

U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY



U.S. DOE FY23 SBIR/STTR Phase I Release 2 SETO Topics Webinar

Solar Energy Technologies Office

November 30, 2022



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 topics (Topic 15 and Topic 16). 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 12: <https://science.osti.gov/sbir/Funding-Opportunities>
- 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. Any questions you will ask during the webinar will be made available to the public on our website so that everyone can read the answer.
- For more info: <https://energy.gov/solar-office/sbir> or contact solar.sbir@ee.doe.gov

Funding Opportunity: FY 2023 SBIR/STTR Phase I Release 2



KEY DATES

FUNDING OPPORTUNITY ANNOUNCEMENT

- Monday, December 12, 2022

MANDATORY LETTER OF INTENT

- Tuesday, January 3, 2023 - 5 pm ET

FULL APPLICATIONS

- Tuesday, February 21, 2023 – 11:59pm ET

We will provide a written response to all questions received
today on this page:
energy.gov/solar-office/sbir

What we will cover in this webinar

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

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 the 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



Solar Hardware Technologies

Photovoltaics (PV)



Utility-Scale PV



Rooftop Solar



Solar + Agriculture

Concentrating Solar-Thermal Power (CSP)



Power Tower CSP



Trough CSP



Thermal Storage

Systems Integration



Energy Storage



Inverters



Sensors

Capacity & Economic Impact

Solar capacity has grown **35-fold** in the last 10 years. Solar energy accounted for **40% of all new electrical** generating capacity installed in 2020.



10,000+

Solar businesses in the U.S.



\$24 billion

Value of the U.S. solar
market in 2020



45% ↓

Solar PV prices have dropped
almost in half over the last 5 years

Source: Data from SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight Report

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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.

American-Made Challenges



<https://americanmadechallenges.org/>

Solar Manufacturing Incubator

For Profit
Team Lead

Periods of
performance
1 – 3
years

20 - 50%
Cost Share

Awards
range
Up to \$8M



DOE-GSA Green Proving Ground (GPG) RFI

- The GPG RFI is a DOE-GSA-National Labs collaboration
- GPG began reducing risk in 2011, augmented in 2022 by regional **Applied Innovation Learning Labs**
- National Lab **TRL-7** field evaluations are typically for one year
- Product testing under real-world conditions by neutral 3rd party experts: National Labs



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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

two execution options

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

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 Challenges



Accelerator for U.S. Domestic Energy and Global Business Opportunities

The American-Made Challenges incentivize the nation's entrepreneurs to strengthen American leadership in energy innovation and domestic manufacturing. These new challenges seek to lower the barriers U.S.-based innovators face in reaching manufacturing scale by accelerating the cycles of learning from years to weeks, while helping to create partnerships that connect entrepreneurs to the private sector and the network of DOE's National Laboratories across the nation.

