Syracuse University
Center of Excellence in
Environmental & Energy Systems

CENTERSTATE
CORPORATION FOR
ECONOMIC OPPORTUNITY

Energy & Equity: Exploring New Funding Opportunities for Small Businesses from the U.S. Department of Energy

A SyracuseCoE Research & Technology Forum

November 12, 2021

EPIC Buildings

- Energy Program for Innovation Clusters (EPIC) Project funded as of October 2021 by US DOE
  - Office of Technology Transfer & Building Technologies Office
- Led by SyracuseCoE
  - in partnership with CenterState CEO
- Assisting small businesses in Central New York to
  - Develop and commercialize energy hardware innovations for grid-interactive & energy-efficient buildings
  - Address equity & health in the built environment and diversify the associated workforce

Webinar outline

- Introduction to "America's Seed Fund"
  - Small Business Innovation Research (SBIR)
  - Small business Technology Transfer (STTR)
- Introduction to US DOE SBIR/STTR programs
- Overview of US DOE SBIR/STTR Topics for FY22 Phase I Release 2
- Discussion of selected topics
- Q&A

“America’s Seed Fund”

- **Small Business Innovation Research (SBIR)**
  - Established 1982
  - Requires federal agencies with extramural research budgets >$100M/yr to award a specified portion to “small” businesses
- **Small business Technology Transfer (STTR)**
  - Established 1992
  - Requires federal agencies with extramural research budgets >$1B/yr to award a specified portion to “small” businesses
- Eligible “small” businesses:
  - Typically <500 employees
  - Small Business Administration (SBA) certifies eligibility

Differences Between SBIR and STTR

	SBIR	STTR
Partnering Requirement	Permits partnering	Requires a non-profit research institution partner
Principal Investigator	Primary employment (>50%) must be with the small business	PI may be employed by either the research institution partner or small business (check solicitation)
Work Requirement	May subcontract up to: 33% (Phase I) 50% (Phase II)	Minimum: 40% Small Business 30% Research Institution Partner
Program Size	3.2% (FY19 - $3.28B)	0.45% (FY19 - $453M)
Majority VC ownership	Allowed by some agencies	Not allowed
Participating Agencies	11 agencies (extramural R&D budget > $100M)	5 agencies (extramural R&D budget > $1B)

The small business is ALWAYS the applicant and awardee!

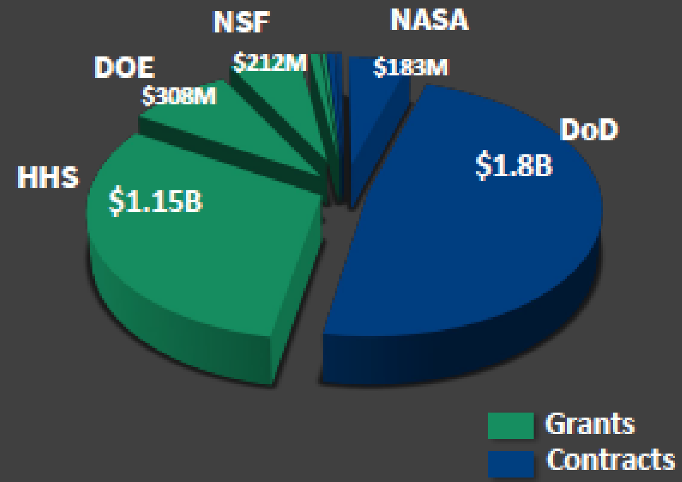
SBA

https://www.sbir.gov/sites/default/files/SBA_SBIR_Overview_March2020.pdf

FY2019 SBIR/STTR Budgets by Agency

Agencies	Budget
Department of Defense (DoD)*	$1.80 B
Department of Health and Human Services (HHS)**, including the National Institutes of Health (NIH)	$1.15 B
Department of Energy (DOE), including Advanced Research Projects Agency – Energy (ARPA-E)	$308 M
National Science Foundation (NSF)	$212 M
National Aeronautics and Space Administration (NASA)	$183 M
U.S. Department of Agriculture (USDA)	$30 M
Department of Homeland Security (DHS)	$17 M
Department of Commerce: National Oceanic and Atmospheric Administration (NOAA)	$9.5 M
Department of Education (ED)	$8.4 M
Department of Transportation (DOT)	$5.2 M
Department of Commerce: National Institute of Standards and Technology (NIST)	$3.9 M
Environmental Protection Agency (EPA)*	$3.6 M

