

U.S. DEPARTMENT OF
ENERGY

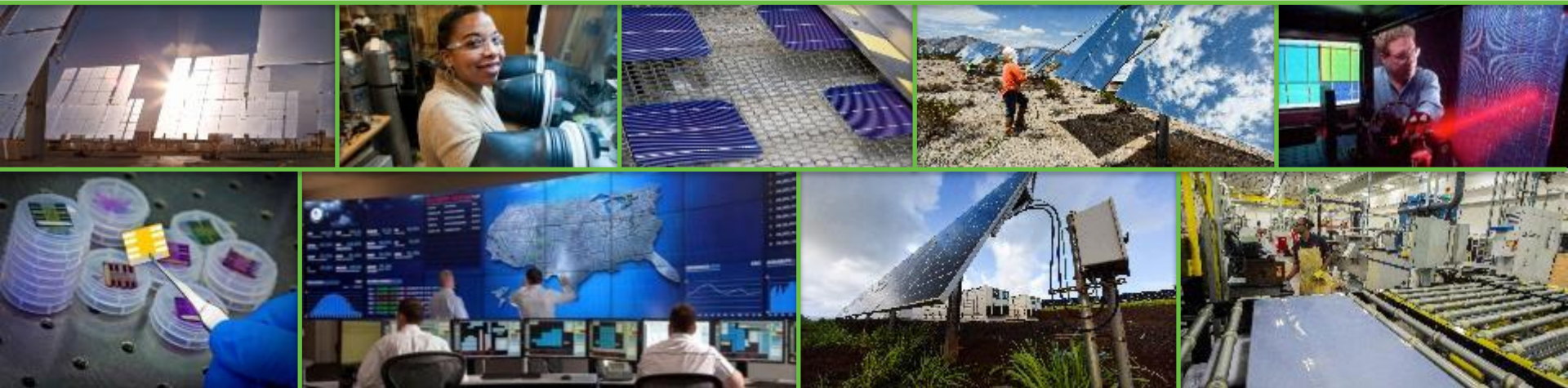
Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY



U.S. DOE FY24 SBIR/STTR Phase I Release 2 SETO Topics Webinar

Solar Energy Technologies Office

December 4, 2023, 2:00 – 3:30pm ET



This WebEx call is being recorded and may be posted on DOE's website or used internally. If you do not wish to have your voice recorded, please do not speak during the call. If you do not wish to have your image recorded, please turn off your camera or participate by phone. If you speak during the call or use a video connection, you are presumed consent to recording and use of your voice or image.

What we will cover in this webinar

- We will discuss only the technical content of the Solar topic (Topic 17). Any question about eligibility, process, criteria, or the Funding Opportunity Announcement should be directed to the DOE SBIR-STTR Office: sbir-sttr@science.doe.gov
- Please read carefully the Funding Opportunity Announcement that will be available at this link on December 11: <https://science.osti.gov/sbir/Funding-Opportunities>
- We will collect questions over chat, but we will NOT answer them “live”. Any questions you ask during the webinar will be reviewed and written responses will be made available to the public on our webpage (<https://energy.gov/solar-office/sbir>) so that everyone can read the answers.
- We DO NOT provide individual feedback on specific applications, ideas, or proposals. In order to be fair to all potential applicants, we discuss only the language of the topics.
- For more info: <https://energy.gov/solar-office/sbir> or contact solar.sbir@ee.doe.gov

Funding Opportunity: FY 2024 SBIR/STTR Phase I Release 2



KEY DATES

FUNDING OPPORTUNITY ANNOUNCEMENT

- Monday, December 11, 2023

MANDATORY LETTER OF INTENT

- Wednesday, January 3, 2024 - 5 pm ET
- Tuesday January 23, 2024 - Non-responsive LOI Feedback

FULL APPLICATIONS

- Wednesday, February 21, 2024 – 11:59pm ET

What we will cover in this webinar

- Who we are (Solar Energy Technologies Office)
- SETO technology-to-market programs
- SETO subtopics
- Technical and business assistance program & the American-Made Network
- Application guidelines

Solar Energy Technologies Office (SETO) Overview

MISSION

We accelerate the **advancement** and **deployment of solar technology** in support of an **equitable** transition to a **decarbonized energy system by 2050**, starting with a decarbonized power sector by 2035

