals

A large fraction of primary metal production in the United States comes in the form of thin gauge products. For example, about two thirds of the 90 million metric tons of US steel produced annually is rolled into coils of sheet and strip. These products often require various forms of heat treatment to achieve desired mechanical properties, to homogenize coatings, or to soften the material in between successive stages of cold rolling.

Advances in heating technologies, such as induction heating, have improved the ability to heat treat thin gauge metals rapidly, with reduced levels of surface oxidation, improved energy efficiencies, and smaller systems with lower capital costs. In addition to operating cost and energy reduction benefits, rapid heating provides new opportunities to control the structure and properties of metals. In particular, rapid heat treatment processes can be exploited to control grain size, diffusion of alloying elements, precipitate sizes and distributions, and phase transformations. Such control can enable superplasticity or ultrahigh strengths in ways that were not previously obtainable.

The combination of reduction in surface oxidation, smaller systems with higher energy efficiencies and improved material performance can lead to a doubling in energy productivity –the target for SBIR projects. Embodied energy reductions include less material required, lifetime system energy use reductions due to lightweighting, and elimination of processing steps.

Areas of particular interests include:

1. Composition and heat treatment: We are soliciting the development of metal compositions and heat treatment practices for novel or enhanced performance (e.g., strength, ductility, formability, wear resistance, fatigue resistance). These metal products and processes shall be enabled by and exploit rapid heat treatment practices, and the combined performance and energy savings from the application of rapid heat treatment shall result in a 50% reduction in embodied energy.
2. New and advanced applications: We are soliciting proposals to apply rapid heat treatment to metal products that are currently manufactured exclusively with conventional (surface heat transfer-limited) heat treating systems—for a targeted 50% reduction in embodied energy.

In all proposed projects the required 50% embodied energy savings shall be demonstrated through the manufacture of exemplar parts or materials, with sufficient experimental measurements and supporting calculations, to show that the savings can be achieved with practical economies of scale.

Questions – contact: David Forrest, david.forrest@hq.doe.gov

c. Desalination without Membranes

Contaminants in water can be eliminated in most cases using inexpensive, mature technologies. Removing small ions (e.g. desalination), however, requires more sophisticated processes such as reverse osmosis (RO). The RO process, however, requires the consumption of significant electrical energy in order to overcome the large osmotic pressure in saline sources using high pressures (5–8 MPa). RO membranes are also expensive and prone to fouling, especially when the feed water does not have consistent quality. In addition, the complicated machinery (e.g., high pressure pump and electricity generator) of RO processes, the maintenance of the RO membranes, and the reliance on fossil fuels complicate operations such as desalination for conventional applications, as well as for remote applications or disaster relief. Alternatives to RO membranes are sought.

An area of particular interest is: Novel, continuous water desalination processes

Grant applications are sought to for novel, continuous water desalination processes based on directional solvent extraction (DSE) that do not use membranes and are both highly efficient and can utilize low-temperature heat sources from waste heat or solar energy to minimize or even eliminate the dependence on fossil fuels for desalination and significantly increase their self-sustainability.

Questions – contact: Bhima Sastri, bhima.sastri@ee.doe.gov

d. Critical Materials for Clean Energy Technologies

In 2008, the National Academy of Sciences Minerals, Critical Minerals and the U.S. Economy Study presented a methodology to assess material criticality based on supply risk and impact of supply restriction. The Department of Energy adapted this methodology and applied it to several clean energy technologies to determine if materials constraints could impact deployment of the clean energy technologies. Basic availability is not the only factor affecting a critical material's overall supply risk. Other factors include political or regulatory risks in countries that are major producers of critical materials; lack of diversity in producers; and a competing technology demand -- many consumer electronics like mobile phones, computers and TVs use materials essential to clean energy technologies.

After examining 16 elements across the periodic table, five rare earth metals (dysprosium, neodymium, terbium, europium, and yttrium) were assessed as critical. Dysprosium and neodymium are used in permanent magnets, important to wind turbines and electric vehicle motors. Terbium, europium and yttrium are used in energy-efficient lighting phosphors. Two other materials (lithium and tellurium) were assessed as near-critical. Lithium is used in batteries and energy storage applications and tellurium is used in photovoltaic thin-films.

The manufacturing of U.S. clean energy technologies is likely to be affected by constrained supplies. As clean energy technologies are deployed more widely in the decades ahead, their share of global consumption of rare earths is likely to grow from 7% in 2010 to 40% or more by 2025. This growth, combined with non-clean energy demand, could result in supply constraints for clean energy technologies. Economic projections suggest certain critical materials could experience supply deficits of up to 30% by 2016.

There are opportunities throughout the lifecycle to develop more efficient processes to more effectively use existing supplies, reduce use and recycle and reuse at the end-of-life. Solutions to these challenges will help enable the continued deployment of clean energy technologies. This solicitation addresses three key elements across the lifecycle of critical materials:

1. Improved separation and processing of critical rare earth elements;
2. Advances in recovery and recycling of rare earth materials from manufacturing waste and end-of-life products; and
3. Novel production methods to enable advanced manufacturing of permanent magnets.

Areas of particular interests include:

1. Separation and processing of critical rare earth elements

Traditional separation and processing technologies for rare earth materials are generally considered inefficient, environmentally unfriendly and unsustainable. Additionally, the processes require long processing times and require significant capital investments. Developing new processes or improving existing methods that increase efficiency, reduce costs and improve environmental performance are of interest. In the United States, there is a significant gap in the rare earth metal supply chain in converting ores and oxides into metal. New technologies to produce concentrates and rare earth oxides could also have the potential to significantly improve the rare earth supply chain.

2. Enabling recycling of rare earth materials from manufacturing waste and EOL lighting

In recycling of rare earth materials, there are two major categories that can be considered: 1) the reduction of manufacturing loss through recovering scrap materials, and 2) end-of-life recycling for commercial and consumer products. In rare earth permanent magnet manufacturing, it is estimated that approximately 30% of the magnetic material is lost during the machining process. Developing technologies to recover the rare earth materials from the machining sludge is of interest.

Lamps containing rare earth phosphors are routinely collected by lamp recyclers for removal of mercury or recycling other lamp components. However, most of the rare earth phosphor powders from end-of-life lamps are landfilled. Technologies that will enable downstream processing of the recovered powders are needed.

3. Production of metal powders for additive manufacturing

Additive manufacturing could provide a more efficient route to rare earth magnetic materials. Additive techniques would reduce the waste associated with machining (e.g. shaping and cutting) bulk magnets, decreasing the sludge and swarf produced in the process. To enable more effective additive manufacturing of rare earth magnetic materials, metal powders with narrow size distribution are needed; however, the production process usually results in waste. More efficient production methods for metal powders, such as advanced atomization techniques, that produce narrower size distributions are of interest.