A Prize Model That Drives American Innovation

 **216**

STARTUP TEAMS
FUNDED

 **\$19M+**

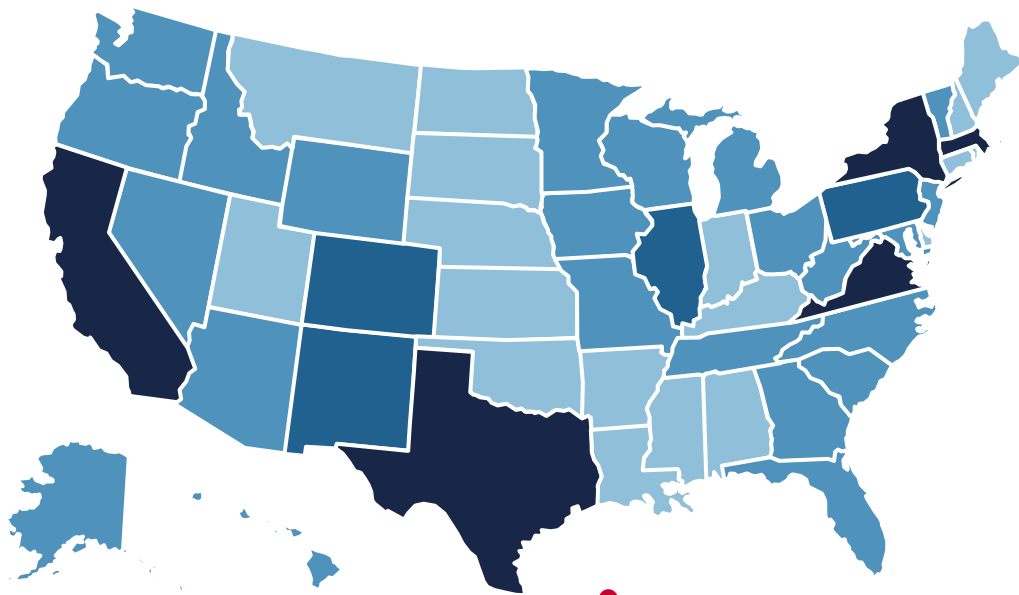
IN CASH PRIZES
AWARDED

 **200+**

NETWORK
MEMBERS

<https://americanmadechallenges.org/>

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.

Matchmaking tool



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

Matchmaking tool



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

Matchmaking tool

These are the connectors that we think are professionally suited to help you in this challenge.

Connector	Match Score	Quality Match	Capabilities	Buttons
BB Brendan Bagiotti CPP Wind Engineering & Air Quality Consultants	88%	Quality Match	Business Development & Commercialization	Message (highlighted), Follow
AJ Adil Jafry CleanX Ventures	85%	Quality Match	Business Development & Commercialization, Strategy, Funding & Investments	Message, Follow
LL Larry Lien Rice Alliance for Technology and Entrepreneurship, Rice University	85%	Quality Match	Business Development & Commercialization, Strategy, Funding & Investments	Message, Follow

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

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Larry Lien LL Rice Alliance for Technology and Entrepreneurship, Rice University	85% Quality Match	Business Development & Commercialization, Strategy, Funding & Investments	Message, Follow

It's a Match!

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

Application Education Services



Resources:

- Application Education
- Webinars
- Workshops
- Office hours

https://www.cebn.org/media_resources/sbir-events/

Application Education Services



Oliver Booth

oliver@adventures.com



Annabelle Swift

aswift@cebn.org



Thomas Jensen

tjensen@entrepreneurfutures.org



Amanda Buchanan

Amanda.buchanan635@gmail.com



Dana Catron

dderego@nmsu.edu

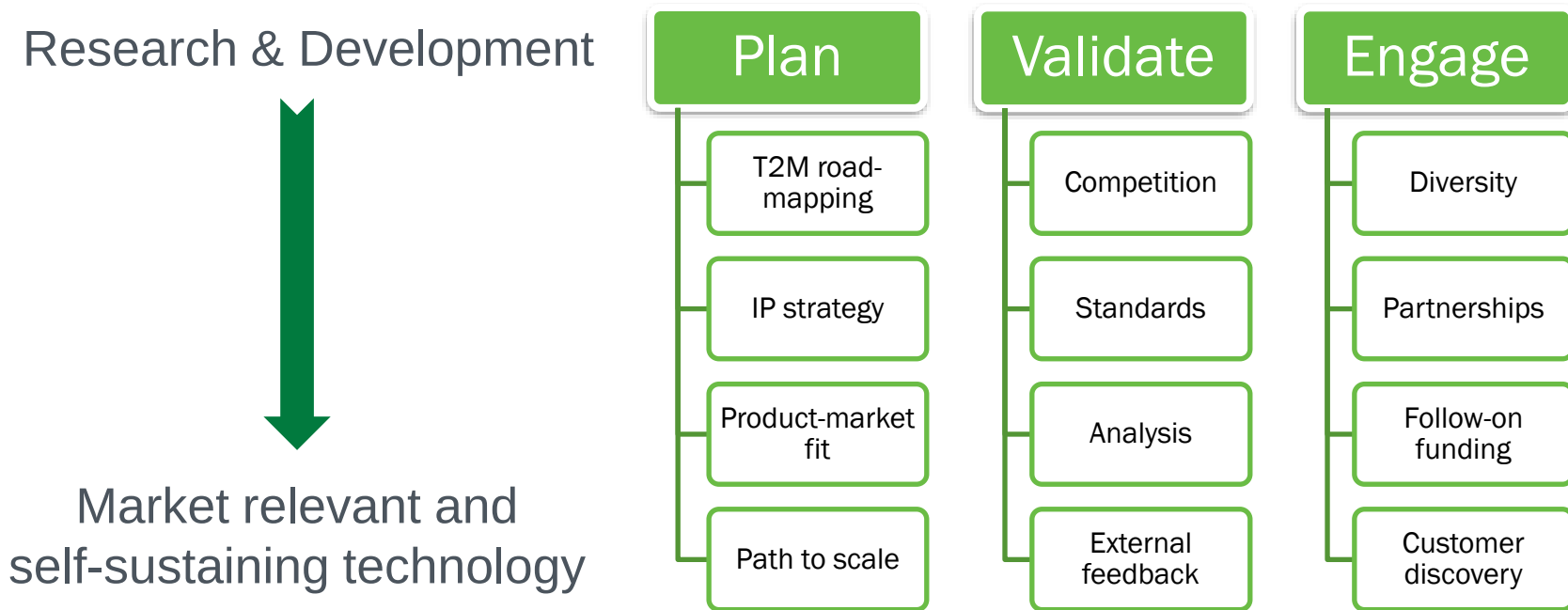
Get in touch:
AMN@nrel.gov

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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.



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 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.

THIS TABLE IS PROVIDED AS AN EXAMPLE ONLY. PERFORMANCE METRICS AND SUCCESS VALUES LISTED HERE SHOULD BE CONSIDERED AS EXAMPLES AND DO NOT NECESSARILY REPRESENT OFFICE GOALS OR SUCCESS METRICS FOR THIS TOPIC.						
#	Month of completion	Performance Metric	Success Value	Assessment Tool / Method of Measuring Success Value	Verification Process	Metric Justification, Additional Notes
1	2	Cell efficiency	> 25% efficiency	Average, standard deviation. At least 10 cells measured under standard conditions. Standard deviation < 1% (absolute efficiency)	Raw data and report sent to DOE for verification	The success value was chosen based on initial cost modeling: efficiency lower than 25% makes this material not competitive with current state of the art
2	3	Circuit model curation	> 30 models, of which at least 20 suitable for testing	Count. 30 realistic and anonymized candidate distribution circuit models identified, of which at least 20 are suitable for detailed testing	Report sent to DOE with description of circuit models including load models, impedances, and connectivity characteristics	Load models, impedances, and connectivity characteristics have to be included in the report to assess the feasibility of the proposed circuits
3	4	Webinar	> 100 participants, of which at least 20 installers and at least 40 developers	Count. A minimum of 100 people should attend for at least 50% of the webinar. The audience should include at least 20 installers operating in the states object of this award, and at least 40 developers. The webinar should include effective ways to engage with the audience, including but not limited to interactive polls and live Q&A sessions	Link to the webinar sent to DOE before the event. Report sent to DOE including slides presented, list of attendees and their affiliation after the conclusion of the event.	Specific audience groups identified to make sure that the relevant stakeholders will receive the content developed during this award.
4	4	Feedback	> 10 potential users	Count. A minimum of 10 potential users of the tool will undergo a demo of the software (in-person or webinar) and provide their feedback. Users must provide specific feedback as to the minimum availability and response time they require for their specific use case.	Documentation of feedback, written approval/signature from feedback providers, and a justified plan to implement or reject recommendations submitted to DOE. Documentation should also include the proposal for availability and response time metrics with	User feedback is a critical part of an iterative development cycle to ensure the solution is useful to potential off-takers.

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**

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Topic 15

Open to 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: YES	Accepting STTR Fast-Track Applications: YES

SUBTOPIC 15a

Open to SBIR and STTR

**Wide-bandgap-based Power Electronics for
Solar Inverters, Converters, and Multi-port
Systems that Integrate Solar Generation with
Energy Storage and/or Electric Vehicle Charging**