WHAT WE DO

Advance solar technology and drive soft cost reduction to make solar **affordable** and **accessible** for all Americans

Enable solar to **support grid reliability** and pair with storage to provide new options for **community resilience**

Support **job growth, manufacturing**, and the **circular economy** in a wide range of applications



Decarbonizing Electricity and Energy Sectors

- Carbon-free electricity sector by 2035
- 100% clean energy economy with net-zero emissions by 2050
- In a fully decarbonized grid, predictions indicate that **30-50% of U.S. electricity generation would come from solar**
- To meet the 2035 goal, we need to deploy solar at **two to five times the current rate**
- Solar can help decarbonization **beyond electricity**, with solar thermal heat for industrial processes and solar fuel production



Capacity & Economic Impact

The amount of U.S. electricity generated by solar has increased **13 times** in the last 10 years.
PV systems accounted for **46% of all new electric** generating capacity installed in 2022.
In 2022 a new solar project was installed every **44 seconds**.



10,000+

Solar businesses in the U.S.

260,000+

People employed by the solar industry



\$36 billion

Value of the U.S. solar market in 2022

24%

Average annual growth of the solar market in the past 10 years



43% ↓

Solar PV prices have declined to almost half in the past 10 years

80% ↓

Utility-scale PV system prices have decreased tremendously since 2010

Sources: Data from SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight Report 2023
Data from NREL Spring 2023 Solar Industry Update

What we will cover in this webinar

- Who we are (Solar Energy Technologies Office)
- SETO technology-to-market programs
- SETO subtopics
- Technical and business assistance program & the American-Made Network
- Application guidelines

SOLAR ENERGY TECHNOLOGIES OFFICE

Technology to Market Funding Programs

Are you an...



INDIVIDUAL

With an...

Idea

Prototype



Need to be an incorporated business

You should apply for...

American-Made Solar Prize



SMALL BUSINESS

Idea

Prototype



Funding up to \$800K over 1 year
Ease of entry: easy
No cost share



Funding up to \$1.3M* over 3 years
Ease of entry: medium
No cost share



Funding up to \$2M over 2 years
Ease of entry: hard
Must provide cost share

American-Made Solar Prize

SBIR/STTR

Incubator**



LARGE BUSINESS

Idea

Prototype

American-Made Solar Prize

Incubator**

*SBIR/STTR funding level is based on participation in two phases of the SBIR/STTR funding program.

