U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

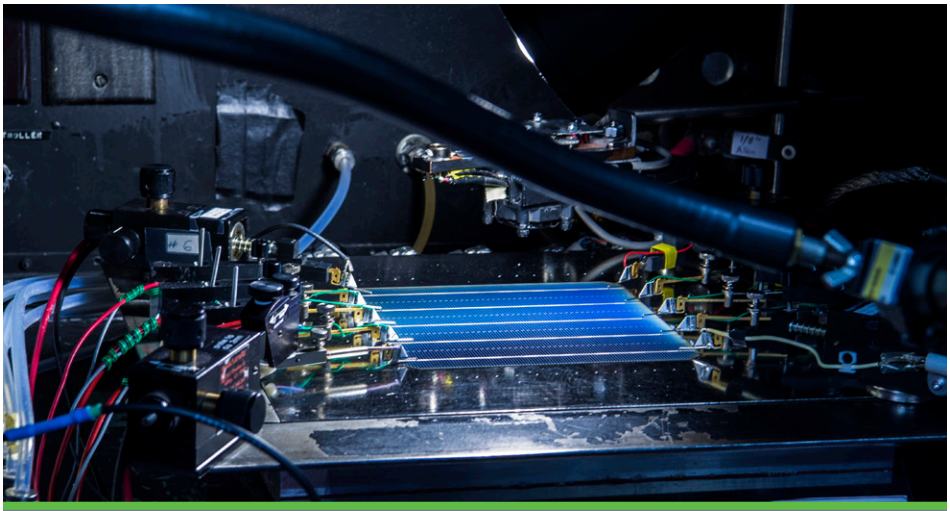
Solar Research Spotlight: Photovoltaics

The photovoltaics (PV) subprogram within the U.S. Department of Energy (DOE) Solar Energy Technologies Office (SETO) supports research and development projects that increase efficiency, improve manufacturability, and enhance PV system reliability to enable the industry to achieve DOE's 2030 cost goals. The subprogram funds national laboratories, academia, industry, and other government agencies to investigate a range of technology approaches that show promise to lower costs and increase performance. Projects advance innovations that have the potential to achieve commercial success in 10-20 years and support the long-term growth of the solar industry.

The photovoltaics subprogram has a strong record of impact over the past several decades. Nearly half of the world's solar cell efficiency records were supported by the Energy Department, mostly through SETO's photovoltaics subprogram and its predecessors.

Solar Energy Technologies Office

The U.S. Department of Energy Solar Energy Technologies Office supports early-stage research and development to improve the affordability, reliability, and performance of solar technologies on the grid. The office invests in innovative research efforts that securely integrate more solar energy into the grid, enhance the use and storage of solar energy, and lower solar electricity costs.



Researchers from the Cell Performance Measuring group measure a solar cell's efficiency using the X25 Solar Simulator at the National Renewable Energy Laboratory.

Research and Development Portfolio

SETO issues competitive solicitations to fund targeted photovoltaic research projects that can enable a levelized cost of electricity of $0.03 per kilowatt-hour for utility-scale solar installations by 2030. Through these financial awards, the office collaborates with a diverse set of partners to help the solar industry advance toward and beyond its 2030 goals.

Increasing Efficiency and Energy Yield

New device architectures, system designs, and improved materials can enable PV systems to generate more electricity from the same amount of sunlight, helping to lower costs. Projects target improvements to crystalline silicon cell absorber layers and contacts, advance the crystal quality and lifetime of cadmium telluride cells, and support the development of emerging and potentially disruptive PV technologies such as perovskites and tandem structures that stack two or more different types of solar cells to reach higher efficiencies. Projects also investigate system designs that increase the amount of sunlight converted into electricity through improved light harvesting and thermal management.

