Record Cell Efficiencies Hold Promising Future for Thin-Film Photovoltaics

C. Constantine
Oerlikon Solar A.G.

Recently confirmed by National Renewable Energy Laboratory, the achievement of world-record efficiency for single-junction amorphous silicon photovoltaic (PV) cells (over 10 percent stabilized efficiency) is an important advance in thin-film silicon technology, and will be a key factor in driving down costs and assuring the long-term competitiveness of thin-film silicon technologies in coming years. The achievement, ***Figure 1,*** resulted from an extensive research and development program funded by a leading manufacturing equipment supplier and demonstrates the potential leverage of equipment suppliers to accelerate technology improvements and scale up. This achievement was a result of two key factors – an optimized amorphous silicon junction, and optimized Transparent Conducting Oxide (TCO) layers (zinc oxide) used for the front and back contacts for the cell. A new Low Pressure Chemical Vapor Deposition (LPCVD) process for TCO deposition results in high light capture and light trapping within the silicon junctions, leading to high overall conversion efficiency. By optimizing the synergy between TCO and single junction amorphous silicon device, the world-record efficiency gains will improve the performance of commercial thin-film silicon PV modules, both single junction type and tandem Micromorph® type.

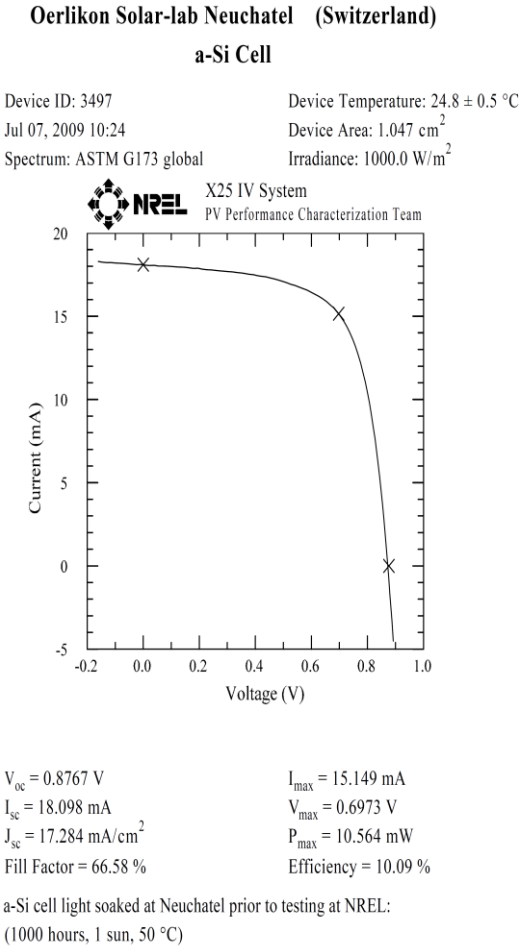

Figure 1 I-V plot for record amorphous silicon solar cell.

As the world emerges from the deep and prolonged financial crisis of 2008 and 2009, it is widely anticipated that solar PV markets will resume rapid growth in 2010. As the cost of solar-generated energy continues to drop and approach the cost of conventional energy sources in many regions, we expect to see a prolonged period of accelerated market growth. In the past, the level of solar technology deployed has been a small percentage of the global energy production, ***Figure 2*** . Clearly, large increases are forecast for the coming years. ***Figure 3*** shows that solar electric energy is expected to grow at greater than 30 percent year over year, with thin-film PV technologies well positioned in today's market (approximately 25 percent of total shipments in 2009). All this demand is fueling the need for further research and development to provide technology improvements to make solar power economically viable. The achievement of a world-record, thin-film silicon cell efficiency is an example of the technology improvements that will further drive down the cost of PV-generated energy.