**Incubator can include Incubator funding opportunity announcements (FOAs) or Incubator topics in SETO-issued FOAs.

What we will cover in this webinar

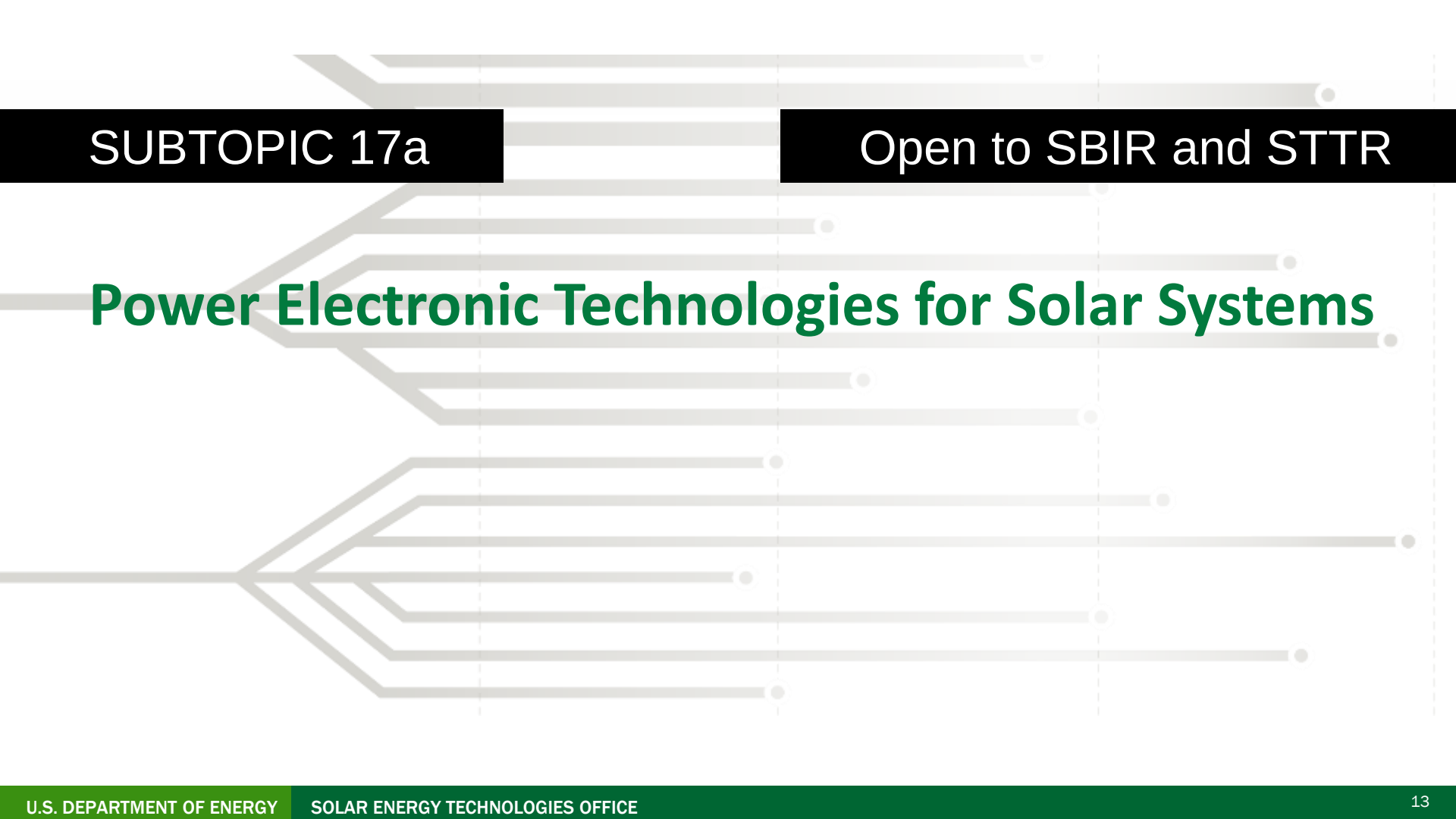
- Who we are (Solar Energy Technologies Office)
- SETO technology-to-market programs
- SETO subtopics
- Technical and business assistance program & the American-Made Network
- Application guidelines

Topic 17

Open to **both** SBIR and STTR applications

Maximum Phase I Award Amount: \$200,000	Maximum Phase II Award Amount: \$1,100,000
Accepting SBIR Phase I Applications: YES	Accepting STTR Phase I Applications: YES
Accepting SBIR Fast-Track Applications: NO	Accepting STTR Fast-Track Applications: NO

- Power Electronic Technologies for Solar Systems
- Supercritical Carbon Dioxide Power Cycles for Concentrating Solar Power (CSP)
- Concentrating Solar-Thermal Power Technologies for Gen3 CSP, Commercial CSP (Gen2 CSP), or Concentrated Solar-Industrial Process Heat (SIPH)
- Solar Hardware and Software Technologies: Affordability, Reliability, Performance, and Manufacturing



SUBTOPIC 17a

Open to SBIR and STTR

Power Electronic Technologies for Solar Systems

Power Electronics for Solar Systems – Looking For...

Goals and Focus

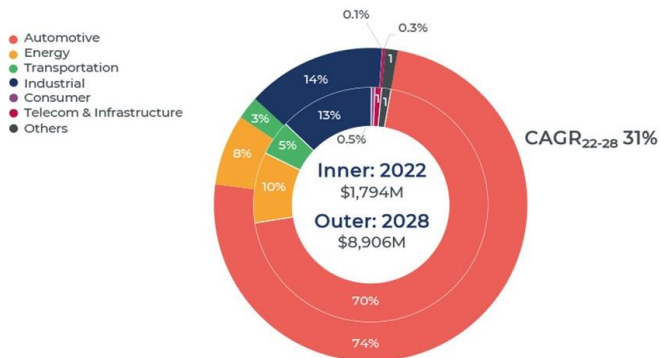
- Develop the **next generation of power-electronic systems** for solar applications demonstrating substantial advantages such as:
 - greater efficiencies,
 - higher power density,
 - lower weight/volume,
 - increased durability/reliability (based on improved design and manufacturing)
 - enhanced functionality and operational flexibility,
 - grid control and support services.
- Create **cost-competitive, high-performance, high-reliability** alternatives to the current state of the art
- Promote the case for **domestic manufacturing** of equipment
- Accelerate **decarbonization** with the utilization of **solar power**

