"What is this *UNI-SOLAR* 15-20% power output advantage I keep hearing about?"

The *UNI-SOLAR* PV cell is especially good at collecting energy at low light levels. We were the original calculator solar cell back in the 1980's. It has been demonstrated at TISO Labs in Europe that the *UNI-SOLAR* PV cell is as much as 40% more efficient than all competitors when light levels are less than ¼ suns. This inherent ability to produce energy under low light levels is demonstrated as *UNI-SOLAR* PV arrays activate (turn on) line-tie inverters earlier in the morning than any other type of solar array. This results in more power into your AC Service Panel every year (per installed watt).

The visible spectrum of light that comes from the sun is familiar to us as the range of colors we see in a rainbow. The *UNI-SOLAR* amorphous silicon solar cell is especially good at collecting the blue part of the visible spectrum. The blue part of the rainbow is dominant in cloudy weather and it is dominant in summer weather. Since the summer is longer than winter in the US, Europe, most of China and all of India, Africa and South America, the *UNI-SOLAR* PV array will be exposed to a favorable spectrum of light for more days of the year than, for example, crystalline cells that work especially well when the spectrum is skewed toward the red. We see a solar spectrum skewed to the red in Northern States and in Northern Europe during cold, clear days in the winter. Greater amounts of time under a favorable spectrum of light will result in more power into your AC Service Panel every year (per installed watt).

All PV cells demonstrate a degradation of voltage (and consequently Power) as the operating temperature of the solar cell gets above room temperature. However, the *UNI-SOLAR* PV cell looses less than half the voltage a typical crystalline cell does under similar conditions. Additionally, the amorphous silicon solar cell will demonstrate a thermal annealing affect when ambient temperatures stay above 15 C for more than a few weeks. For these reasons, the *UNI-SOLAR* PV array will produce excellent power output under pleasant weather conditions and a predictable de-rate of less than 10% under even the most intense hot-weather conditions seen in the Southwest U.S. or desert regions of Africa, India or other tropical countries.

Take a close look at the data sheets for all *UNI-SOLAR* PV modules and you will notice United Solar Ovonic quantifies the initial degradation that our PV modules experience upon their first few weeks of exposure to sunlight. Most other modules manufacturers do not quantify this initial degradation. For example, it has been shown that crystalline modules degrade ~2% from their rated power after initial exposure to sunlight. Since *UNI-SOLAR* modules have a greater (but predictable) degree of initial degradation, United Solar Ovonic is very conservative in their module ratings. Recognition and quantification of this well-known phenomenon gives our customers more confidence that their *UNI-SOLAR* array will perform at its rated power.

UNI-SOLAR PV cells are interconnected with a bypass diode across EVERY solar cell. You can think of a *UNI-SOLAR* PV module in the same way you think about a 3-wire Christmas Tree Light string. If one bulb goes out, the rest stay lit. Same thing with a *UNI-SOLAR* module. If one of the cells is covered or shaded, or is damaged by flying

debris during severe weather, the cell will be bypassed and the rest of the module will perform normally. This can be contrasted with most crystalline modules where there are only two bypass diodes in the J-box. Shade one cell and 50% of the module's power output is lost.

The *UNI-SOLAR* PV cells are protected by a "high-tech" plastic called ETFE. This plastic is a derivative of Teflon and allows typical rain fall to wash the modules clean. This plastic is also less reflective than the glass that protects crystalline solar cells. This less-reflective surface allows PV system owners to tilt their PV modules over a greater variety of tilt angles without suffering measurable losses. This effect has been documented at a site in Santa Cruz, California (www.rmeter.com, Electroroof Pilot) where *UNI-SOLAR* PV arrays laid flat on the deck are generating as much energy as polycrystalline modules mounted at an ideal tilt angle. Additionally, United Solar is taking orders from airports across the US that prefer *UNI-SOLAR* PV modules over the more reflective crystalline products. This attests to the low-glare surface of the *UNI-SOLAR* product.

