

# Amorphous Silicon PV Manufacturing Research

Utility Power Group participated in both Phase 1 and 2A of PVMaT.

PVMaT is a 5-year, cost-shared partnership between the U.S. Department of Energy and the U.S. PV industry to improve the worldwide competitiveness of U.S. commercial PV manufacturing.

## Utility Power Group

### Goals

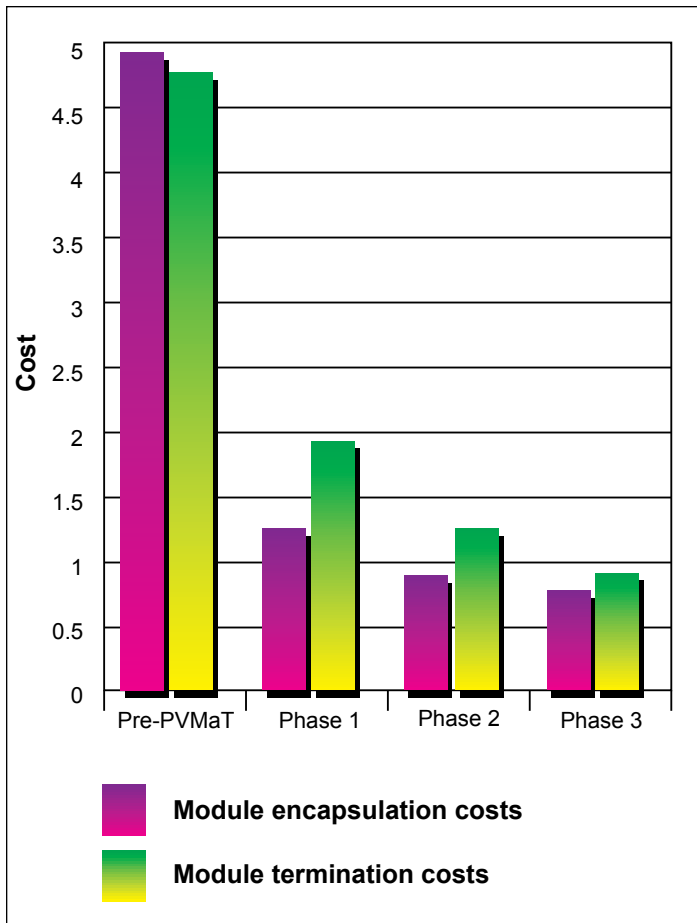
The goals of Utility Power Group (UPG) under the PVMaT Project have been to (1) significantly advance its PV manufacturing technologies, (2) reduce module production costs, (3) increase average module performance, and (4) increase the production capacity of UPG's existing manufacturing facility. In Phase 1 of PVMaT, UPG identified two specific process steps having the greatest potential for reducing costs. UPG then focused on two research areas: encapsulation approaches not requiring a second glass layer, and automation of electrical termination.

### Technology

UPG's PV technology is based on amorphous silicon (a-Si) thin films deposited on glass substrates. The a-Si thin films and the back electric conductor of the solar-cell structure are deposited with an in-line vacuum system similar to those that coat architectural glass. The thin films are patterned to produce series-connected solar cells on the glass surface without wire interconnection. Whereas single-crystal solar cells must be interconnected individually to produce a module, thin-film devices can be made monolithically—as a single unit. After the films are deposited and patterned to form the circuit, the PV module is electrically terminated to tap into the power produced by the PV device. Finally, the module is encapsulated to



*Amorphous silicon PV modules are prepared for in-line encapsulation and termination processing.*



UPG module encapsulation and termination costs.

protect the PV circuit materials from environmental weathering.

## Results

Under the PVMaT Project, UPG improved its earlier encapsulation and termination systems by simplifying the processes and reducing materials. UPG accomplished this by eliminating the back glass and

developing a highly automated encapsulation system that protects the PV circuit materials. UPG also developed an advanced electrical termination system that takes advantage of the enhanced mechanical properties of the new encapsulant.

The advances in PV manufacturing technologies have led to reduced module production costs, specifically in encapsulation and termination. At the end of the 3-year effort, UPG has reduced the cost of encapsulation and termination by 80%. With this reduced cost, UPG has reduced the total module cost by 30%.

In developing these new PV manufacturing technologies during the PVMaT Project, UPG increased the average power rating of its modules. This improvement resulted from both an increase in

the unit-area conversion efficiency and a decrease in the standard deviation of the module power output.

With the simplified process for encapsulation and termination and the increased level of automation associated with these process developments, UPG has significantly increased the throughput of its manufacturing facilities. With this

greater throughput and the improved module performance, the total-power rated capacity of UPG's manufacturing facility has increased almost fivefold during the PVMaT Project.

## Company Profile

UPG is a small business located in Los Angeles, California, dedicated to developing PV manufacturing technology and integrating PV systems into the electric utility sector. UPG, involved in PV development since 1985, has participated in several DOE-sponsored projects, including Photovoltaics for Utility-Scale Applications, TEAM-UP, and PVMaT.

## References

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