Power Electronics for Solar Systems – Opportunity

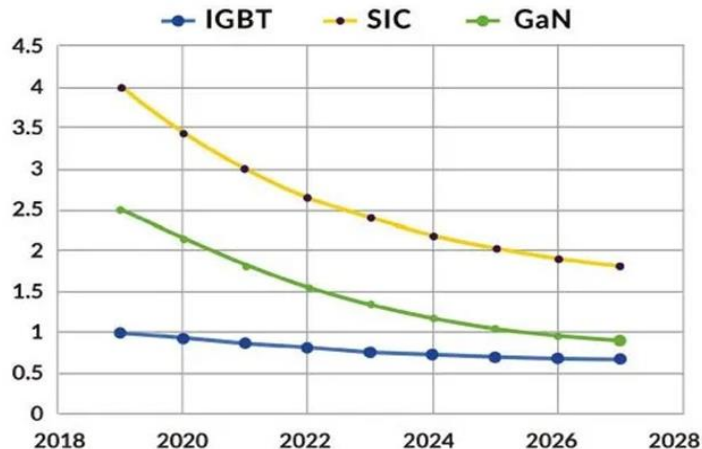
- Accelerated **WBG-device market growth**, driven by the expanding electric vehicle industry
- Dropping SiC/GaN prices driven by the expanding industry

2022-28 - Power SiC market by application

(Source: Power SiC 2023, Yole Intelligence, August, 2023)



<https://www.yolegroup.com/product/report/power-sic-2023/>



<https://ehv.mydigitalpublication.co.uk/articles/gan-on-silicon-comes-of-age-visic->

- Opportunity to use WBG chips in **power-electronics** components for the solar industry in a **cost-competitive way** compared to incumbent technologies.
- The United States is a pre-eminent supplier of high-quality SiC wafers and chips making a **compelling case for domestic manufacturing**

Power Electronics for Solar Systems – Looking For...

Applications

- Power-electronic equipment based on wide- or ultra-wide-bandgap semiconductor materials (SiC, GaN, Ga₂O₃)
 - Inverters, DC/DC converters/optimizers, solid-state transformers
 - Innovative designs and topologies
 - High-frequency transformers, planar magnetics, transformer-less designs
 - Faster switching frequency applications
 - High-power or high voltage applications
 - Design and build processes with potential for automated manufacturing
 - Technical innovation and assessment of the potential for domestic manufacturing
- Multi-port systems integrating distributed PV with **energy storage** and **electric vehicle charging** (including DC fast charging, V2H, V2G) that:
 - Improve generation to demand profile matching
 - Enable operational flexibility
 - Reduce system costs

Power Electronics for Solar Systems – Looking For...

Applications (cont.)

- Advanced power electronic controls
 - Enable operational flexibility and dispatchability
 - Allow for grid control and support services
 - Perform grid forming functionality
- Improved component and system reliability and durability
 - Improve design and manufacturing processes
 - Minimize associated failures and their impacts

Power Electronics for Solar Systems – Not Looking For...

Applications will be considered nonresponsive and declined without external merit review if

- they do not have a **clear, direct, and immediate** relevance and impact to the **solar industry** but rather revolve around **earlier-stage** research and development that would be beneficial to multiple-industries;
- their emphasis is **not power electronic technologies and products** specifically designed **for solar applications** or their focus is **general manufacturing** of power semiconductor devices.



SUBTOPIC 17b

Open to SBIR and STTR

Supercritical Carbon Dioxide Power Cycles for Concentrating Solar Power (CSP)

sCO₂ Power Cycles for CSP

Why is SETO interested in sCO₂ Cycles for CSP?