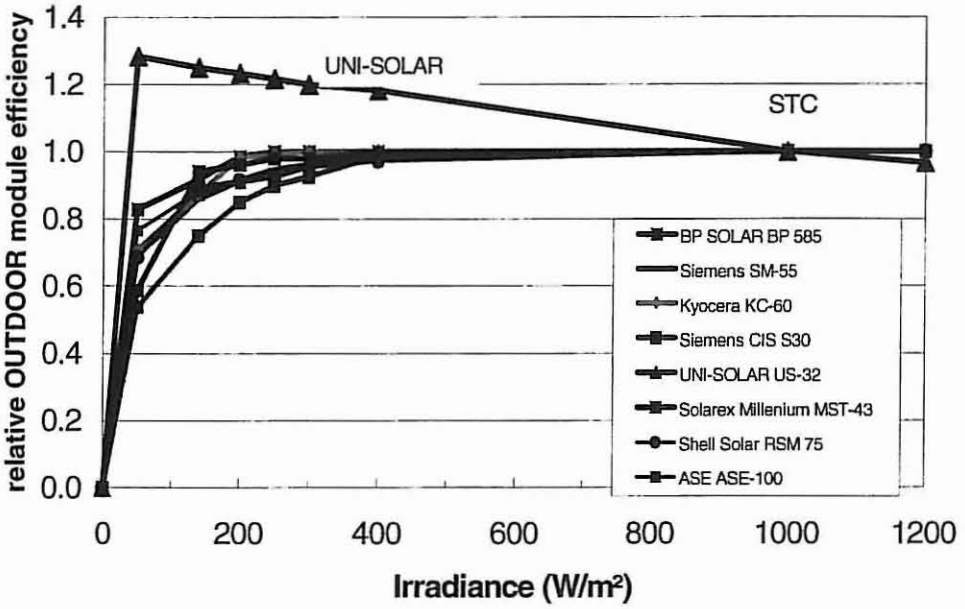
Although the solar cells used in *UNI-SOLAR* terrestrial PV products are 8.5% efficient, our researchers have achieved 14.1% stabilized efficiency in the lab and the solar cells used in our PV products designed for NASA, Lockheed Martin and other buyers who will use these cells in the upper atmosphere and in space are greater than 10% efficient. These advanced solar cells will be worked into our terrestrial products over the next few years.

So what is this "15-20% *UNI-SOLAR* power output advantage" you have been hearing about? It's all about:

1. **The best low light response of any solar cell on the market,**
2. **A solar cell that responds well to the solar spectrum (sunlight) we see in the late Spring, Summer and Fall,**
3. **The lowest voltage drop (due to high temperature operation) compared to all other PV technologies,**
4. **A "thermal annealing" affect under high temperature operating conditions that increases current (amp) flow,**
5. **A recognition of the initial degradation of our PV modules and a conservative power rating that favors our customers,**
6. **Bypass diodes across every solar cell resulting in less power loss under shaded conditions,**
7. **Less-reflective top surface allowing for greater energy collection when the module is not oriented perpendicularly to the sun, and**
8. **Constant improvement to our terrestrial products driven by our advances in space cell development.**

"What is this *UNI-SOLAR* 15-20% energy output advantage I keep hearing about?"

The *UNI-SOLAR* PV cell is especially good at collecting energy at low light levels. We were the original calculator solar cell back in the 1980's. It has been demonstrated at ECN Labs in Europe that the *UNI-SOLAR* PV cell is as much as 40% more efficient than all competitors when light levels are less than ¼ suns. This inherent ability to produce energy under low light levels is demonstrated as *UNI-SOLAR* PV arrays activate (turn on) line-tie inverters earlier in the morning than any other type of solar array. This results in more power into your AC Service Panel every year (per installed watt).



