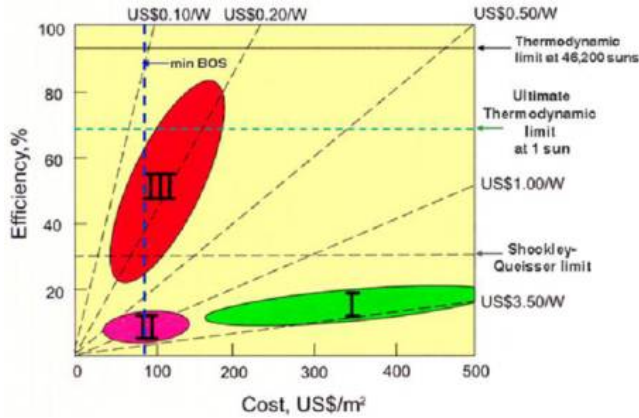


# High-Efficiency Photovoltaic Research Project



Present-day PV module performance generally fall into Regions I and II in the figure, but there are good grounds to expect radically new approaches will achieve Region III's far more cost-effective performance.

Commercial photovoltaic (PV) technology may be on the threshold of widespread cost-effective deployment in the developed world. Record levels of public and private investment capital is fueling research, and both cost and efficiency breakthroughs are possible. These potentially game-changing technology advancements are important for the utility industry to understand and monitor.

EPRI has joined with Electricité de France and several others to investigate this potential transformation. Investors in this research project will receive first-hand, regular updates on the progress toward very high efficiency (VHE), "third generation" PV technology. A key element of the collaboration will be to identify and develop new business models that address significant deployment of distributed PV.

## Value

Information from this project will help to answer the questions:

- Will distributed rooftop solar power demand a new business model for the utility industry?
- How long before distributed PV generation is competitive with other generation technologies?

Stay abreast of PV technology and consider the possibilities in resource and business planning.

- Obtain first-hand perspectives on the nature and timing of potentially disruptive PV technology advances.
- Join an international collaborative investigating some of the most promising efficiency advances in PV technology.
- Be seen as an innovator in planning the future role of distributed PV generation.

## Drivers and Trends

The most important driver of PV economics is solar-cell efficiency. Present commercial devices capture, at best, only about one-fourth of the maximum achievable electric energy in converting sunlight to electricity. Merely doubling commercial module efficiency would, by itself, come close to achieving cost parity on a cost-per-kilowatt-hour basis with other generation options. Tripling conversion efficiency, while also resulting in module cost reductions through increased production experience, would have profound impacts on PV market development.

## Project Summary

During the initial three year period, our objectives are:

1. To demonstrate, by modeling validated by experimental tests, the possibility of a real technological breakthrough with the discovery of structures and materials having a sunlight conversion efficiency potential of over 40%.
2. To plan the creation of VHE devices by devising a technical roadmap for achieving them.

## Deliverables

- December 2007: Interim EPRI report covering project results, such as:
  - Design of characterization tools for PV performance prediction suitable for VHE materials (up/down conversion and intermediate-band devices)
  - Modeling of materials for up-conversion and intermediate-band technologies
  - Assessment of solar-energy concentration on existing PV technologies
- December 2008: Interim report covering project results, such as:
  - Modeling of materials for the hot-carrier technology
  - Results of tests on the first set of materials for up/down conversion
  - Development of *ab-initio* model at the quantum level as performance prediction of VHE materials
- December 2009: Interim report covering the 2009 project results, such as:
  - Results of tests on the first set of materials for hot-carrier devices
  - Full model (with experimental validation) of a hot-carrier cell
- December 2010: Final EPRI report covering global evaluation of VHE concepts and decision elements

Anticipated reviews and technical presentations include two project meetings per year, one in the United States and one in Europe, in 2007, 2008, and 2009.

## Price of Project

The total cost for all funders of this work is more than \$5 million. The price to participate is \$20,000 per year with a three year commitment. Companies that fund any Generation Sector program may use tailored collaboration (TC) funds to support this project.

## Project Status and Schedule

This project began in 2007 and is expected to last for at least three years. With favorable initial results it may be extended.

## Who Should Join

Companies interested in distributed PV generation with existing or planned solar electric operations.

## Contact Information

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