Reducing Material and Process Costs

Using less expensive materials and more efficient fabrication processes can improve manufacturability and lower system costs. For example, projects are employing flexible substrates in a roll-to-roll fabrication process and are developing low-cost deposition techniques such as hydride vapor phase epitaxy, which can be used to grow materials for high-efficiency multijunction solar cells.

Understanding Reliability and Mitigating Degradation

Improving solar module reliability and lowering degradation rates can extend PV system lifetime and significantly lower the cost of solar electricity. Research in this area focuses on developing and understanding durable materials for solar modules, improving

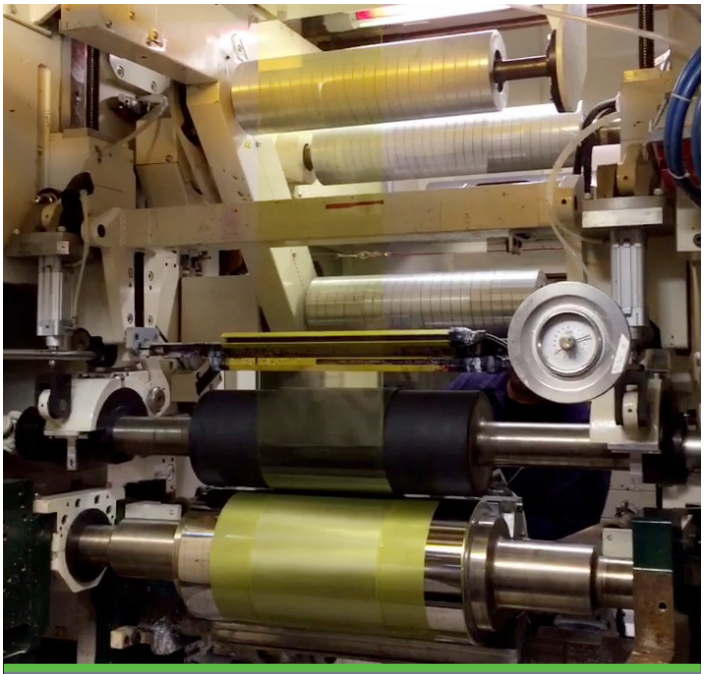
This 16.5 megawatt solar farm was built on a 130-acre property in Oxford, Massachusetts. This panaramoic photo displays just half the capacity of the total project. *Photo courtesy of Lucas Faria.*

the accelerated testing designed to mimic field conditions, and the development of testing standards to validate the quality of PV modules.

Current Funding Programs and Partnerships

The photovoltaics subprogram manages several funding efforts that address its research areas of interest. Current active funding programs include:

- **Photovoltaic Research and Development (PVRD and PVRD2)** – Both programs focus on advancing current and emerging technologies that can improve power conversion efficiency and energy output, enhance service lifetime, and decrease hardware costs. PVRD also includes small, single-year projects focused on novel, high-risk concepts.
- **Durable Module Materials (DuraMat)** – This consortium brings together national laboratories and university researchers with photovoltaic and supply-chain industries to develop and de-risk new materials that can last longer in the field.
- **Physics of Reliability: Evaluating Design Insights for Component Technologies in Solar (PREDICTS 2)** – This funding program takes a physics-based approach to understanding degradation and failure modes for PV products. Projects focus on identifying, evaluating, and modeling degradation mechanisms as well as improving PV system performance prediction to overcome perceived risks of PV technologies.
- **Solar Energy Technologies Office Laboratory Support FY19-21 (SETO Lab Call)** – This funding program enables our country's national laboratories to address the most impactful barriers preventing the advancement of PV technologies and progress toward SETO's 2030 goals.



Roll-to-roll coating of perovskite ink at 100 ft/min on a polyethylene terephthalate substrate previously coated with indium tin oxide and a hole transport material.

Funding Opportunities

For more information on open funding opportunities, visit SETO's funding opportunities webpage: energy.gov/eere/solar/funding-opportunities.

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For more information, visit: energy.gov/eere/solar

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