* Budgeted Amount; other Agencies Obligated Amount
** Provides grants and contracts



SBIR: $3.28 Billion
STTR: $453 Million

https://www.sbir.gov/sites/default/files/SBA_SBIR_Overview_March2020.pdf

Three Phase Process

Phase I
Concept Development
6 months – 1 year
~ $50,000 – 250,000

Phase II
Prototype Development
24 months
~ $500,000 – 1.5M

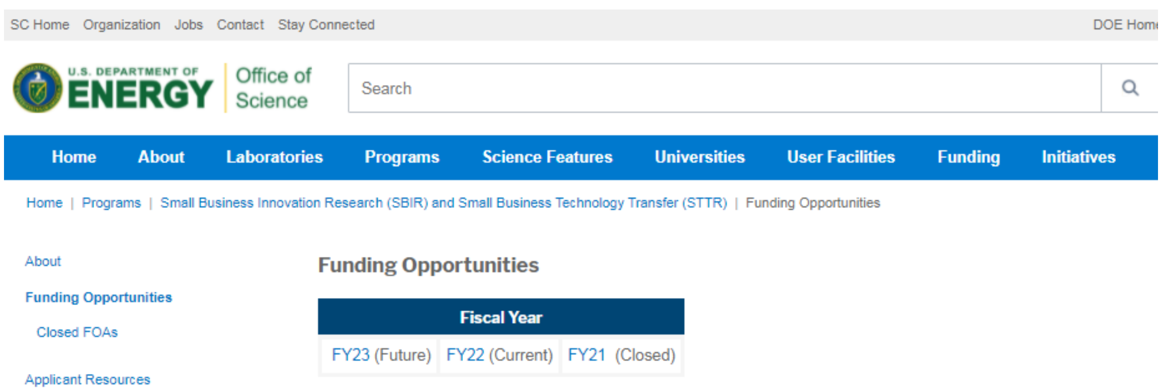
Phase III
Commercialization
Not SBIR funding

SBA

https://www.sbir.gov/sites/default/files/SBA_SBIR_Overview_March2020.pdf

US DOE SBIR/STTR programs

- 2 “Releases” each year for Phase I proposals
  - Each Release focused on a different set of DOE programs
    - Release 1: Basic sciences
    - Release 2: Applied sciences
- https://science.osti.gov/sbir/Funding-Opportunities



2022

Phase I	Release 1	Release 2
Topics Issued	Monday, July 12, 2021	Monday, November 8, 2021
Document	Phase I Release 1 Topics	Phase I Release 2 Topics
Topic Webinar, week of	Webinar 1: Topics 01 – 23 Slides Webinar 2: Topics 25 - 35 Slides	November 16: CESER, NNSA, OE & FE Topics 1- 6 & 21-23 Register November 17: EERE Topics 7-20 Register November 18: FES, HEP & NE Topics 24-38 Register
FOA Issued	Monday, August 9, 2021	Monday, December 13, 2021
Document	DE-FOA-0002554	
FOA Webinar	Phase I Release 1 FOA Webinar Slides	Friday, December 17, 2021*
Letters of Intent (LOI) Due	Monday, August 30, 2021 5:00pm ET	Monday, January 3, 2022 5:00pm ET
Non-responsive LOI Feedback Provided	Monday, September 20, 2021	Monday, January 24, 2022
Full Applications Due	Tuesday, October 12, 2021 11:59pm ET	Tuesday, February 22, 2022 11:59pm ET
Award Notification	Monday, January 03, 2022**	Monday, May 16, 2022**
Projected Grant Start Date	Monday, February 14, 2022	Monday, June 27, 2022
Principal Investigator Meeting		
*Registration link will be posted here, one week prior to the webinars. To receive this link automatically via email, please join our Mail List.		
**Preliminary dates subject to change		

https://science.osti.gov/sbir/Funding-Opportunities

DOE SBIR/STTR FY22 Phase I Release 2 Topics

- 35 Topics
  - 6 SBIR only
  - 1 STTR only
  - 18 either SBIR or STTR
- 147 Subtopics
  - 128 Specific
  - 19 "Other"
- Funding levels:
  - Phase I: up to $200,000 or $250,000 (paid in advance!)
  - Phase II: up to $1.1 million or $1.6 million