Questions – contact: Michael Mckittrick, michael.mckittrick@ee.doe.gov.

References:

Subtopic a:

1. S. M. C. Miranda, P. Kessler, J. G. Correia, R. Vianden, K. Johnston, E. Alves, K. Lorenz, "Ion implantation of Cd and Ag into AlN and GaN," physica status solidi (c), Volume 9, Issues 3-4, pages 1060–1064, March 2012. Available from http://onlinelibrary.wiley.com/doi/10.1002/pssc.v9.3/4/issuetoc.
2. Masakazu Kanechika and Tetsu Kachi, "n-type AlN layer by Si ion implantation," Appl. Phys. Lett. 88, 202106 (2006). Available from http://scitation.aip.org/content/aip/journal/apl/88/20/10.1063/1.2204656.

Subtopic c:

1. Elimelech, M. & Phillip, W. A. The Future of Seawater Desalination: Energy, Technology, and the Environment. Science 333, 712-717 (2011). Available from http://www.sciencemag.org/content/333/6043/712.figures-only.
2. Avlonitis, S. A., Kouroumbas, K. & Vlachakis, N. Energy consumption and membrane replacement cost for seawater RO desalination plants. Desalination 157, 151-158 (2003). Available from http://www.researchgate.net/publication/222525379_Energy_consumption_and_membrane_replacement_cost_for_seawater_RO_desalination_plants.
3. Luo, T., Bajpayee, A. & Chen, G. Directional solvent for membrane-free water desalination-A molecular level study. J. Appl. Phys. 110, 054905 (2011). Available from http://scitation.aip.org/content/aip/journal/jap/110/5/10.1063/1.3627239.

4. Bajpayee, A., Luo, T., Muto, A. & Chen, G. Very low temperature membrane-free desalination by directional solvent extraction. Energy & Environmental Science 4, 1672-1675 (2011). Available from http://pubs.rsc.org/en/Content/ArticleLanding/2011/EE/c1ee01027a.

Subtopic d:

1. National Academy of Science, "Minerals, Critical Minerals, and the U.S. Economy", (2008). Available from http://www.nap.edu/catalog.php?record_id=12034.
2. DOE Critical Materials Strategy, http://energy.gov/pi/office-policy-and-international-affairs/downloads/2011-critical-materials-strategy

3. BUILDINGS

Maximum Phase I Award Amount: **$150,000**	*Maximum Phase II Award Amount:* **$1,000,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **NO**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **NO**

DOE's Building Technologies Office (BTO) advances building energy performance through the development and promotion of efficient, affordable, and high impact technologies, systems, and practices. BTO's long-term goal is to reduce energy use by 50%, compared to a 2010 baseline. To secure these savings, research, development, demonstration, and deployment of next-generation building technologies are needed to advance building systems and components that are cost-competitive in the market. Electric lighting now consumes ~1/10 of the primary energy delivered annually in the U.S. representing ~22% of the electricity produced. The building envelope (walls, roofs, windows etc.) are often assembled on-site by labor-intensive, low-tech processes. Highly automated manufacturing processes could allow for modular building components to be shipped directly to the jobsite, reducing installation costs. Finally, BTO is dedicated to promoting the widespread and effective use of advanced whole-building energy simulation in all aspects of the building life cycle, including early-stage and detailed design for new construction, commissioning and fault detection for existing buildings, and auditing and retrofits.

Grant applications are sought in the following subtopics:

a. Integrating Energy Efficient Solid-state Lighting with Advanced Sensors, Controls and Connectivity

The DOE's Office of Building Technologies has determined that few emerging technologies represent as much potential to conserve energy and enhance the quality of our commercial, industrial and residential building inventory than does energy efficient, solid-state lighting (SSL). Electric lighting in the US domestic building inventory consumes almost 1/10 of the primary energy delivered annually in the US representing about 22% of the electricity produced. The DOE has estimated that advancing energy efficient electric lighting in US buildings could conserve more than 50% of this energy. The DOE and the General Illumination Industry in North America have begun to harvest measurable lighting energy conservation in this important end use by taking advantage of existing SSL technology. But the migration of energy efficient SSL into the remaining North American buildings inventory will take many years to accomplish. This topic seeks to identify novel and inexpensive solutions that will accelerate the adoption of this disruptive yet energy efficient and environmentally green technology into the North American building inventory.

Possible areas of interest for novel solutions include:

1. SSL Luminaries and lamps – modern manufacturing techniques can respond to small and dynamic market needs using innovative concepts such as 3-D printing, digital metal forming and many other efficient yet flexible manufacturing techniques. These proven advanced manufacturing processes may be used to create SSL luminaires and SSL lamps in ways heretofore not possible. Novel approaches to quickly, efficiently and inexpensively bring SSL technology into the American lighting marketplace using these new methodologies in quality and useful general illumination products whose value to end users is apparent and consistent with the goals of the DOE's SSL activity are sought. Incremental advancements to existing SSL products and processes will not be considered under this FOA.

2. SSL Components, materials or constituent components – modern state-of-the art manufacturing techniques have been proven to substantially reduce product costs especially in consumer electronics and related products. While some of this technology has appeared in SSL products, most products available in the North American market today are made using discrete components and using dated, labor intensive manufacturing techniques. Fully automated assembly, advanced printing and integrated electronics designs may provide substantial opportunity to inexpensively and quickly manufacture high quality products whose value proposition is comparable to the legacy lighting products and components being replaced by SSL and modern digital electronics.

3. SSL Systems, components, sensors and software – SSL is inherently digital and easily made compatible with modern electronics, sensors and control systems, yet has failed to be fully exploited in installed systems. While certain niche products that use advanced controls, sensors or even personal device control compatibility (e.g., iPhone, Android, etc.) have achieved modest levels of consumer acceptance, such advanced systems architectures have not achieved widespread popularity, limiting the energy conservation potential thought possible using advanced controls and sensors. It is possible that imaginative and inexpensive components including sensors, control algorithms and even applications for common digital platforms may provide control functionality to SSL products adding value to users with little or no additional cost. With the immense popularity and ease of programming interface capabilities into personal digital assistants, it is possible that creative and useful new applications can be developed at modest cost, but that provide access to the enormous and powerful computational capabilities of present and future SSL systems , components and sensors. Applications, compatible sensors or control hardware or even additional processor capability are all viable topics for this FOA provided they are inexpensive and easily integrated into SSL systems.