- sCO₂ cycles such as the recompression Brayton cycle (RCBC) are uniquely beneficial for CSP due to the potential for high thermal to electric conversion efficiency, ability to scale to sizes between 5 and 100 MWe and amenability with dry cooling.
- sCO₂ cycles have thermal to electric conversion efficiencies greater than 50% at temperatures above 700°C.
- CSP has the ability to reach temperatures >700°C while also being able to incorporate thermal energy storage (TES) at large scales.
- sCO₂ systems may also serve as a heat pump; adding energy to CSP thermal energy storage reservoirs is of interest.

sCO₂ Power Cycles for CSP

Goals and Focus

- SETO, Fossil, and Nuclear are all interested in sCO₂ cycles for power generation.
- DOE funded projects, such as STEP, Sunshot, and Apollo have advanced the TRL level of sCO₂ turbomachinery.
- sCO₂ Turbomachinery is nearing maturity as TRL levels are increasing.

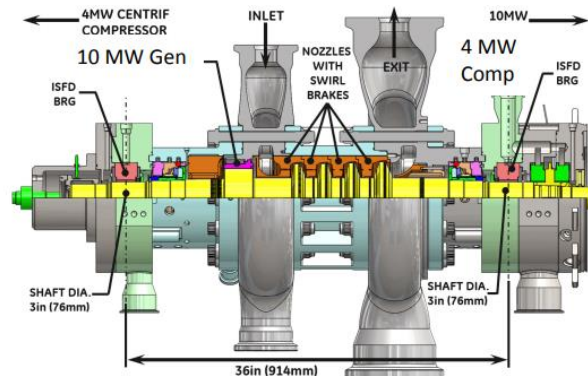
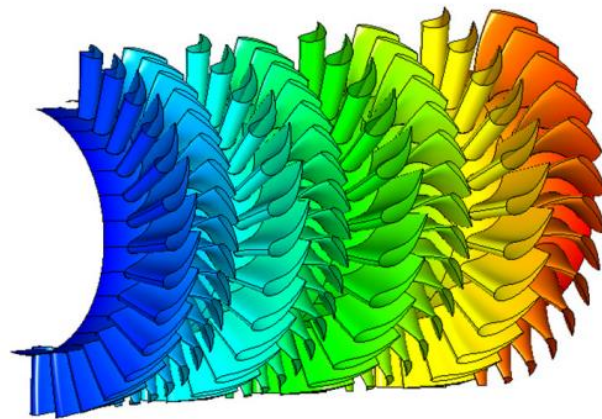


Figure 4: SunShot sCO₂ 10 MWe 27krpm Turbine (Ertas, et. al, 2017)



sCO₂ Power Cycles for CSP

- Further sCO₂ component development including
 - turbomachinery,
 - heat exchangers,
 - piping,
 - dry coolers
- Subcomponents
 - dry gas seals,
 - bearings,
- Supporting systems for high temperature sCO₂ systems and components
 - control systems,
 - modelling,
 - cycle design,
 - metrology,
 - material research



COMPRESSOR IMPELLER

sCO₂ Power Cycles for CSP

Goals and Focus

- Applicants should target concepts that could either:
 - a) immediately be incorporated with commercial nitrate salt based CSP operating a turbine at $> 550^{\circ}\text{C}$ or
 - b) future Gen3 CSP applications with turbine inlet temperatures of 700°C or greater. Concepts targeting commercial CSP applications should clearly identify near term technology transition opportunities.

SUBTOPIC 17c

Open to SBIR and STTR

**Concentrating Solar-Thermal Power
Technologies for Gen3 CSP, Commercial CSP
(Gen2 CSP), or Concentrated Solar-Industrial
Process Heat (SIPH)**

Concentrating Solar Thermal

Opportunity

- This subtopic seeks the development of CSP technologies, components, systems, and materials relevant to either low-cost electricity production or the decarbonization of industrial thermal processes.

Goals

- Develop technologies necessary to advance GEN3 (700C+) efforts
- Support R&D efforts needed to resolve issues with deployed solar facilities (GEN2)
- Enhance the ability of solar energy technologies to contribute to industrial decarbonization efforts by providing industrial process heat (IPH)

Concentrating Solar Thermal

What does CSP have to offer?

- CSP technologies can uniquely deliver high-temperature heat from a renewable source needed for industrial processes and efficient power production
- Existing CSP plants have already demonstrated long durations of daily storage, up to 15 hours, which increases their value to the grid. With integrated TES, CSP plants can produce reliable, dispatchable electricity, regardless of the time of day or amount of cloud cover.
- Continued development of this technology will improve the performance, reliability, and cost of future CSP plants, which have the potential to provide between 25 and 160 GW of U.S. capacity by 2050.
- For next-generation CSP plants, SETO has set a target to lower the cost of electricity from baseload plants, with greater than 12 hours of storage, to \$0.05/kWh by 2030.