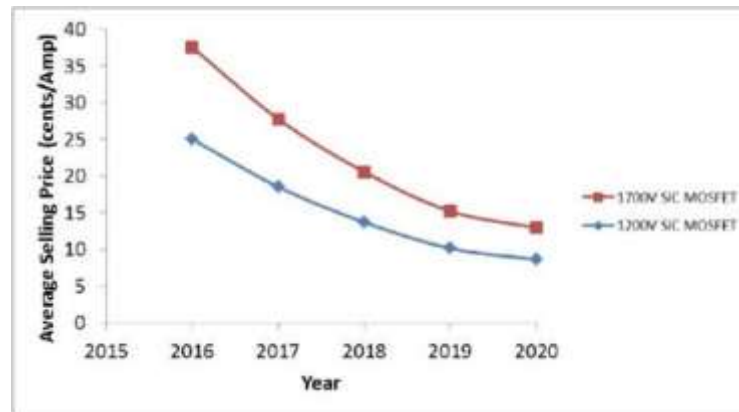
Next-Generation Power Electronics – Opportunity

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

2019-2025 power SiC market forecast split by application



http://www.semiconductor-today.com/news_items/2020/nov/yole-161120.shtml



https://www.nist.gov/system/files/documents/pml/high_megawatt/Banerjee-APPROVED.pdf

- 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**

Next-Generation Power Electronics – Looking For...

Goals and Focus

- Develop the next generation of power-electronic components integrating and leveraging the **benefits of wide-band-gap materials** (like SiC or GaN), such as:
 - greater efficiencies,
 - higher power density,
 - lower weight/volume,
 - higher operating temperatures.
- Create **cost-competitive**, high-**performance**, high-**reliability** alternatives to silicon-based equipment
- Promote the case for **domestic manufacturing** of equipment
- Accelerate **decarbonization** of the electricity system with the utilization of **solar power**

Next-Generation Power Electronics – Looking For...

Applications

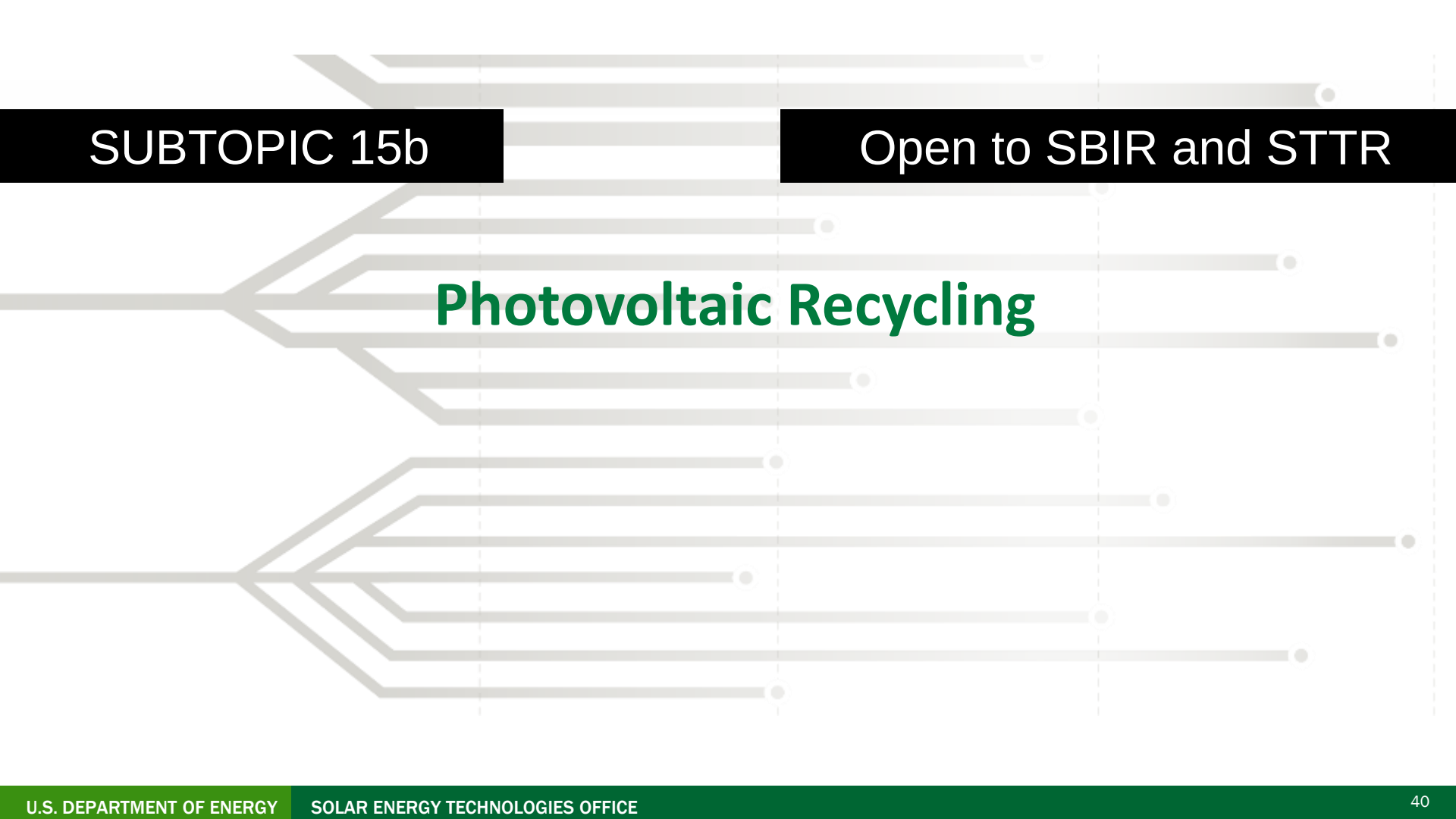
- Extending the state of the art in areas such as (but not limited to):
 - Innovative inverter/converter **designs and topologies** (impact on manufacturing),
 - **transformer-less** designs,
 - **planar magnetics**,
 - **faster switching** frequency applications,
 - **high-power** applications,
 - **high-voltage** applications,
 - **design and build processes**.
- Involving novel multi-port systems integrating solar with **energy storage** (including novel storage tech) and **EV charging** (including DC fast charging, V2H, V2G) that:
 - Enable operational flexibility
 - Improve generation to demand profile matching
 - Reduce system costs
- Combining technical innovation with assessment of the **potential for domestic manufacturing**