DOE SBIR/STTR FY22 Phase I Release 2 Timeline

- Next week: DOE webinars:
  - Tue 11/16 2pm ET: Topics 1-6 & 21-23
  - Wed 11/17 2pm ET: Topics 7-20
  - Thu 11/18 2pm ET: Topics 24-38
- 12/13/21: Funding Opportunity Announcement ("FOA") released
- 1/3/22: Letter of Intent Due
- 2/22/22: Full Application Due
- 5/16/22: Notification of Decisions
- 6/27/22: Grant Start Date

Topics expected to be of interest to webinar attendees (1 of 2)

- 5: Advanced Grid Technologies (SBIR only)
- 6: Advanced Energy Storage and Power Conversion for Energy Equity (SBIR only)
- 7: Community-Driven Solutions for a Just and Equitable Energy Transition
- 10: Thermal Energy Storage
- 15: Solar Energy Technologies
- 16: Solar Energy Technologies (STTR only)
- 19: Advanced Manufacturing

Topics expected to be of interest to webinar attendees (2 of 2)

- 20: Building Technologies
- 21: Innovative Energy Systems
- 22: Carbon Capture and Removal
- 23: Carbon Management
- 32: High-Field Superconducting Magnet Technology
- 34: High-Energy Physics Detectors and Instrumentation

Selected Topics

- Topic 6a: Adaptable, Deployable, and Robust Power Conversion System for Energy Storage Used by Disadvantaged Off-grid Communities
- Topic 10b: Advanced Building Controls for Managing and Controlling Thermal Energy Storage
- Topic 10c: Integrated Thermal Energy Storage in HVAC&R Systems
- Topic 22a: Novel Carbon Capture Technologies Employing Waste Heat in Regeneration of Materials Used in Direct Air Capture

Topic 6a: Adaptable, Deployable, and Robust Power Conversion System for Energy Storage Used by Disadvantaged Off-grid Communities

Remote renewable energy-based power systems deployment is growing in popularity around the world to address energy access challenges. They provide flexible and efficient supply of energy to off-grid communities. However, the lack of in-depth design considerations has resulted in some failures in some off-grid communities. Applications are being sought to develop advanced PCS that can seamlessly integrate various types of storage and renewable technologies and provide sustainable power solutions for disadvantage communities such as on Native Tribal lands. The advanced PCS must be affordable, flexible, and easily deployable for remote communities. The desired PCS rating is >1.5 kW (single user) to 30 kW (community systems) and 120V ac single-phase output. The final design should show a significant increase in performance, flexibility, adaptability (i.e., ability to sense and connect various types of storage and renewable technologies with ease), cost reduction, and decrease in footprint compared to a traditional off-grid power conversion design for remote communities. The PCS should also demonstrate flexible parallel operation to increase power level, as needed, and show advanced control capability that supplies the power to the load continuously while optimizing all power sources requirements.

Topic 6a: Adaptable, Deployable, and Robust Power Conversion System for Energy Storage Used by Disadvantaged Off-grid Communities

- Possible ideas:
  - ”Energy Pod” type of packaged PV +Storage system
  - Easy install (plug and play) and deployment in fields (outside home)
  - Advanced control of Battery/PV

Topic 10b: Advanced Building Controls for Managing and Controlling Thermal Energy Storage

Develop intelligent and robust sensors for TES or controls with look ahead capability to properly schedule the TES charging/discharging. Advanced sensors are needed for TES, such as estimating the TES state of charge. Controls are needed to coordinate the TES operation with other equipment, such as HVAC system, to optimize or co-optimize energy efficiency, user comfort, tear and wear, utility bills, etc. Full control is needed over when/how TES charges and discharges, including considering the state of charge. Built-in robustness is required for ensuring guaranteed control performance by actively rejecting disturbance from the uncertainties associated with weather, occupancy, electricity price etc. The control algorithm should show meaningful improvement over simple schedule-based control algorithms. Additional functionality to control and co-optimize hybrid systems utilizing TES and battery storage is of interest.

