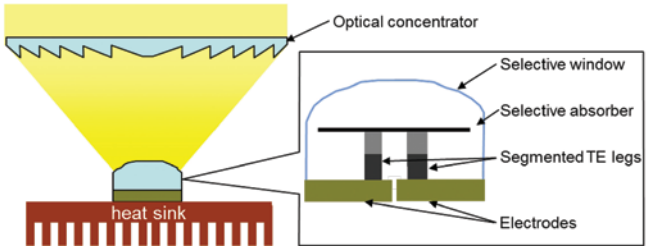
Concentrated Solar Thermoelectric Power

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PROGRAM:	SunShot CSP R&D 2012
TOPIC:	Advanced Power Cycles
LOCATION:	Cambridge, Massachusetts
AWARD AMOUNT:	Up to $1 million
PROJECT TERM:	2012–2015



Thermoelectric energy conversion uses temperature difference across solids to convert heat into electricity. Concentrating solar thermoelectric generators (CSTEGs) have the potential to achieve greater than 10% solar-to-electrical energy conversion efficiency and provide electricity day and night. *Illustration from MIT*

CONTACTS

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Partnering Organization:
- Boston College

MOTIVATION

Concentrating solar power (CSP) systems traditionally use mechanical power-generation blocks to convert solar heat into electricity. Representing about 15% of the total system cost, power blocks include the steam turbine, generator, and associated equipment such as condensers and water treatment systems. This project has the potential to replace traditional CSP power generation systems with concentrating solar thermoelectric generators (CSTEGs) that have greater than 10% solar-to-electrical energy conversion efficiency and 24-hour operation.

PROJECT DESCRIPTION

The research team previously demonstrated flat-panel solar thermoelectric generators (STEGs) that produce electricity by harnessing the sun's heat to create a 200°C temperature differential between the interior of the device and the surrounding air. These STEGs achieved a 4.6% solar-to-electric energy conversion efficiency with no optical concentration. The current effort is working to demonstrate CSTEGs with >10% solar-to-electrical energy conversion efficiency while limiting optical concentration to less than a factor of 10 and potentially less than 4.

IMPACT

Preliminary modeling carried out by the team shows that STEG system efficiencies of 10%–15% are achievable with small amounts of optical concentration. In addition, STEGs have shown great low-cost potential. When combined with thermal storage, CSTEGs have the potential to provide electricity day and night using no moving parts at both the utility and distributed scale.

For more information, visit the project page at: www.solar.energy.gov/sunshot/csp_sunshotrnd_mit.html.

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