All proposals sought must be demonstrated with modest feasibility studies within the constraints of the Phase I grant and budget with commercial demonstration and transition to manufacturing occurring in Phase II. Successful proposals will take advantage of popular trends in manufacturing that embrace innovation and entrepreneurship by offering products or components that provide value to customers, but at greatly reduced cost or by being readily reconfigurable to meet evolving market trends. Proposals may be submitted to any one of the subtopics listed above but all applications must:

1. Whenever possible, be consistent with and have performance metrics linked to the DOE SSL Multi-Year Program Plan (MYPP) available for download directly at: http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_mypp2012_web.pdf
2. Clearly define the proposed application, the merit of the proposed innovation and the anticipated outcome of the overall effort including Phase I and Phase II;
3. Include quantitative projections for price and/or performance improvement that is tied to representative values included in the MYPP or in comparison to existing products. Projections of price or cost advantage due to manufacturing improvements; materials use or design simplification, for example, should provide references to current practices and pricing to enable informed comparison to present technologies.
4. Commercial viability should be demonstrated with a quantifiable return on DOE investment as is described elsewhere in this FOA.
5. All performance claims must be fully justified with either thoughtful and justified theoretical predictions, or relevant experimental data.

Questions – contact: James Brodrick, james.brodrick@ee.doe.gov

b. Advanced Manufacturing Processes to Reduce Soft Costs of Energy-Efficient Building Envelope Technologies for Retrofitting Existing Buildings

In residential and commercial buildings, soft costs, or balance of system (BOS) costs, include factors such as labor costs, ease of installation, transportation issues, wiring, wireless, etc. In many cases, these factors dominate the installed cost. For example, the installed cost (materials + labor) of 3.5 inches of fiberglass batt insulation to an interior wall is estimated to cost $0.57 (Kosny 2013). The labor portion of this cost is estimated to vary from $0.43 to $0.47 (Kosny 2013). These soft costs must be minimized to enable the adoption of next-generation energy efficient technologies.

BOS costs are particularly important for the retrofit market. Walls, roofs and windows make up the structure of the building. They vary widely from building to building, and as a result, retrofits must be done on a case-by-case basis. This leads to long construction times, high labor costs and energy-efficiency improvements that have negative impacts on building performance metrics, such as indoor air quality or moisture control. BOS costs dominate the total installed costs for many sealing and insulation technologies. Possible approaches to reducing these costs include low-cost, advanced thermal insulation with reduced thickness to enable quick interior retrofits that do not require typical retrofit tasks such as rearranging outlets and re-adjusting pipes, combining exterior continuous insulation with siding or roofing products, and producing an airtight and watertight envelope with automated sealing verification.

Advanced manufacturing processes are critical to reducing the soft cost of building envelope technologies. The building envelope (walls, roofs, windows etc.) are often assembled on-site by labor-intensive, low-tech processes. Highly automated manufacturing processes could allow for modular building components to be shipped directly to the jobsite, reducing installation costs. These modular components would need to be easily shipped, and attached or integrated with the existing building structure. Ultimately, the total installed cost for a proposed technology would need to show a simple payback period of less than seven years.

Questions – contact: Karma Sawyer, karma.sawyer@ee.doe.gov

c. Integrating Advanced Whole-building Energy Simulation into End-user Workflows and Tools

BTO is dedicated to promoting the widespread and effective use of advanced whole-building energy simulation in all aspects of the building life cycle, including early-stage and detailed design for new construction, commissioning and fault detection for existing buildings, and auditing and retrofits. BTO is interested in new products and services that leverage, support, and enhance its open-source platform consisting of the EnergyPlus whole-building energy modeling engine, the Radiance lighting engine, and the OpenStudio energy/lighting modeling software development kit (SDK).

Example projects of interest for novel solutions include:

1. New end-user tools for design, retrofit analysis, commissioning/fault-detection, and auditing. Preference will be given to tools that emphasize simplicity and low-cost/effort and target small buildings and projects.
2. Plug-ins for existing commercial software including architectural and mechanical design software.
3. Plug-ins and extensions to the current platform that extend its capabilities or link it to other analyses.
4. Support and training for the platform itself or general modeling support and training incorporating the platform.

Applicants should demonstrate a clear business plan and a compelling case for the need and viability of the proposed product or service. Applicants should detail relevant experience with energy modeling, software development, training and support, as applicable.

Questions – contact: Amir Roth, amir.roth@ee.doe.gov

4. FUEL CELLS

Maximum Phase I Award Amount: **$150,000**	*Maximum Phase II Award Amount:* **$1,000,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **NO**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **NO**

The Office of Energy Efficiency and Renewable Energy Fuel Cell Technologies Office (FCTO) http://www1.eere.energy.gov/hydrogenandfuelcells works in partnership with industry (including small businesses), academia, and DOE's national laboratories to establish fuel cell and hydrogen energy technologies as economically competitive contributors to the U.S. transportation needs. Information on FCTO priorities and future directions can be found in the FY2014 Budget overview at http://www.eere.energy.gov/office_eere/pdfs/budget/fuel cells_ataglance_2014.pdf. A detailed budget request can be found at: http://energy.gov/sites/prod/files/2013/04/f0/FY%2014%20DOE%20Budget%20-%20volume3.pdf#page=179. A roadmap for development of fuel cell and hydrogen technologies that guides FCTO investments aimed at lowering the related risks and costs can be found at, http://www1.eere.energy.gov/hydrogenandfuelcells/mypp/index.html. The FCTO aims to build from other early niche market successes in applications such as fuel cell-powered lift trucks by helping the fuel cell industry succeed in another motive power application market and thus help enable a robust domestic supply base.

The conversion of high emission, low miles per gallon heavy duty trucks into completely zero-emission vehicles represents an opportunity for fuel cell technologies. For example, there are an estimated 179,000 high emission, low mpg waste hauling trucks in the U.S fleet. A typical garbage truck travels 25,000 miles annually and gets 2.8 mpg-- the lowest average fuel efficiency of any vehicle type—and consumes ~8,600 gallons of petroleum fuel. Diesel garbage trucks are a major source of air pollutants, including smog-forming compounds, particulate matter, and toxic chemical constituents. In addition, noise can be a significant concern; for example an operating diesel garbage truck generates noise up to the 100 decibel level, which is associated with serious hearing damage.