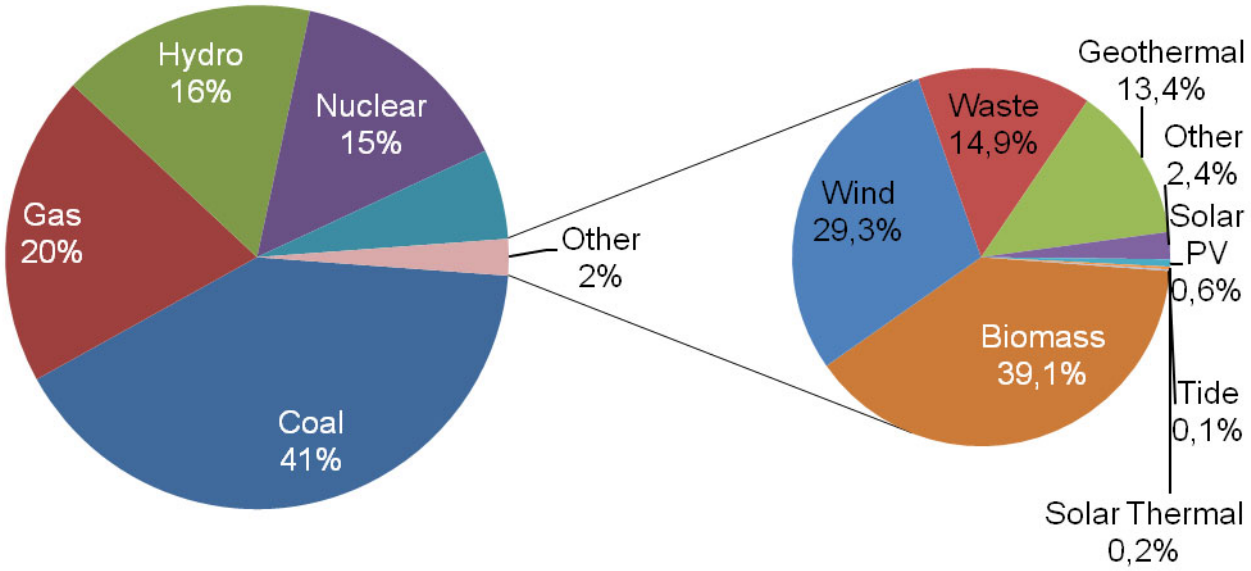

Figure 1. Distribution of the 2006 global energy production of 19 GWH.

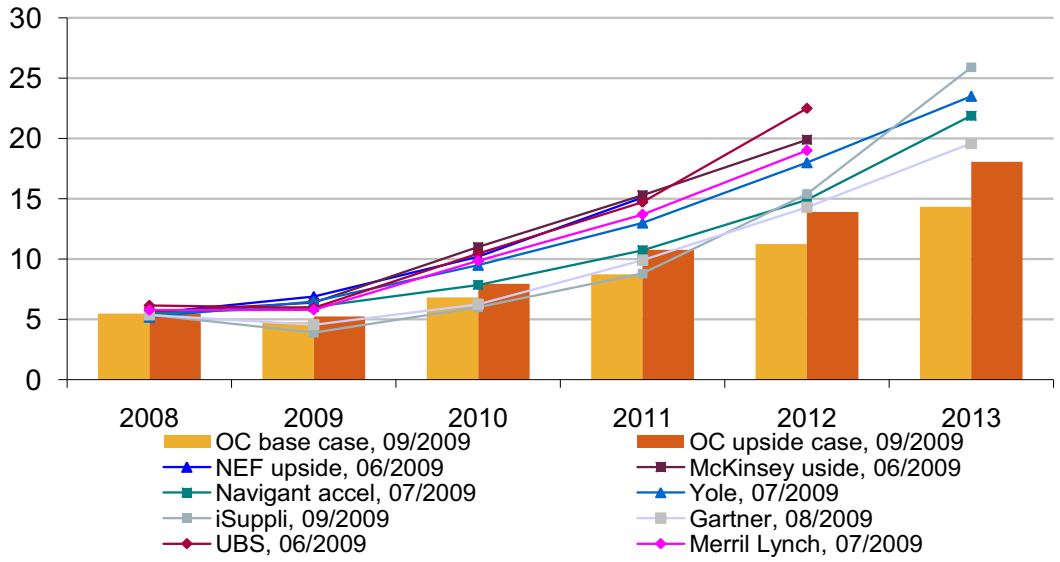

Figure 3. Predicted increase in solar energy production.