



Technology Brief

idealPV's patented solar technology is based on the fundamental discovery of the Law of Forward Only Zero Hot Spots (FOZHS). FOZHS *eliminates* reverse bias in solar cells - the negative voltage bias that leads to the flow of reverse current across the junction in a cell, resulting in hot spots that damage solar cells, melt wiring, cause yellowing of encapsulants, reduce efficiency and significantly degrades module performance over time. A hot spot can cause the operating temperature of a solar cell to rise from a normal operating temperature of around 100° F to over 400°F in seconds. At the most extreme, hot spots can not only burn the solar module but also the building on which the module is installed.

The remedial measures that worked reasonably well decades ago (bypass diodes and improved factory inspection) that attempt to *mitigate* the worst effects of hot spots are no longer adequate. Over the past few decades, solar cells have been getting steadily more efficient, which is good for power production, but it magnifies the hot spot problem. Yesterday's top-of-the-line 180 watt panels produced 40% less power than today's 300-watt (and higher) panels, so they had 40% less electrical power to contribute to heating up the victim cell. We are deploying idealPV's new, patented FOZHS technology, which, rather than seeking to *mitigate* the damage caused by hot spots, *prevents* them entirely. Eliminating the fundamental problem of hot spots allows us to release multiple new technologies for lowering costs, improving safety, and increasing efficiency.

General Considerations

It must first be understood that the idealPV solar module is a software defined, upgradable, and repairable electronic device. It has a computer built into each module that handles computations in milliseconds that adjusts in real time to weather conditions and replaces all industry standard, add-on components such as optimizers, micro-inverters, and rapid shut down devices. It adjusts for Maximum Power Point (MPP) every one thousandth of a second (conventional panels in approximately 4-6 minutes).

idealPV panels can never create a plasma arc in either the module or the wiring, will rapidly shut down (in a millisecond) at the panel level if an inverter is not detected, will never create a hot spot, has 4-6% less internal wiring resistance, more power in partial shading, can be installed in intermittently shaded conditions, millisecond adjustments for atmospheric scintillation, and can interoperate in any conventional panel string

Basic cost savings scenario

idealPV solar modules will produce 20% more AC kWh than a conventional, equal nameplate wattage panel. This reduces the number of panels required for projected output. The degradation rate of the system should be 80% less than conventional systems due to lack of hot spots and less wiring resistance. idealPV modules will produce more power especially in cloudy weather conditions. Due to significant cooler operating temperatures, there is less strain on inverter capacitors, increasing the viable life of the inverters.

With 20% fewer modules in our system, that means 20% fewer BOS components such as racking and wiring. Since our current is 4 times less, we also require smaller wiring size along with shorter wiring runs due to fewer modules. Optimizer and micro-inverters (where normally specified) are eliminated. This, in turn, reduces installation time per module in half and the number of interconnects in half (and optimizers, microinverters, other add on electronics fail even more often than the panels and the interconnects themselves are points of frequent failure and also reduce overall system efficiency).