Concentrating Solar Thermal

GEN3

- The primary technical strategy being pursued for CSP is to raise the temperature of the heat that next-generation CSP plants deliver to the power cycle, thereby increasing plant efficiency. Specifically, 'Generation 3' Concentrating Solar Power Systems (Gen3 CSP) targets the development of high-temperature components and develops integrated designs with thermal energy storage that can reach operating temperatures greater than 700° Celsius (1,290° Fahrenheit).
- In March of 2021, SETO announced the selection of a Gen3 CSP pathway based on solid particle heat transfer media, led by Sandia National Laboratories, to receive approximately \$25 million to build a megawatt-scale integrated test facility to validate the performance of this system. Improvements in GEN3 CSP technologies are needed in systems, components for particle and gas receivers including, but not limited to, receivers, heat exchangers, thermal energy storage (TES), particle elevators, and in measurement and metrology.

Concentrating Solar Thermal

GEN2

There are nearly 100 CSP plants in commercial operation worldwide, representing almost 7 GW of capacity. SETO, working close with NREL, has identified potential areas of improvement with respect to reliability of these operating CSP plants. The areas of interest include high impact components that affect the operability, O&M costs, or plant installation costs of commercial CSP plants.

Concentrating Solar Thermal

INDUSTRIAL PROCESS HEAT

As a cost-effective alternative to conventional fuels, SETO seeks to advance the deployment of CSP in providing industrial process heat. Developing scalable, low-cost solutions for a variety of applications is a key challenge. Candidate applications for SIPH includes both high and low-temperature processes, such as:

- **LOW TEMP:** enhanced oil recovery, food processing, water desalination, and
- **HIGH TEMP:** calcination to produce cement, thermochemical water splitting for producing solar fuels, and ammonia synthesis for producing fertilizer.

SUBTOPIC 17d

Open to SBIR and STTR

Solar Hardware and Software Technologies: Affordability, Reliability, Performance, and Manufacturing

This subtopic solicits proposal for...

Solar research and technology development within the SETO mission and goals. Specific areas of interest include, but are not limited to:

- Increasing competitiveness of the U.S. solar industry via **innovative software/hardware solutions**;
- **Reduction of manufacturing costs** of solar energy system components or subcomponents to boost domestic manufacturing;
- Measuring, validating, and increasing **outdoor PV system reliability**;
- Improving **operation and maintenance of PV systems**;
- Enhancing the ability of solar energy systems to contribute to **grid reliability, resiliency, and physical and cyber security**;
- Reduction of the **balance-of-system costs** of a PV system;
- Developing hardware components for **photovoltaic-thermal (PVT) technologies**, including solar modules, collectors, and control systems;
- Enabling the development and operation of **virtual power plants (VPPs)** with clear focus on **solar distributed energy resources (DER)**;

This subtopic solicits proposal for... (cont.)

Solar research and technology development within the SETO mission and goals. Specific areas of interest include, but are not limited to:

- Improving the overall **recyclability and refurbishment** of PV modules and/or other hardware or balance-of-system components of a solar system;
- **Building on other SETO programs** and/or leverage results and infrastructure developed through these programs;
- Developing components and systems for **application-specific** needs such as building-integrated photovoltaics (**BIPV**), vehicle-integrated photovoltaics (**VIPV**), floating photovoltaics (**FPV**), or other **infrastructure-integrated photovoltaic systems**.
- Developing technologies or solutions for **solar for grazing lands** (primary interest) and other **agricultural PV (APV)** uses, where solar systems are collocated with agricultural processes and activities.

Applications specifically not of interest

The following types of application will be considered nonresponsive and declined without external merit review -

- Focus exclusively on HVAC or water heating applications;
- Propose products or projects for satellite or other space applications;
- Proposed products or applications of indoor or wearable PV;
- Propose development of concentrated PV or solar spectrum splitting technologies;
- Propose development of technologies with very low possibility of being manufactured domestically at a competitive cost (e.g., PV modules based on copper zinc tin sulfide (CZTS) or amorphous silicon thin films; technologies assuming incorporation of functional materials, such as quantum dots or luminescent solar concentrators);
- Propose technologies to improve the shade tolerance of PV modules;
- Include on business plans or proofs of concept that do not contain documentation supporting their necessity or benefit. Competitive approaches in this application segment should be clearly defined in the application;
- Focus on undifferentiated products, incremental advances, or duplicative products;

Applications specifically not of interest (cont.)