Grant applications are sought in the following subtopic:

a. Demonstration of a Prototype Fuel Cell-battery Electric Hybrid Truck for Waste Transportation

The FCTO seeks projects that develop and demonstrate a proof of concept for a heavy-duty fuel cell-battery electric hybrid truck for waste hauling applications. The fuel cells should be those that operate on hydrogen fuel. In Phase II DOE will seek new applications for projects that demonstrate the commercial feasibility of fuel cell – battery electric plug in hybrid trucks at waste disposal and recycling centers.. The proposals should help accelerate the development and production of cost-effective on-board, fuel cell-battery electric trucks for waste hauling powered by electric drivetrains to substantially increase the zero emission driving range and reduce battery recharging times. This topic's outcome, when fully commercialized, will dramatically reduce petroleum consumption and related emissions.

The specific vehicles of interest are commercial trucks that pick up and haul waste or recycled materials to landfills or recycling centers in their daily operations. In this small business topic, the FCTO seeks technology and business solutions that will help: establish a business case, mitigate the cost of hydrogen fuel infrastructure, and demonstrate fuel cell – battery electric hybrid truck technologies. If landfill gas is used in the proposed application, technology development and analysis indicate that landfill gas can be purified and reformed economically to transportation grade (i.e. SAE J2719) hydrogen fuel. The FCTO will NOT consider applications for the development of landfill gas and bio-methane reformation technologies under this announcement.

<u>Expected Outcomes:</u>

<u>Phase 1</u>

1. A design feasibility analysis and plan describing the power system and truck designs and specifics (e.g. cost, performance requirements, etc.) using a model analysis report by Argonne National Laboratory: "The Benefits of Using a Fuel Cell Auxiliary Power Unit to Double the Range of Current Battery Electric Vehicles," as a guide for planning hydrogen fuel consumption, cost trade-offs and other impacts of using a small fuel cell to extend the driving range of a battery electric vehicle.
2. An economic assessment, including a payback analysis, concerning the use of hydrogen-fueled PEM fuel cells for fuel cell hybrid trucks used as commercial waste hauling vehicles. Intrinsic value proposition factors should be included, such as any operations or productivity gains (e.g. avoided residential community noise, energy and petroleum fuel savings, scheduled maintenance advantages, emissions reductions and other benefits).

Phase 2

1. One (1) fuel cell power system unit (approximately10 to 30 kW) delivered and installed on commercially available battery electric waste hauling truck and tested for a minimum of100 hours of real world operations.
2. Final report describing operations testing performance results and a commercialization plan.

Questions – contact: Peter Devlin, peter.devlin@ee.doe.gov

References:

1. Facts on Greening Garbage Trucks: New Technologies for Cleaner Air. (http://www.informinc.org/fact_ggt.php)

5. GEOTHERMAL

Maximum Phase I Award Amount: **$150,000**	*Maximum Phase II Award Amount:* **$1,000,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **NO**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **NO**

The heat energy from the earth represents an enormous and underutilized domestic resource. The Office of Energy Efficiency and Renewable Energy Geothermal Technologies Office (GTO) (www1.eere.energy.gov/geothermal/) works in partnership with industry (including small businesses), academia, and DOE's National Laboratories to establish geothermal energy as an economically competitive contributor to the U.S. energy supply. Technologies for electricity generation or energy utilization from marine geothermal resources will not be considered under this topic. Information on GTO priorities and future directions can be found in the FY2014 Budget overview at http://www.eere.energy.gov/office_eere/pdfs/budget/geothermal_ataglance_2014.pdf. The detailed budget request can be found at: http://energy.gov/sites/prod/files/2013/04/f0/FY%2014%20DOE%20Budget%20-%20volume3.pdf#page=179.

A roadmap for development of geothermal exploration technologies that guides GTO R&D investments aimed at lowering the risk and cost of geothermal prospect identification can be found here, http://www.eere.energy.gov/geothermal/pdfs/exploration_technical_roadmap2013.pdf. The technology roadmap that helps guide GTO investments in Enhanced Geothermal Systems (EGS) R&D can be found here, http://www.eere.energy.gov/geothermal/pdfs/stanford_egs_technical_roadmap2013.pdf

Grant applications are sought in the following subtopic:

a. Well Construction Technologies that Reduce Energy Costs

The GTO seeks well construction technologies, excluding rock reduction (both mechanical and non-mechanical), that have the potential to contribute to reducing the levelized cost of electricity from new hydrothermal development to 6¢/kWh by 2020 and Enhanced Geothermal Systems (EGS) to 6¢/ kWh by 2030. Applications should include a clear and detailed pathway to such cost reduction using the proposed technology. Applicants should consider using the Geothermal Electricity Technology Evaluation Model

(GETEM) developed by GTO to model power generation costs and the potential for technology improvements to affect these costs. Information on GETEM may be found at www.eere.energy.gov/geothermal/getem.html and information on its use is at www.eere.energy.gov/geothermal/news_detail.html?news_id=17496.

In its small business topic the GTO seeks technologies, other than rock reduction technologies, that reduce the cost of geothermal well construction. Cost analysis (e.g. www.eere.energy.gov/geothermal/pdfs/egs_well_contruction.pdf.) indicates that reducing well costs will require multiple focus areas and non-hole making well construction activities are significant cost drivers. The GTO will NOT consider applications for the development of rock reduction technologies (i.e. drill bits, cutting structures) under this announcement.

Questions – contact: Greg Stillman, greg.stillman@ee.doe.gov

6. SOLAR

Maximum Phase I Award Amount: **$225,000**	*Maximum Phase II Award Amount:* **$1,500,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **YES**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **YES**

The DOE SunShot Initiative (www.energy.gov/SunShot) aims to achieve subsidy-free, cost competitive solar power by the end of the decade. SunShot seeks proposals for the development of innovative technologies in the areas of: (a) Software Tools for PV Soft Cost Reductions and Grid Integration, (b) Analytical Modeling and Data Aggregation, (c) Supply Chain for Concentrating Solar Power and (d) Labor Efficiencies through Hardware Innovation. Applicants are encouraged to propose deliverables that demonstrate clear progress, are aggressive but achievable, and are quantitative.

Grant applications are sought in the following subtopics:

a. Software Tools for PV Soft Cost Reductions and Grid Integration

SunShot seeks innovative, transformative information technology and software solutions that can significantly reduce photovoltaic (PV) soft costs and expedite cost–effective deployment of PV generation on the power grid.

