# Testing Asoleyo Decorative Solar Cell and Modules

## Cooperative Research and Development Final Report

## CRADA Number: CRD-20-16732

NREL Technical Contact: Nikos Kopidakis

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Contract No. DE-AC36-08GO28308

**Technical Report**
NREL/TP-5900-83862
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**NOTICE**

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# Cooperative Research and Development Final Report

**Report Date:** August 10, 2022

In accordance with requirements set forth in the terms of the CRADA agreement, this document is the CRADA final report, including a list of subject inventions, to be forwarded to the DOE Office of Scientific and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

**Parties to the Agreement:** Mirimantis LLC (Team Asoleyo Decorative Solar)

**CRADA Number:** CRD-20-16732

**CRADA Title:** Testing Asoleyo Decorative Solar Cell and Modules

**Responsible Technical Contact at Alliance/National Renewable Energy Laboratory (NREL):**

Nikos Kopidakis | nikos.kopidakis@nrel.gov

**Name and Email Address of POC at Company:**

Adam Winsor | adam@mirimantis.com

**Sponsoring DOE Program Office(s):** Office of Energy Efficiency and Renewable Energy (EERE), Solar Energy Technologies Office

**Joint Work Statement Funding Table showing DOE commitment:**

| Estimated Costs | NREL Shared Resources a/k/a Government In-Kind |
|---|---|
| Year 1 | $39,133.00 |
| TOTALS | $39,133.00 |

**Executive Summary of CRADA Work:**

Team Asoleyo is transforming the utilitarian rectangular grid that dominates the visual style of standard solar panels by re-designing solar cells' silver contact grid using principles of symmetry, rhythm, and line. Our designs use well-established manufacturing equipment, techniques, and materials, achieving similar manufacturing costs but far superior aesthetic effect– without the need for additional layers or occlusion. This project will test new decorative PV Cell front contact designs, individually and interconnected within modules, for their performance characteristics.

**CRADA benefit to DOE, Participant, and US Taxpayer:**

- Assists laboratory in achieving programmatic scope
- Uses the laboratory's core competencies

**Summary of Research Results:**

The Asoleyo team focuses on manufacturing PV modules with improved aesthetics. To achieve this, they design cells with special metallization patterns, such as the one shown in Figure 1 (top), and use them to make modules such as the one shown in Figure 1 (bottom).

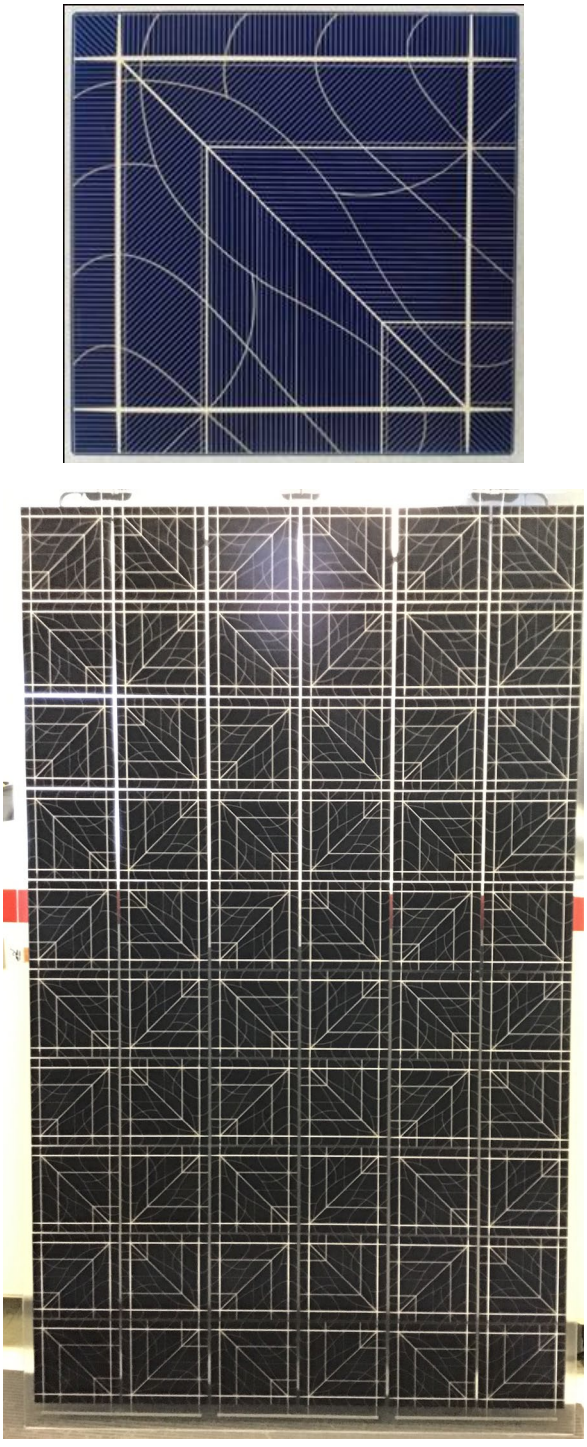

**Figure 1. Top: Special top contact pattern for the cells made by the Participant (Mirimantis/Asoleyo). Bottom: a module made by Asoleyo using the special metallization cells.**