Next-Generation Power Electronics – Not Looking For...

Applications focused on power conversion without including or incorporating wide-bandgap power electronics into the power conversion topology will be considered non-responsive and declined without external merit review

Applications will be considered nonresponsive if they address self-consumption optimization exclusively and are not grid-interactive





SUBTOPIC 15b

Open to SBIR and STTR

Photovoltaic Recycling

Photovoltaic Recycling

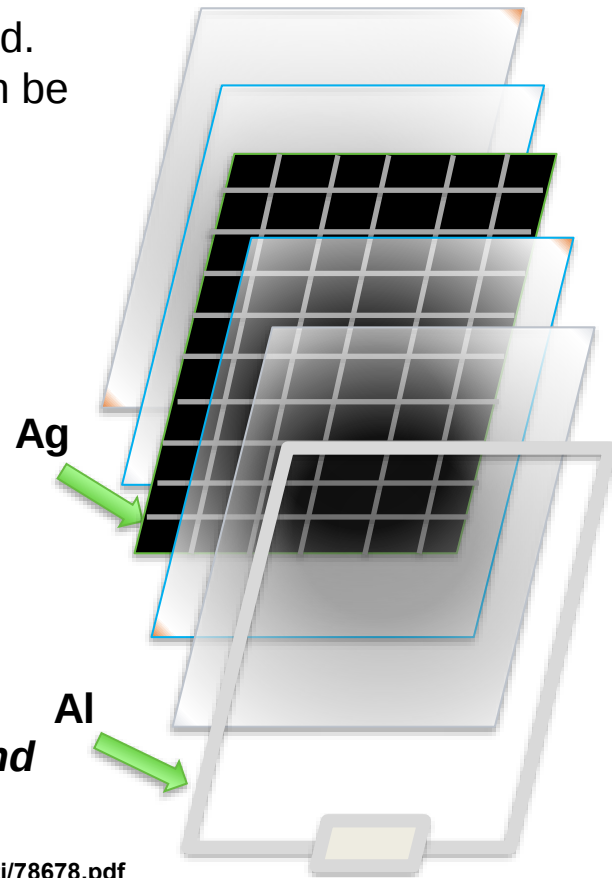
Toward End-of-Life (>20y), older PV modules are decommissioned. Very often the modules still retain significant performance and can be refurbished and resold.

