

A Summary of the Findings of Field Testing of idealPV Solar Panels at Harvey Mudd College

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The technology developed by idealPV that the CHERP Solar Works factory and others in the Locally Grown Power Network will manufacture was field tested at Harvey Mudd College, in Claremont, California.

All solar panels on the market today are subject to a problem known as reverse bias, which triggers hot spots—intense, localized surges in temperature. Hot spotting in photovoltaic panels causes physical damage, power loss, reduced lifetime reliability, and increased manufacturing costs while also raising safety concerns. The problem arises routinely in defect-free standard panels; any string of cells that receives uneven illumination develops hot spots, and the temperature rise often exceeds 100°C in conventional silicon panels despite on-panel bypass diodes, the standard mitigation technique. Bypass diodes limit the power dissipated in a cell subjected to reverse bias, but they do not prevent hot spots from forming.

IdealPV developed a technology that senses in real-time the dynamic conductance of a string of cells and adjusts its operating current so that a partially shaded cell is never forced into reverse bias. To our knowledge, there is no competing technology that achieves this, and the idealPV innovation, including both a control module that is attached to the solar panel and the accompanying panel architecture, is patented.

In our field testing we observed that cells in conventional panels suffer significant heating and structural damage in reverse bias, with desoldering of cell-tabling and discolorations on the front cell surface. All of this is widely described in the literature. We also tested idealPV's panel-level solution that anticipates and prevents hot spots in real-time and have demonstrated experimentally its efficacy. Hot spots are indeed prevented in the idealPV panels.

The innovation has a number of implications:

- As panel efficiency improves, so does the resultant danger of a cell entering reverse bias. Greater efficiency translates into more power in reverse bias. Without a solution to reverse bias, it will become increasingly difficult and dangerous to rely on the industry's current approach of mitigation.
- Fires that originate in solar panels, such as the ones at the seven Walmart facilities, originate in hot-spots. idealPV solar panels, unlike any other solar panel, never increase in temperature as a result of operation and cannot trigger catastrophic failure, such as through arc faults.

- To the best of our knowledge, these are the world's only existing solar panels that are safe to operate without bypass diodes and with all cells in a single string. This simplifies manufacturing of the panel itself.
- The control module renders expensive microinverters and optimizers, which are included in almost all residential solar installs today, effectively redundant.
- The fact that the control module adjusts the maximum power point in milliseconds has the potential for harvesting power that other solar panels cannot harvest.

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