Areas of particular interest include:

1. PV Soft Cost Reductions: With global PV module prices declining rapidly, non-hardware (soft) PV costs – such as customer acquisition, permitting, installation, inspection, interconnection, operations, and maintenance – have become a major driver of installed U.S. PV system prices. Software innovations will play a critical role in achieving SunShot's installed-system soft costs targets of $0.65/W for residential systems and $0.44/W for commercial systems by 2020. Areas of interest include, but are not limited to (i) streamlining of sales and system design aspects; (ii) expediting of permitting, installation and interconnection; (iii) optimization of interfaces between project elements; (iv) next generation site assessment and bid preparation; (v) multiple-owner, multiple-tenant and crowd funded business models; (vi) standardization; and (vii) automation.

2. Grid Integration: Advanced software to interface with existing hardware systems is sought to (i) aggregate, visualize, analyze and control multiple PV generation at the distribution feeder, substation and sub-transmission level in real-time; (ii) synchronize and manage integrated PV resources at the distribution level; (iii) collect, analyze and process enormous amount of feeder, load and PV data in real-time; and (iv) expedite the utility PV interconnection technical screening process. Proposals for advanced open source and enterprise tools to automate data exchange between PV and utility software systems and promote interoperability between existing utility legacy software and new systems are also encouraged. Emerging bulk transmission and dynamic distribution engineering analysis software combined with innovative hardware systems for data acquisition, predictive analysis, and real-time visualization, enables the utility to quickly and effectively model aggregated PV grid impacts, recommend mitigation solutions, and provide advanced capabilities for system planning and grid operations with high penetration of PV. Consequently, with these innovative tools, utility concerns about the uncertainty of PV impact on the grid are significantly decrease thereby allowing higher level of PV penetration to be integrated on the distribution system. In addition, these advanced tools can significantly reduce the expensive interconnection study fees paid by developers, reduce turnaround time for initial determination, allows more PV to pass the interconnection screens, and ultimately expedite the interconnection and cost-effective deployment of PV generation on the distribution and transmission system.

Questions – contact: solar.sbir@ee.doe.gov

b. Analytical and Numerical Modeling and Data Aggregation

The capability to efficiently collect, store, manipulate, and visualize vast, diverse, and complex streams of data can transform the operations of stakeholders throughout the solar value chain: from electric utilities managing distributed generation on their infrastructure; to solar fleet operators designing maintenance schedules; to solar sales lead generations seeking to reduce customer acquisition soft costs. The development of innovative data and simulation tools is sought under this topic area. Tools should provide actionable insights; use existing datasets or collect non-redundant datasets; and advance state-of-the-art modeling and visualization techniques. Areas of interest include, but are not limited to: (1) predictive analytics applied to solar resource forecasting, accurate technology adoption prediction, or operation and maintenance modeling; (2) advanced verification and validation tools; (3) novel techniques of and methods for capturing, aggregating, and analyzing structured or unstructured datasets; (4) aggregation and anonymization of solar performance and reliability data of residential, commercial, and utility scale installations (along with requisite metadata) to assign actionable, credible statistics for financiers; (5) consumer-facing decision-making platforms leveraging social and new media; and (6) incorporation of nearly real-time energy consumption data (e.g., applying smart meter data) . Areas not of interest include device-level modeling. Applicants must quantify the impact of the proposed research and justify the economic viability of the proposed product.

Questions – solar.sbir@ee.doe.gov

c. Supply Chain for Concentrating Solar Power

Areas of particular interest include:

1. Molten Salt Flexible and Rotating Couplings: Flexible pipe couplings suitable for molten salt heat transfer fluid (HTF) in Concentrating Solar Power (CSP) parabolic troughs are currently not commercially available for utility power generation applications. This one critical component is a key solution to enable a significant reduction in the levelized cost of electricity (LCOE) for CSP parabolic trough technology. Currently parabolic trough is the most prevalent CSP technology with over 1 GW installed in the United States and an additional global installed capacity of almost 2 GW. This technology, as deployed today, uses oil as a heat transfer fluid which is limited to maximum temperature of approximately 400^{o}C. Molten salt HTF such as Sodium Nitrate / Potassium Nitrate blends has a temperature operating range between 250 to 600^{o}C, and lower operating temperature blends with Sodium Nitrite or Calcium Nitrate can operate between 150 to 500^{o}C. Numerous studies have concluded that the use of molten salt heat transfer fluid at temperatures between 450^{o}C to 550^{o}C will significantly improve efficiency and reduce the cost of thermal energy storage leading to substantial reductions in levelized cost of electricity for parabolic trough technology. This solicitation seeks applications for the development and demonstration of flexible pipe couplers suitable for a 30 year service life operation in a CSP parabolic trough plant using molten salt HTF at operating temperatures up to 550^{o}C.

2. CSP Mirror Cleaning Systems: Mirror soiling in Concentrating Solar Power (CSP) plants currently contributes to approximately a 5% loss in potential annual energy production. This translates directly to lost revenue or requires additional capital to oversize the CSP collector field capacity. Mirror cleaning maintenance costs are estimated to account for over half of the operation and maintenance (O&M) costs of a CSP facility which translates to approximately ½¢/kWh of the levelized cost of electricity (LCOE) and may account for 10% of the annual water consumption. This solicitation seeks applications for the development and demonstration of systems to improve the annual average trough and heliostat mirror reflectivity while reducing cost and water consumption of this operation. Solutions which may be considered for this solicitation may include but are not limited to intelligent sensing, soil resistant surfaces, robotic or other automated systems to remove soil from mirrors while eliminating or recapturing water. It is expected that such systems remain cost effective with a 30 year service life, 95% availability while maintaining the performance and service life of CSP collector field mirrors above 95% of their original performance.

Questions – contact: solar.sbir@ee.doe.gov

d. Labor Efficiencies through Hardware Innovation

Installing a photovoltaic (PV) system requires both electrician and non-electrician labor and includes assembling the module, racking and mounting or ballasting it, running conduit, and connecting the inverter, meter, and disconnect. In the United States, streamlining installations is complicated by the heterogeneity of installation platforms, component materials, electric systems, and utility requirements. Optimizing system performance typically requires customizing both system design and installation.

Hardware innovations are sought to reduce installation labor costs by increasing labor efficiency or reducing the process complexity required to install a PV system. Installation cost reduction opportunities include: (1) integrated racking, which reduces balance of system hardware; (2) module-integrated electronics, which reduces cable runs; (3) prefabrication, which streamlines installation; and (4) 1,000-volt direct current technologies, which enables more modules wired together per string. The proposed innovation must be sufficiently differentiated with respect to existing commercial products or solutions. Applicants must quantify achievable cost reductions and justify the economic viability of the proposed product assuming near term (< 5 years) industry deployment.