Those that cannot still contain valuable elements such as Silver, Aluminum, Cadmium, Tellurium and Indium

Module recycling and refurbishment opportunities include:

- Improved designs for ease of recycling or refurbishing
- Designs for reduced recycling burden
- Lower cost approaches to recycling or refurbishing
- Methods that facilitate the refurbished module market

Not of interest: applications focused exclusively on resale platforms or software/web platforms to facilitate a secondhand hardware market



NREL "Best Practices at the End of the Photovoltaic System Performance Period" www.nrel.gov/docs/fy21osti/78678.pdf

SUBTOPIC 15c

Open to SBIR and STTR

Solar Systems Resilient to Weather-related or Cyber Threats

Solar System Resilience

Opportunity

- The electrical grid and **solar generation assets**, are **vulnerable to disruptive events**. **Increased asset resilience** presents opportunities to **maximize operability and energy availability** and **minimize restoration costs** following these occurrences

Goals

- Improve the ability of solar assets or electronic devices associated with solar systems to **quickly recover** from
 - **Weather-related** events and threats
 - **Cyber** events and threats.
- Enhance the ability of solar energy technologies to **contribute to grid reliability and resilience**

Areas of Interest

- Component or system designs that
 - improve **survival**,
 - improve **recovery** time,
 - minimize **cost** of disruptive events,
 - ensure **access control**,
 - ensure **confidentiality, integrity, availability**,
 - use passive or active approaches.
- Inclusion of
 - description of addressed **components** and **deterred threats**;
 - **cost/benefit** of proposed solution compared to current state of the art;
 - system **integration and interoperability**;
 - identification of **compromises**.
- Applications will be considered nonresponsive if they do not demonstrate clear innovation compared to the current state of the art.

SUBTOPIC 15d

Open to SBIR and STTR

Heliostat Components and Systems for Low-Cost, Autonomous, and High-Concentration Solar Collectors

HelioStat Components and Systems for Low-Cost, Autonomous, and High-Concentration Solar Collectors

To advance heliostat technology development, SETO has established a National Laboratory-led consortium on heliostat technology, HelioCon.

- In September 2022, HelioCon released a detailed Roadmap describing the key technical gaps and promising strategies to achieve low-cost, high-performance heliostat systems.
 - HelioCon: <https://heliicon.org>
 - Roadmap: https://heliicon.org/roadmap_report_release.html

SETO is seeking new heliostat components technologies for low-cost installation and high-accuracy operation of high concentration solar collector systems.

- Innovation of interest include, but are not limited to:
 - Heliostat Structure;
 - Mirror Facets;
 - Mirror Facet Alignment Systems;
 - Wireless Control Systems;
 - Heliostat Drives.

Detailed Areas of Interest

- **Heliostat Structure**

- SETO seeks to advance the use of low-cost composite materials in heliostats.

- **Mirror Facets**

- The reflective surface of a heliostat is made up of 1 or more mirrored facets. These facets are often comprised of a mirror and a structural backing.
 - SETO is seeking a composite sandwich facet design with 2 mm or less of highly reflective glass mirror or other reflective material, capable of meeting the heliostat operational targets as well as the optical requirements below:
 - Average Reflectivity > 95.5%
 - Precision < 1.5 mrad total RMS

- **Mirror Facets Alignment Systems**

- Larger heliostats, with many mirror facets, typically require in-situ adjustment just after installation and periodically require recalibration.
 - SETO is seeking facet designs or mirror facet to structure interfaces that allow for infield canting adjustments in less than ~15 minutes.

Detailed Areas of Interest

- **Wireless Control Systems**

- Maturing wireless control systems to a commercial off-the-shelf product would ultimately provide tremendous risk and cost reduction, eliminating the need for heliostat designers to take on the software development.
- SETO seeks to mature the heliostat wireless control system and meet the following goals:
 - Flexible – database or variable driven. Adaptable to multiple heliostat fields
 - Closed loop – Calibration and Normal Operations
 - Secure – Secure from attack (DOS, Control Interference)
 - Safe – Fail-safe, fault-tolerant architecture. Free of common cause failure

- **Heliostat Drives**

- The drive systems represent the largest component cost of a heliostat.
- SETO seeks to advance drive technologies, while reducing total cost (combination of initial cost, power requirement, accuracy, expected lifetime, and maintenance over the desired 30-year life of a CSP tower system).