Features and Benefits released in our current model

SOLAR PUNCH LIST (FROM SLIDE)		Problem solved for all currently available panels world-wide.	Problem solved for idealPV panels.
	Shadows destructive	No	Yes
	Custom interconnects	Yes	Yes
	Cells/Panels must match	No	Yes
	Impurities destructive	No	Yes
	Cracks destructive	No	Yes
	Opens destructive - arc safe	No	Yes
	Max Voltage thermal	No	Yes
	Max current flux	No	Yes
	High Temperature	No	Yes
	Eliminate catastrophic plasma arcs	No	Yes
	Cannot turn off - w optimizers Yes	Yes	Yes
	Cannot interoperate - w solar edge Yes	Yes	Yes
	Silver contacts / wire	No	Yes
	Expensive Reverse Bias specs	No	Yes
	Wafer scale	No	Yes
	Reduced Clipping?		
MARKET VALUE		Conventional Panels	idealPV
1	Forward Only Zero Hot Spot (FOZHS™). IdealPV panels can never be reversed biased and cause cellular hot spots.	No	Yes
2	Safety: First Responder Safe Solar (FRSS™). Rapid, panel-level shutdown	No	Yes
3	Insurance Premium reductions possible	No	Yes
4	Plasma arc suppression technology (SAS™). Spark Arresting Solar. Arcs suppressed from the panel AND the wiring.	No	Yes
5	ScintillationPV™ Unique, high-speed tracking to 1,000th of a second captures more photos from high-speed atmospheric changes, cloud lensing, and even light filtering through tree leaves.	No	Yes
	more power in cloudy weather	No	Yes
	more important than everything under more raw power below		
	more power early and late in the day	No	Yes
6	More raw potential power by 4-6%. Our 330 watt panel is equivalent to a 350 W conventional panel - (330 x .06)+330	No	Yes
	more edge effect	No	Yes
	less current by 4, more voltage by 4	No	Yes
	less wiring losses (60" vs 24")	No	Yes
	fixed temp coefficient - more panels per string		
	I²/R losses. our voltage always higher = 3-4%		
	less wire losses		
	More power in partial shading		
	rapid response in milliseconds	No	Yes
	Peak Shaving. Series/parallel inverter with lower peak power = less expensive		
	no bypass diodes, one string	No	Yes
6	No micro inverters/optimizers needed and 50% fewer interconnects	No	Yes
7	80% less Degredation over life of panel compared to all othe conventional panels. 20% Industry claimed degradation is not accurate. Ours will degrade 80% less than industry - so 4% over 20 years.	No	Yes
8	Reliability (FMEA) - standard panels do not live 20 yrs. on paper - ours live 50. We are 50,000 less sensitive to interconnect failures . Ours should easially last 30 years.	No	Yes
9	Tripplles placement opportunity	No	Yes
10	Interoperable with all other panels	No	Yes
11	Better Warranty (local, repairable)	No	Yes
12	Reliability of supply from Network		
13	Culture of Craftmanship		
14	Made in the USA	No	Yes
15	Made in your City!		
16	Dramatic installation labor savings	No	Yes
17	Direct to battery applications	No	Yes
18	Marine, Agricultural, Rural, EV	No	Yes
19	Upgradable power appliance (IOT)	No	Yes
20	Voltage/current programmable	No	Yes
21	Panels can be wrapped with design		
22	Less wiring loss and cost in BOS wiring	No	Yes
23	Panels are repairable		
24	PID protection built in		
25	Accepts mismatched silicon / silicon weathering		
26	Onboard computer handling 1 million instructions per second		
	Sub Total		
MANUFACTURING BENEFITS		Conventional	idealPV
	Fewer parts, no bypass diodes	No	Yes
	One string	No	Yes
	No heat and FMEA = enormous mfg margins / tolerances	No	Yes
	May use rejected / donated materials	No	Yes
	Licensed only in the U.S.	No	Yes
	Factory network will create purchasing power	No	Yes
	Factory network will create massively parallel mfg model for reliability, scalability, resilience.	No	Yes
ONGOING R & D		Conventional	idealPV
	silver to aluminum	No	Yes
	glass to plastic, acrylic, or cheaper glass	No	Yes
	upgraded metallurgical silicon mfg in US	No	Yes
	panels can be programmed to shut down if stolen -- anti-theft	No	Yes
	Upgradable / programmable panels	No	Yes
	micro payment trailer -- direct to battery and having a solar panel that can expire to prevent theft	No	Yes
	agricultural pumps -- direct to battery	No	Yes
	Whole house UPS battery can be connected directly to the panels (don't need specialty Tesla electronics), more efficient, more reliable	No	Yes
	Direct to EV batteries	No	Yes
	Perovskite, thin film, etc.		Yes
	Plug n Play with DC volt homes		