Achieving the SunShot price target requires a decrease in total commercial installation labor costs from $0.42/W in 2010 to $0.07/W by 2020 ($0.59/W to $0.12/W for residential systems).

Questions – contact: solar.sbir@ee.doe.gov

7. VEHICLES

Maximum Phase I Award Amount: **$150,000**	*Maximum Phase II Award Amount:* **$1,000,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **NO**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **NO**

EERE's Vehicles Technologies Offices (VTO) (www1.eere.energy.gov/vehiclesandfuels/) is focused on developing technologies to enable average new vehicle fuel economy of more than 60 miles per gallon for cars and more than 43 miles per gallon for trucks by 2025. Proposals deemed to be duplicative of research that is already in progress, or similar to proposals already reviewed this year will not be funded; therefore all submissions should clearly explain how the proposed work differs from other similar work in the field.

Grant applications are sought in the following subtopics:

a. Electric Drive Vehicle Batteries

Applicants are sought to develop electrochemical energy storage technologies which support commercialization of micro, mild, and full HEVs, PHEVs, and EVs. Some specific improvements which are of interest, but are not limited to, include: new low-cost materials, high voltage and high temperature non-carbonate electrolytes, improvements in manufacturing processes, speed or yield, improved cell/pack design minimizing inactive material, significant improvement in specific energy (Wh/kg) or energy density (Wh/L), and improved safety. Proposals must clearly demonstrate how they advance the current state of the art and address the relevant performance metrics listed at www.uscar.org/guest/article_view.php?articles_id=85.

When appropriate, evaluation of the technology should be performed in accordance with applicable test procedures or recommended practices as published by the Department of Energy (DOE) and the U.S Advanced Battery Consortium (USABC). These test procedures can be found at, www.uscar.org/guest/article_view.php?articles_id=86. Phase 1 feasibility studies must be evaluated in full cells (not half cells) greater than 200mAh in size while Phase II technologies should be demonstrated in full cells greater than 2Ah. Proposals will be deemed non-responsive if the proposed technology is prohibitive to market penetration due to high cost; requires substantial infrastructure investments or industry standardization to be commercially viable; cannot accept high power recharge pulses from regenerative breaking.
Questions – contact: Brian Cunningham, brian.cunningham@ee.doe.gov

b. Lightweight Materials

Applications are sought to develop and demonstrate unique lightweight metals and metal forming processes that support weight reduction in passenger and commercial vehicles. Applications must include metal alloys with greater than 60% Fe, Al, Mg, or Ti by weight, and must demonstrate that the proposed materials and processes can yield a weight savings of greater than 30% at a cost of less than $2.00 per pound of weight saved when compared to a standard baseline vehicle material and component. Applications should emphasize production and/or forming of metal components, but should not include joining or assembly. Traditional materials and processes are not desired - the application should clearly explain how the proposed technology differs substantially from existing light-metals and processes, or other work in the field. In particular, incremental modifications to known alloys, forming processes, or casting processes are not desired.

Questions – contact: William Joost, william.joost@ee.doe.gov

c. Electric Drive Vehicle Power Electronics Subcomponents

Power electronic inverters and converters are essential for electric drive vehicle operation, and currently add significant cost to these vehicles, therefore limiting their commercialization potential. Improvements in their performance can lead to cost reduction or better utilization of their capabilities in vehicles, as outlined in the U.S. DRIVE partnership Electrical and Electronics Technical Team Roadmap (http://www1.eere.energy.gov/vehiclesandfuels/pdfs/program/eett_roadmap_12-7-10.pdf). Specifically, improvements are sought for magnetic materials that are used for inductors and magnetic subcomponents in vehicle power electronics such as inverters, converters, and on-board chargers. Improvements of interest are reduction in size, weight, losses, and cost relative to current state of the art used in production vehicle power electronics. Materials should be able to withstand operation in a vehicle environment, with ambient temperatures of up to 150°C and no dedicated cooling provided.

Phase I efforts should involve the development and validation of the proposed technology or material with demonstrated performance under simulated operating conditions. In Phase II, the technology should be further advanced and demonstrated through the production of prototype devices.

Questions – contact: Steven Boyd, steven.boyd@ee.doe.gov

d. Injector Spray Imaging Techniques

Gasoline direct injection engine and diesel engine fuel injector spray structures can have a significant effect on both the fuel economy and the exhaust emissions of modern vehicle engines. Advanced imaging and visualization concepts are sought that characterize both the liquid spray structures and the pre-ignition vapor phase of the fuel within internal combustion engine cylinders.

The Phase I effort should involve the development and validation of the proposed technology under in-cylinder, pre-combustion operating conditions. In Phase II, the technology should be further advanced and demonstrated through the construction of prototype devices capable of characterizing the liquid spray and vapor distribution of actual in-cylinder, pre-combustion, fuel injections from common fuel injectors, under normal operating conditions in a laboratory environment. All submissions should clearly explain how the proposed work differs from other, similar work in the field. Promising new techniques which have been used in other, non-automotive research fields are highly desirable.

Questions – contact: Leo Breton, leo.breton@ee.doe.gov

e. Advanced Ignition Concepts

Lean-burn combustion in gasoline engines introduces physical conditions that severely impede reliable ignition of fuel-air mixtures.

Advanced ignition concepts are sought that:

1. Extend the lean ignition limit air/fuel ratio to > 20,
2. Enable reliable ignition under high in-cylinder pressures (up to 100 bar at the time of ignition) thus enabling high load operation,
3. Enable operation under high levels of exhaust gas recirculation, and
4. Lower or maintain ignitability (coefficient of variance of IMEP < 3%). Advanced ignition systems such as laser ignition, microwave ignition, plasma jet ignition, or those using advanced concepts such as pulse trains, pre-chamber spark plugs, etc. are considered typical candidates for this effort.

Questions – contact: Leo Breton, leo.breton@ee.doe.gov

f. Engine/Driveline Friction Reduction

Proposals are sought to develop innovative technologies to enable the reduction of friction in engine/driveline systems of existing vehicles through advanced lubricants. Technology must be able to be used as a drop-in or be retrofitted into existing on-road vehicles and demonstrate at least a 3% reduction in energy required to propel the vehicle. Engine lubricants, manual transmission lubricants, and axle/gear lubricants are acceptable applications. The comparison lubricant used as a baseline for demonstration/justification of the 3% fuel efficiency improvement should be commercially available, state-of-the-art technology for the intended application, e.g., GF-5 oil for gasoline engine applications or CJ-4 oil for diesel engine applications. Axle and transmission lubricants should also employ current, best-available technology as a baseline for demonstrating/justifying the proposed technology results in a 3% fuel efficiency improvement.