The scope of this work is to test whether the new designs for cells and modules perform as well as the conventional ones in the market. The Participant was awarded an American Made Solar Prize to have the cells and modules tested by the NREL PV Cell and Module Performance (CMP) team and the results are reported below.

**The Participant will:**

**Task 1: The Participant will participate in a monthly check-in with the NREL Principal Investigator. If a check-in meeting is missed two months in a row, the agreement may be cancelled by the American-Made Challenges Solar Prize team.**

The NREL and the Participant team were in regular communication as needed to plan sample sets to be sent, measurement conditions and discussion of results.

**Task 2: The Participant will provide 24 new solar cells, including 12 bifacial 1-sun cells and 12 monofacial PERC cells, to NREL.**

Mirimantis provided 3 monofacial and 6 bifacial cells for testing. The NREL results are shown below.

**Task 3: The Participant will provide 8 modules to NREL, 4 monofacial and 4 bifacial.**

The Participant provided 5 bifacial and 3 monofacial modules that were tested by the NREL CMP team. The results are presented below.

**NREL will:**

Technical and business support provided by NREL to develop finalist concepts in advance of Demo Day events. The technical advisement will include:

**Task 1. NREL will test 24 new PV cell front contact designs, including 12 bifacial and 12 monofacial PERC cells.**

The NREL team provided spectral response and current-voltage (IV) results at Standard Test Conditions for the cells submitted by the Participant under Task 2 above. An example IV is shown in Figure 2, showing the power conversion efficiency of this cell to be 18.9%, which compares well to existing Si cells in the market today.

**Task 2. NREL will test 8 modules using a unique combination of multiple cell designs in varied orientations.**

The NREL CMP team tested the performance of 8 modules submitted by the Participant and reported the results (spectral response and IV curves at Standard Test Conditions) in two test reports. A representative IV curve is shown in Figure 3, with an efficiency of 15.4%.