SUBTOPIC 15e

Open to SBIR and STTR

Concentrating Solar-Thermal Power Technologies for Gen3 CSP or Industrial Decarbonization

Concentrating Solar-Thermal Power Technologies for Gen3 CSP or Solar-Thermal Industrial Decarbonization

SETO seeks innovative components and systems for concentrating solar-thermal technologies for both electricity production and solar-thermal industrial process heating.

– Innovation of interest include, but are not limited to:

- Receivers and thermochemical reactors;
- Solid particle transport systems;
- Thermal energy storage;
- Heat exchangers;
- Components for supercritical carbon dioxide power cycles.

Detailed Areas of Interest

- **Receivers and thermochemical reactors**

- SETO seeks to advance next-generation high-temperature solar thermal receivers and thermochemical reactors that can achieve temperatures above 700 °C for concentrating solar power & process heat applications
- Resources:
 - Next-Generation High-Temperature Solar Thermal Receivers for Concentrating Solar Power Systems
 - https://www.mdpi.com/journal/energies/special_issues/Solar_Thermal_Receivers

- **Solid Particle Transport Systems**

- The falling particle receiver is a technology that can increase the operating temperature of concentrating solar power systems, improving efficiency and lowering the costs of energy storage. SETO is seeking advancements in the technology, or new concepts, in the transportation of such particles throughout the next generation falling particle CSP plant.
 - Information on the Gen 3 Particle Pilot Plant (G3P3): Integrated High-Temperature Particle System for CSP
 - <https://www.energy.gov/sites/default/files/2021-08/Executive%20Summary%20-%20Gen3%20Particle%20Pilot%20Plant%20%28G3P3%29%20-%20Sandia%20National%20Laboratories.pdf>

Detailed Areas of Interest

- **Thermal Energy Storage (TES)**

- SETO is seeking to expand the dispatchability and availability of CSP plants to provide value to grid operators, with an emphasis on:
 - Long duration storage - greater than 12 hours
 - Concepts that expand the availability of CSP plants for weekly or seasonal dispatch
 - Development of pumped TES for overnight electricity generation
 - Balance of plant and full plant systems models of CSP plants

- **Heat Exchangers**

- SETO seeks to advance the technologies in Particle/Supercritical-CO₂ Heat Exchangers for use with next-generation high-temperature solar thermal receivers, that achieve temperatures above 700 °C, for concentrating solar power & process heat applications

- **Components for supercritical carbon dioxide power cycles**

- SETO seeks solutions that will significantly reduce the cost of supercritical carbon dioxide power cycles or increase efficiencies.

SUBTOPIC 15f

Open to SBIR and STTR

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

Areas of interest

Anything within the SETO mission and goals, with a specific emphasis on:

- 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 security;
- Reduction of the balance-of-system costs of a PV system;
- Building on other SETO programs and/or leverage results and infrastructure developed through these programs;
- Components and systems for application-specific needs such as integration with vehicles or agriculture, or special climates.

Areas NOT of interest (applications declined without merit review)

- Focus exclusively on HVAC or water heating applications;
- Propose products or projects for satellite or other space applications;
- 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;
- Business plans or proofs of concept that do not include documentation supporting their necessity or benefit;
- Undifferentiated products, incremental advances, or duplicative products;
- Projects lacking a substantial, clear, and measurable impact on the solar industry resulting from federal funds (e.g., retiring risk sufficiently for follow-on investment or catalyzing development);
- 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.

Topic 16

Open to STTR applications only

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

SUBTOPIC 16a

Open to STTR only

Transferring Novel Solar Technologies from Research Laboratories to the Market

Areas of interest

Anything within the SETO mission and goals, with a specific emphasis on:

- Increasing competitiveness of the U.S. solar industry via innovative software/hardware solutions;
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QUESTIONS

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

<https://www.energy.gov/eere/solar/funding-opportunity-announcement-sbirsttr-fy-2023-phase-i-release-2>

solar.sbir@ee.doe.gov

Learn About Upcoming Funding Opportunities

EERE Funding Opportunity Updates

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



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