Applications containing the following strategies shall be considered nonresponsive to subtopic f, (Engine/Driveline Friction Reduction) and will not be reviewed:

Formulations (1) that simply lower the viscosity of the lubricant without regard for increased solid-solid contact; (2) that aren't expected to show a fuel efficiency improvement within the first 4000 miles or 50 hours of engine operation; (3) that are exclusively for use in off-road (rail, marine, construction, small engines) or motorcycle applications; (4) that are exclusively for alternative fuel applications; (5) that increase wear or reduce component durability; (6) that are not compatible with existing emissions control systems and (7) that are exclusively for automatic transmissions.

Projects focused mainly on production methods for lubricants.

Questions – Steven Przesmitzki, steven.przesmitzki@ee.doe.gov

8. WIND

Maximum Phase I Award Amount: **$150,000**	*Maximum Phase II Award Amount:* **$1,000,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **NO**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **NO**

The Office of Energy Efficiency and Renewable Energy's Wind Technology Office (www.eere.energy.gov/wind/) seeks proposals for innovations that significantly advance the goal of large cost reductions in the deployment of U.S. wind power resources, including (a) Tower and Foundation Systems for Small Wind Turbine Technology and (b) Avian and Bat Monitoring Technologies and Methods For Offshore Wind Facilities and (c) US Offshore Wind O&M Vessels Personnel and Equipment Transfer System.

Grant applications are sought in the following subtopics:

a. Tower and Foundation Systems for Small Wind Turbine Technology

Increasing tower height is a means for increasing turbine performance; however, tower and foundation system design, including hardware as well as transportation and installation considerations, are significant cost drivers for small wind turbine technology. Specifically, for small wind turbine designs, as defined by AWEA 9.1-2009, self-supporting monopole towers can account for as much as 50% of total installed cost. Guyed and lattice tower designs can offer a lower cost alternative, but are typically considered to be less desirable for aesthetic reasons. A new generation of innovative, rapidly installed self-supporting monopole systems or other novel concepts that can be economically manufactured and deployed could significantly lower costs and increase deployment.

Grant applications are sought for new technologies that can provide low-cost, easily deployable tower and foundation systems for small wind turbine technology.

Grant applications must:

1. Address small wind turbines, as defined by AWEA 9.1-2009;
2. Propose to develop towers and foundations designed to IEC 61400-2 standards;
3. Propose to develop towers that reach a minimum hub height of 35 meters;
4. Provide baseline cost data for a state of the art self-supporting monopole tower and foundation design; and
5. Demonstrate a clear cost reduction from the existing state of the art.

Questions – contact: Shreyas Ananthan, shreyas.ananthan@ee.doe.gov

b. Avian and Bat Monitoring Technologies and Methods for Offshore Wind Facilities

Understanding the interactions between offshore wind facilities and sensitive wildlife will be critical for projects to obtain regulatory approval; however, monitoring the impacts of offshore wind on birds and bats poses a number of challenges associated with collecting data remotely in marine environments. While some instrumentation already exists to monitor issues such as bird and bat strike or avoidance of/attraction to wind turbines, many of these approaches are not perfected, or remain untested in the marine environment. In order to fully assess the effects of offshore wind farms on these species, improvements are needed in device automation, performance, and survivability in the marine environment, as well as in data processing techniques. Thus, innovation is required to improve the effectiveness of monitoring systems for offshore wind deployments to generate accurate, quality datasets that can be used to reduce uncertainty by effectively characterizing risk to wildlife and informing regulatory decision-making.

Grant applications are sought for new technologies that can provide low-cost, easily deployable environmental monitoring systems for offshore wind deployments to assess bird and bat interactions with offshore wind farms. Applications should focus on innovative technologies that monitor incidence of collision with wind turbines, or that improve detection of organisms to assess behavior of birds around turbines, particularly to understand whether birds are avoiding the area (macro and/or micro-avoidance), or habituating to the presence of offshore wind turbines. Advances could be made in several areas, including accuracy or range improvements for camera or radar systems, marinization of existing devices, or advancements in processing capabilities, including, but not limited to algorithm development for improved image detection, reduced post-processing time requirements, or improved system operation controls. While land-based testing may occur as part of the device development process, ultimately these devices should be designed for the offshore wind market.

Applications should include a thorough description of the current strengths and limitations of the technologies they are seeking to advance and a discussion on if and how the work proposed will affect each of these variables, including spatial and temporal resolution, data bandwidth, storage and transfer, survivability in marine environments, and data processing time and cost. Importantly, since environmental regulations are species-specific, applications should address current device ability to distinguish between species and whether and how the proposal will enhance this capability.

Applicants must demonstrate both of the following in their applications:

1. Proposed research will provide results that will substantially reduce regulatory and environmental risks to future projects facing similar issues by substantially reducing the costs and/or enhancing environmental monitoring capabilities. If the technology proposed is currently not cost competitive with alternatives, a credible pathway to cost competitiveness must be demonstrated.

2. To the extent that device testing will occur under this award, the proposed studies should actively incorporate the input of and demonstrate buy-in from relevant federal and/or state regulatory and resource management agencies, project developers, and/or any other stakeholders whose participation will be critical to the effective execution of the testing.

Specific deliverables will include a final technical report, which contains a detailed technical summary of all performed tasks. This technical report should include a section with user instructions and suggested methodology for monitoring strike at offshore wind farms.

Questions – contact: Patrick Gilman, patrick.gilman@go.doe.gov

c. US Offshore Wind O&M Vessels Personnel and Equipment Transfer System

While lessons learned from the experiences of the European offshore wind farms will help shape the US offshore wind industry, environmental conditions in each location vary. As seen in the offshore oil and gas industry, vessels may be purposefully designed for their intended area of operability. For example, although much can be learned from the vessels and experiences in the Gulf of Mexico, vessels have been specifically designed to operate in the North Sea conditions. In the National Offshore Wind Strategy, the DOE has committed to addressing supply chain development, including specialized vessels and other operations and maintenance technology. The specialized infrastructure required to operate offshore wind farms cost-effectively, such as purpose-built vessels, does not currently exist in the U.S. To support a world-leading domestic offshore wind industry, technical solutions should be optimized for the proposed site conditions.