The following types of application will be considered nonresponsive and declined without external merit review -

- Involve technologies that do not have a clear, direct, and immediate relevance and impact to the solar industry and do not have an immediate solar application or product as their end goal;
- Propose projects lacking substantial impact from federal funds. This subtopic intends to support projects where federal funds will provide a clear and measurable impact (e.g., retiring risk sufficiently for follow-on investment or catalyzing development). Projects that have sufficient monies and resources to be executed regardless of federal funds are not of interest;
- Duplicative software solutions with many existing competitors in the market, including software to facilitate system design or system monitoring and any software solution to improve customer acquisition processes;
- Propose development of ideas or technologies that have already received federal support for the same technology at the same technology readiness level.

What we will cover in this webinar

- Who we are (Solar Energy Technologies Office)
- SETO technology-to-market programs
- SETO subtopics
- Technical and business assistance program & the American-Made Network
- Application guidelines

Technical And Business Assistance (TABA) Program



Additional funding for commercialization activities in addition (again, for emphasis!) to your R&D award funding

Up to \$6,500 in Phase I:
total award amount = \$200,000 + \$6,500 = \$206,500

Up to \$50,000 in Phase II:
total award amount = \$1,100,000 + \$50,000 = \$1,150,000

two execution options

Phase I only

Work with a vendor provided by DOE ->
No need to do anything at this point

Phases I & II

Select your preferred vendor -> Include it in your Application!!

TABA commercialization services include:

**Product
Sales**

**IP
Protections**

**Market
Research**

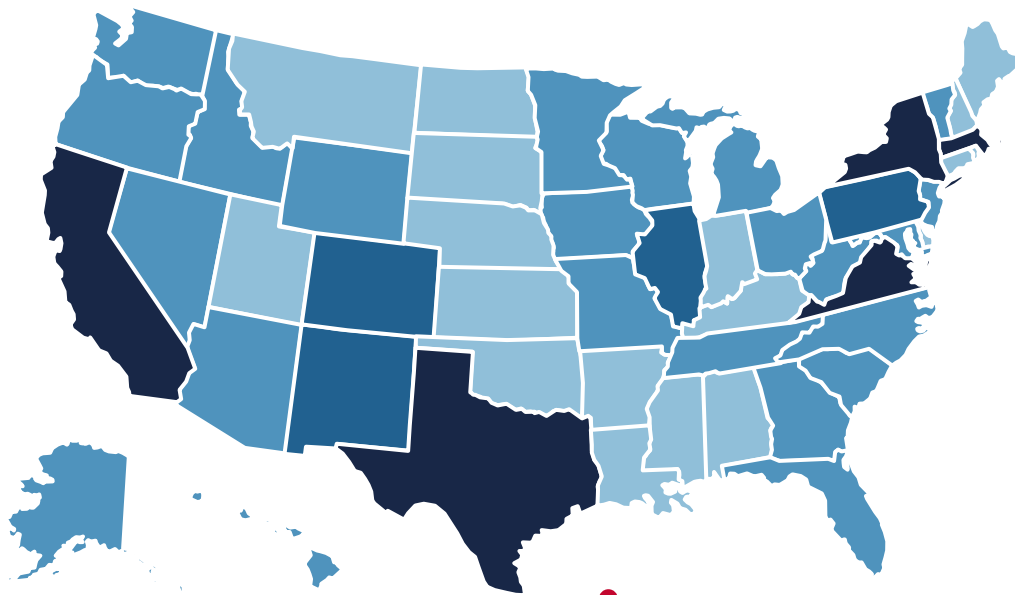
**Certification
& Regulatory
Plans**

**Market
Validation**

**Manufacturing
Plans**

For more information, take a look [here](#)

American-Made NETWORK



 **200+**

NETWORK
MEMBERS



None 1-5 6-10 10+

Network members **fuel America's Innovation Engine**, propelling innovators into a successful cleantech future. These members of the public and private sectors are committed to **reenergizing American energy innovation**. Each one is actively seeking to provide mentoring, tools, resources, and support to accelerate ideas into real-world solutions for environmental justice and economic renewal.