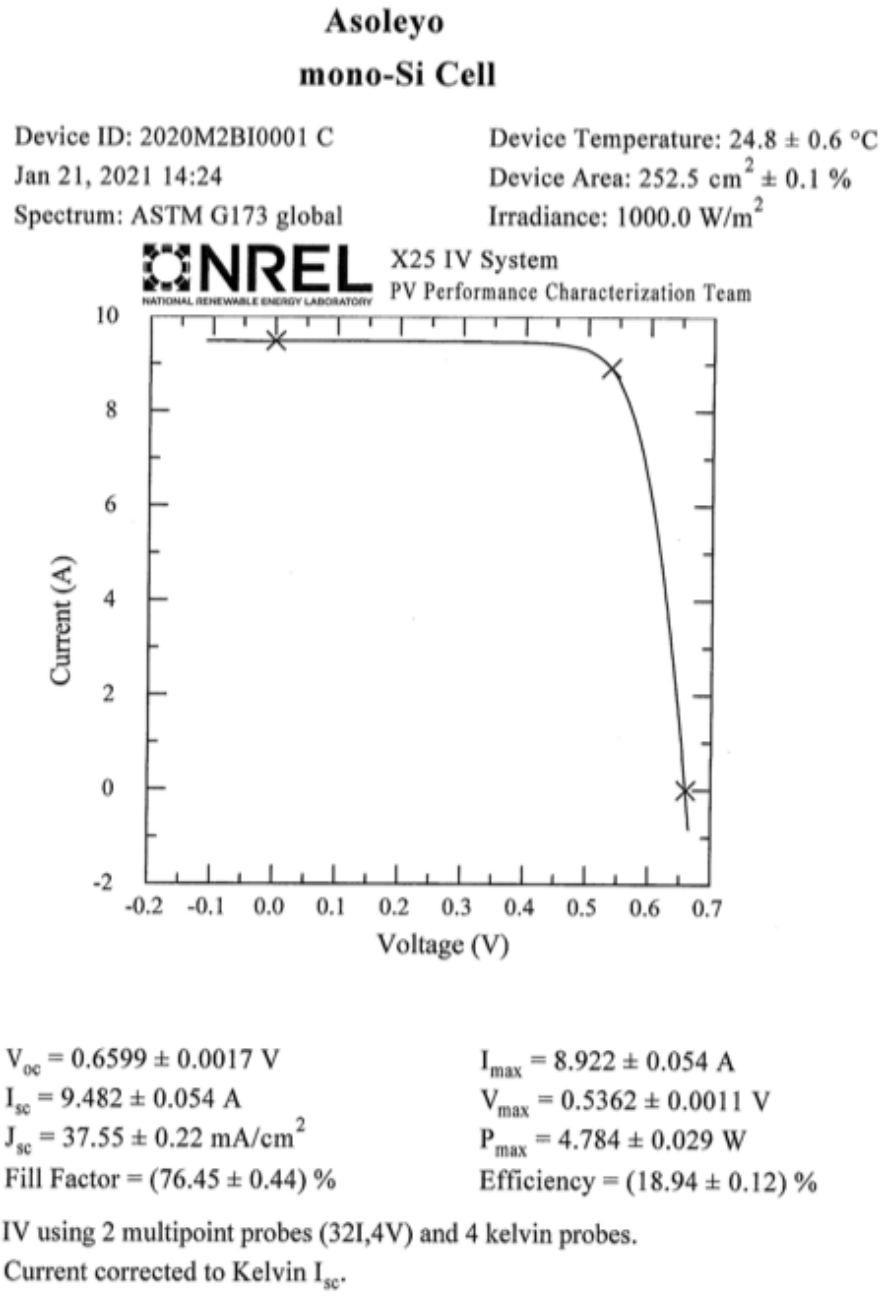


**Figure 2. Current-voltage curve at Standard Test Conditions for a representative Mirimantis/Asoleyo cell, with its performance metrics listed under the curve.**

**Task 3: The Principal Investigator agrees to provide the following to DOE Office of Scientific and Technical Information (OSTI): (1) an initial abstract suitable for public release at the time the CRADA is executed; (2) a final report, within thirty (30) days upon completion or termination of this CRADA, to include a list of Subject Inventions; and (3) other scientific and technical information in any format or medium that is produced as a result of this CRADA.**

The abstract was completed and this report serves as the final report mentioned.

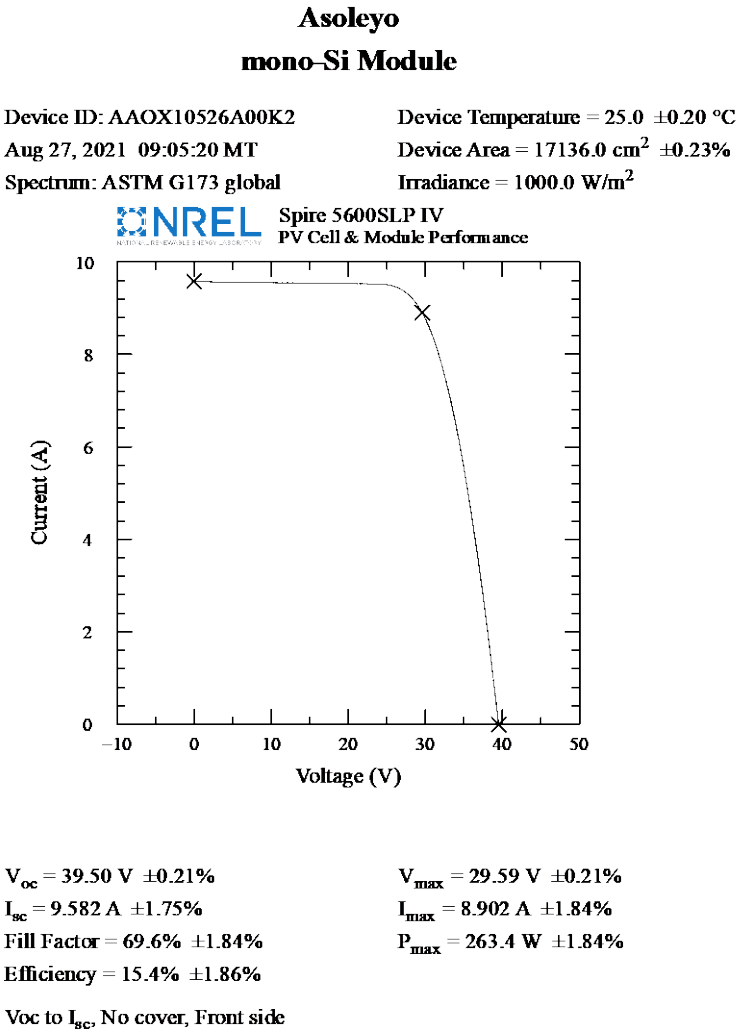


**Figure 3. Current-voltage curve at Standard Test Conditions for a representative Mirimantis/Asoleyo module, with its performance metrics listed under the curve.**

## Subject Inventions Listing:

None

## ROI #:

None