Topic 10b: Advanced Building Controls for Managing and Controlling Thermal Energy Storage

- BESTLab at SyracuseCoE has previous extensive research experiences on:
  - Both physics based and data-driven advanced controls for energy storage, and HVAC system
  - The control design is based on weather, occupancy, electricity price, HVAC, etc.
  - Both simulation and experiment studies

- *Dong, B. et al. 2014, February. A real-time model predictive control for building heating and cooling systems based on the occupancy behavior pattern detection and local weather forecasting. In Building Simulation (Vol. 7, No. 1, pp. 89-106). Springer*
- *Mirakhorli, A. and Dong, B., 2018. Market and behavior driven predictive energy management for residential buildings. Sustainable cities and society, 38, pp.723-735.*
- *Fontenot, et al. 2019. Nationwide Evaluation of Potential Energy Savings and Payback of Integrated Building and Battery Energy Storage System through Model Predictive Controls. Build Simul, 2020, pp.1659-1666.*

Topic 10c: Integrated Thermal Energy Storage in HVAC&R Systems

Design and develop turnkey packaged solutions with installation in mind and minimizing on-site customization needs. Systems that are market ready within 2 years are greatly preferred. This requires a thermal storage that is integrated into a packaged system or is combined with central chillers more seamlessly without onsite custom engineering. This also requires maximizing the utility of the storage, by enabling the largest possible cost savings for the building owner or electric utility. Applications that seek to demonstrating the benefits of TES by developing use cases and field validation are also of interest.

The following targets are highly desirable:

- $15/kWh incremental cost of adding TES to the system
- Mass fraction PCM for the whole HX system >90%
- For direct refrigerant evaporator/condenser operation, charge of refrigerant per unit thermal storage < 4 oz per kWh

Topic 22a: Novel Carbon Capture Technologies Employing Waste Heat in Regeneration of Materials Used in Direct Air Capture

DAC technologies are not constrained by the availability of the CO_2 source and can be co-located with power plants or industrial facilities to access low-carbon thermal sources, such as waste heat. Grant applications are sought for the development of processes and/or materials that make use of low-grade waste heat for the regeneration of materials used to capture CO_2 directly from atmospheric air. Proposed DAC technologies should focus on heat not commonly utilized by proposed host site. Unutilized waste heat in the industrial and geothermal sectors are of particular interest. Preference will be given to the applications proposing DAC technologies that maximize the use of thermal energy to regenerate DAC materials. DAC technologies that produce large electrical loads such as vacuum swing desorption, should not be part of any application submitted and will be considered non-responsive to the sub-topic.

Tips and suggestions (1 of 2)

- Attend DOE informational webinar(s) next week
- Learn about the sponsoring program office: relevant technology roadmaps
- Envision success: Commercialization in Year 4!
  - Frame Phase I & Phase II to produce proof-of-concept prototype of commercial product at end of Phase II
  - Engage a large company as an advisor and prospective commercialization partner
- Engage SyracuseCoE & CenterState CEO for feedback and/or introductions to potential partners
  - To arrange a confidential discussion, contact Tammy Rosanio at SyracuseCoE: tlrosani@syr.edu

Tips and suggestions (2 of 2)

- Contact the designated DOE staff member to discuss your concept
- Explore additional resources:
  - DOE Phase 0: SBIR/STTR Assistance Program
    https://doephase0.dawnbreaker.com/
  - Cornell University Center for Regional Economic Advancement SBIR/STTR Assistance Program
    https://crea.cornell.edu/project/sbir-sttr-assistance-program/

Connecting with EPIC Buildings

- Interested in the EPIC Buildings program?
  https://syracusecoe.syr.edu/geb
- Interested in the opportunities for Grid-interactive & Energy-efficient Buildings?
  - "An Introduction to GEB" – Registration Link
    Bing Dong, Syracuse University
    & David Lovelady, National Grid
    Tuesday, November 30, 3:30 PM