AMN@nrel.gov

<https://network.americanmadechallenges.org/>

Application Education Services



Resources:

- Application Education
- Webinars
- Workshops
- Office hours

Application Education Services



Frank Yang – frank@adlventures.com

Athanasios Tsouknidas – athanasios.tsouknidas@adlventures.com

Nigara Nizamidin – nigara.nizamidin@adlventures.com



Lynn Abramson, Andy Barnes, Allie Judge, and Awa Darboe
cebn@cebn.org



Thomas Jensen – admin@entrepreneurfutures.org



Jerry Cronin – jcronin@odu.edu

Steve Goad – hgoad@odu.edu



Amanda Buchanan – amanda.buchanan635@gmail.com

Casey Carrillo – ccarrillo@uaci.com

What we will cover in this webinar

- Who we are (Solar Energy Technologies Office)
- SETO technology-to-market programs
- SETO subtopics
- Technical and business assistance program & the American-Made Network
- **Application guidelines**

Manufacturing and Competitiveness Project Approach

Promote activities that amplify the impact of R&D projects and enable technology transformations from prototypes to real-world, viable solutions.

Research & Development



Market relevant and
self-sustaining technology

Plan

T2M road-
mapping

IP strategy

Product-market
fit

Path to scale

Validate

Competition

Standards

Analysis

External
feedback

Engage

Diversity

Partnerships

Follow-on
funding

Customer
discovery

Application guidelines

- Phase I awards will be in the form of a **grant**.
- Applicants are strongly encouraged to include a table containing a **summary of objectives** they expect to achieve by the end of the Phase I period of performance. Each application should include **technical, business, and stakeholder engagement**-related objectives with clear, quantifiable, measurable, verifiable, aggressive yet realistic success metrics, and clear definitions of how completion of an objective will be assessed. Completion of a task or activity should not be considered an objective. The table should be organized chronologically.
- SETO expects applicants to plan their project execution using **SMART** (Specific, Measurable, Achievable, Relevant, and Time-Bound) **milestones** and goals.
- SETO expects to issue Phase II awards as **Cooperative Agreements**. In a cooperative agreement, DOE maintains substantial involvement in the definition of the scope, goals, and objectives of the project. A similar table will be required in a Phase II application. DOE has the **possibility to negotiate project milestones** with entities selected for a Phase II award.

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

The SBIR/STTR programs encourage U.S.-based small businesses to engage in **high-risk, innovative research and technology development** with the **potential for future commercialization**.

The solar office funds businesses working to **advance the affordability, reliability, and performance of solar technologies** on the grid. Solar topics may include photovoltaics, grid integration, solar plus energy storage, and community solar, among others.

SMALL BUSINESS INNOVATION RESEARCH

- Use **small business** to meet federal research and development needs
- Increase **private-sector commercialization** of innovations derived from federal research and development
- **Principal investigator must be employed by the small business**
- **Majority of the research and development tasks to be conducted by the small business**

SMALL BUSINESS TECHNOLOGY TRANSFER

- Cooperative research and development carried out **between small business and nonprofit research institution**
- Foster **technology transfer** between research institutions and small business
- **Principal investigator may be employed by the small business OR research institution**
- A minimum of **30% of the research and development tasks to be conducted by the research institution**

Learn About Upcoming Funding Opportunities

EERE Funding Opportunity Updates

Promotes the Office of Energy Efficiency and Renewable Energy's funding programs.



SIGN UP NOW:

[energy.gov/eere/funding/
eere-funding-opportunities](https://energy.gov/eere/funding/eere-funding-opportunities)

SETO Newsletter

Highlights the key activities, events, funding opportunities, and publications that the solar program has funded.



SIGN UP
NOW:

energy.gov/solar-newsletter

THANK YOU!

<https://energy.gov/solar-office/sbir>

<https://www.energy.gov/eere/solar/funding-opportunity-announcement-sbirsttr-fy-2024-phase-i-release-2>

solar.sbir@ee.doe.gov



SBIR · STTR
America's Seed Fund

SUPPORTING **small business** SOLAR INNOVATIONS