Although operational and maintenance tasks may be similar, an optimized technical solution to transport and deliver personnel and equipment may be different. Vessels and supporting systems designed to service offshore wind farms in the North Sea may be overbuilt and more expensive than a vessel or system necessary for a US offshore wind farm. From the NREL 2013, "Installation, Operations and Maintenance Strategies to Reduce the Cost of Offshore Wind Energy" technical report, current technology in Europe restricts the operational window of O&M vessels to waves less than 1-1.5m, resulting in a wind farm accessibility of 40-60% in the North Sea. The low accessibility can reduce the wind farm availability which can lead to increased O&M costs as well as a reduction in revenue due to power losses.

Grant applications are sought for the design of a personnel and/or equipment transfer system to be retrofitted into an existing US flagged vessel or integrated into a purpose built US flagged vessel to service future US offshore wind farms. This system should result in increased accessibility of the wind farm and achieve wind farm availability of greater than 95%. Crew transfers can be made to either the service platform or the access ladder while equipment transfers should be made to the service platform. Grant applications should: 1) indicate a vessel class or type on which the technology would be installed, 2) describe the transfer system technology and its vessel integration, 3) include preliminary drawings of the proposed transfer system and vessel integration, 4) indicate the intended service area, 5) present statistical wave conditions for the intended service area, and 6) establish the environmental conditions in which the system is operable and demonstrate the increase in the wind farm's availability.

Questions – contact: Greg Matzat, greg.matzat@ee.doe.gov

9. TECHNOLOGY TRANSFER OPPORTUNITY: Energy Efficiency and Renewable Energy

Applicants to Technology Transfer Opportunities should review the section describing Technology Transfer Opportunities on page 3-4 of this document prior to submitting applications.

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Maximum Phase I Award Amount: **$150,000**	*Maximum Phase II Award Amount:* **$ 1,000,000**
Accepting SBIR Phase I Applications: **YES**	*Accepting SBIR Fast-Track Applications:* **NO**
Accepting STTR Phase I Applications: **YES**	*Accepting STTR Fast-Track Applications:* **NO**

Grant applications are sought in the following sub-topic:

a. **Cost-effective Membrane Electrode Assemblies Utilizing Novel Membranes and Non-platinum Group Metal Catalysts for Direct Methanol Fuel Cells**

Development of cost-effective membrane electrode assemblies (MEAs) lies on the critical path for the implementation of many technologies of strategic importance. Presently-available membranes are not optimal for use with fuels such as methanol or liquid fuel systems due to cross-over of organic fuel to the other electrode as well as cross-over of water and oxygen which may contaminate the liquid fuel. Poisoning of the catalysts on electrodes resulting from reaction of the organic materials on the electrodes is a major problem and the cost of presently available catalyst systems is a major obstacle to broader implementation of the technology. There exists then considerable opportunity to modify and replace existing membranes to improve performance as well as to improve the performance of the electrodes in the MEA. Improvement is defined as increasing the operating voltage and current density (power density) by: 1) modification of the electrode structure to optimize for liquid fuel behavior; 2) minimization of the catalyst loading using presently available commercial catalysts to significantly reduce cost while maintaining performance; and 3) replacement of the platinum group metal catalysts with inexpensive transition metal or organic catalysts mounted in novel electrode structures that provide the desired performance at much reduced costs.

The work that is envisioned between the SBIR/STTR grantee and LBNL would involve Technical Transfer of several LBNL IP properties - IB-3169, (http://www.lbl.gov/tt/techs/lbnl3169.html), IB-1553 and IB-1554 (http://www.lbl.gov/Tech-Transfer/techs/lbnl1553.html) and with a possible application of IB-1618 (http://www.lbl.gov/tt/techs/lbnl1618.html). LBNL will propose to work on the optimization of membranes, electrode structures, development of non-platinum group metal catalysts and quality control measures and metrics for MEA manufacturing. The objective is to lower the cost and improve the durability and performance of direct methanol fuel cells for a range of applications including back-up power and other stationary power applications. The SBIR/STTR grantee will contribute to development of MEA manufacturing methods, scale-up and cell stack development and testing. The SBIR/STTR grantee will perform field testing and both organizations will participate in failure analysis and iterative product improvement and durability testing.

Lawrence Berkeley National Laboratory Information:
TTO tracking number: TBD
Contact: Shanshan Li, 510-486-5366, shanshanli@lbl.gov

DOE- POC: Dimitrios Papageorgopoulos, dimitrios.papageorgopoulos@ee.doe.gov

Durable Membrane Electrode Assemblies for Polymer Electrolyte Membrane Fuel Cell Applications

Conventional polymer electrolyte membrane (PEM) fuel cell technology suffers from a lack of durability, high manufacturing costs, and rapid performance degradation. These factors overshadow the technology’s potential benefits and have prevented fuel cells from entering the mainstream automobile, portable electronics, and power generation markets in which customers are price sensitive and selective in their purchases of durable goods. A revolutionary method of building a membrane electrode assembly (MEA) for PEM fuel cells has been developed by Los Alamos National Laboratory (LANL) scientists that can significantly increase durability, reduce manufacturing costs, and extend the lifetime of a fuel cell product. This method incorporates a unique polymer dispersion that can be applied to both perfluorinated sulfonic acid (PFSA) and hydrocarbon-based MEAs to produce superior electrode performance, stability, and durability during harsh fuel cell operating conditions.

The LANL-produced MEA has been evaluated and certified using an Accelerated Stress Test (AST) developed by the DOE in conjunction with car manufacturers. The AST was developed to study the durability of state of-the-art MEAs and includes challenging performance targets (e.g. voltage losses of 0.8 A/cm2 less than 30 mV after potential cycling from 0.6 to 1.0 V for 30,000 cycles at 80°C). When comparing the results of the AST from a premier manufacturer's commercially available MEA versus LANL's novel MEA, the commercially available MEA did not meet the target after 30,000 cycles. However, voltage loss of LANL's MEA still remained below 30 mV even after 70,000 cycles. Results obtained from two other commercially available PFSA dispersions also fell short of the DOE's target with 48 and 33 mV losses after 30,000 cycles. In addition the LANL MEA fabrication process utilizes a novel swelling agent that significantly lowers hot pressing temperatures and improves the interfacial stability of the MEA.

The work that is envisioned between the SBIR/STTR grantee and LANL would involve Technical Transfer of LANL IP on non-aqueous liquid compositions comprising ion exchange polymers (U.S. Patents 7981319; 8394298; 8236207) and on advanced MEAs for fuel cells (U.S. Patent No. 8227147).

Los Alamos National Laboratory Information:
TTO tracking number: TBD
Contact: Mariann Johnston, 505-667-4391, mjohnston@lanl.gov,

DOE- POC: Dimitrios Papageorgopoulos, dimitrios.papageorgopoulos@ee.doe.gov