Source: Characterization of PV-Modules of New Generation, J. Eikelboom, M. Jansen, ECN-report No ECN-C –00-067, 2000

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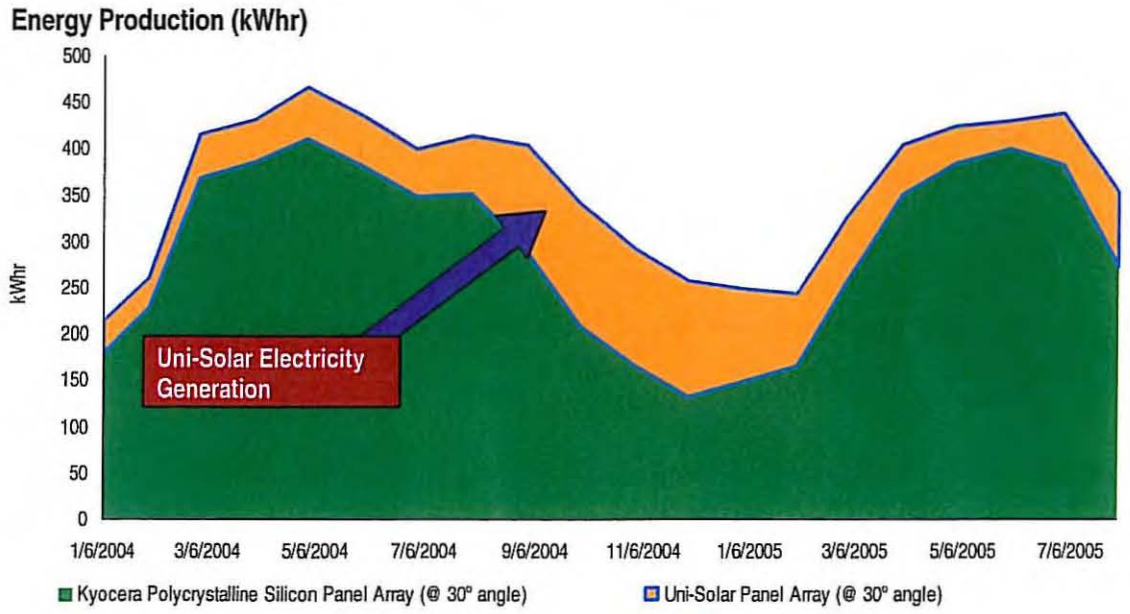
All PV cells demonstrate a degradation of voltage (and consequently Power) as the operating temperature of the solar cell gets above room temperature. However, the *UNI-SOLAR* PV cell looses less than half the voltage a typical crystalline cell does under similar conditions. This fact alone will result in 5-7% better energy output when comparing a *UNI-SOLAR* PV array to a crystalline array.

United Solar is taking orders from airports across the US that prefer *UNI-SOLAR* PV modules over the more reflective crystalline products. This less-reflective surface allows PV system owners to tilt their PV modules over a greater variety of tilt angles without suffering measurable losses. This effect has been documented at a site in Santa Cruz, California (www.rmeter.com, Electroroof Pilot) where *UNI-SOLAR* PV arrays laid flat on the deck are generating as much energy as polycrystalline modules mounted at an ideal tilt angle. At the same site, it can be seen that UNI-SOLAR Framed PV modules are producing 18% more energy on an annual basis compared to an identically rated polycrystalline array tilted at the same angle (30 degrees).



Source: PV System Performance Santa Cruz Test Site, United Solar Ovonic and Solar Quest

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2. A solar cell that responds well to the solar spectrum (sunlight) we see in the late Spring, Summer and Fall,
3. The lowest voltage drop (due to high temperature operation) compared to all other PV technologies,
4. A recognition of the initial degradation of our PV modules and a conservative power rating that favors our customers,
5. Bypass diodes across every solar cell resulting in less power loss under shaded conditions, and
6. A less-reflective top surface allowing for excellent energy production when the module is not oriented perpendicularly to the sun.