Energy generation is a multifaceted industry comprising dozens of major discrete technologies and thousands of companies. For reasons that are at once political, economic, and environmental, the energy industry occupies a central place in modern human society, and it will for the foreseeable future.

Alternative energy resources, such as photovoltaic modules and wind turbines, represent a particularly fast-growing segment of the industry. This article will look at this sector from the perspective of quality assurance and safety testing, two extremely important concerns for producers, as well as consumers, of alternative energy.

A brief history lesson

Quality assurance and safety-test marking within the energy industry goes back to the very beginning of electrification, to the days of Thomas A. Edison. From the outset, Edison understood the need for third-party safety-testing and product verification processes for the light bulb, which he invented in 1879. At that early date, Edison realized that much research and refinement was necessary before his light bulbs were ready for mass production. Unfortunately, aggressive competitors were not willing to wait, and knockoff light bulbs soon began appearing in homes. The resulting and predictable fires and tragic deaths were clearly attributed to the shoddy and inconsistent production values of Edison’s competitors—but it was Edison himself who did something about it.

In 1896, Edison formed the Lamp Testing Bureau, both to assuage consumers’ fears about the safety of light bulbs and to advance the research and development of this new technology. As further electrical devices were introduced to the public, the role of the Lamp Testing Bureau expanded and the name changed to the Electrical Testing Laboratories (ETL).

It was around this time that another well-recognized safety-testing label came into existence. Formed in 1894, the Underwriters’ Electrical Bureau, of the National Board of Fire Underwriters, began to test the safety of various combustible and noncombustible products. The organization later became Underwriters Laboratories (UL). Today, the UL mark and product-safety standards written by UL have become recognized seals of quality and safety.

Know & Go

- Alternative energy products such as photovoltaic modules and wind turbines are increasing in popularity.
- Safety testing within the energy industry began with the Electrical Testing Laboratories (ETL) more than 100 years ago.
- Intertek, which absorbed ETL and uses its safety mark, tests photovoltaic modules as well as large and small wind turbines.
- SolarWorld Industries America is a manufacturer of photovoltaic modules that has moved to an automated manufacturing system to better ensure product safety and quality.

As the industry expands, safety testing takes on a bigger role.
Industry standardization in nomenclature as well as rating systems was achieved with the formulation of the International Electrotechnical Commission (IEC) in 1906. Lord Kelvin, a world-renowned scientist with an impressive background in thermodynamics and electrical engineering, was named as the IEC’s first president. IEC standards cover a broad range of electrical, electronic, and related industries, including the competence of testing laboratories.

**Third-party testing**

Intertek, of Boxborough, Massachusetts, is an international provider of quality assurance and safety-testing services. Edison’s original testing lab is now a part of Intertek, and Intertek’s ETL safety mark is ubiquitous within the electrical product sector.

The alternative energy market is a particular focus for Intertek product-safety testing. The company’s labs do a great deal of work in safety-testing photovoltaic modules, for example. UL 1703—“UL Standard for Safety Flat-Plate Photovoltaic Modules and Panels” is the standard that’s used in this area.

The burgeoning popularity of alternative energy products such as photovoltaic modules and panels has led to quite a demand for safety-testing services. “The problem is that this is a growing, rapidly changing industry, and there’s a backlog for testing,” says Roy Strunin, senior marketing manager at Intertek. “Our clients were telling us that it was taking them from six to 18 months from the time that they said, ‘Please test’ until the test started.”

As a result of the need for increased product testing, Intertek has recently opened two new photovoltaic testing labs—one in Southern California and one in Beijing, China. The Asian lab is indicative of the increased emphasis on alternative energy in international markets. In fact, there are many nations that are ahead of the United States in taking advantage of energy resources such as photovoltaic modules and wind turbines.

The wind sector is an area in which Intertek has a key presence as well. “There’s an interesting dynamic in the wind industry,” says Strunin. “In photovoltaics, you have a specific standard [UL 1703], and every solar panel needs to be tested to that standard. In the United States, we don’t have a standard for wind turbines.”

The problem is particularly acute in the “large wind” segment of the industry. Large wind turbines, which are designed for commercial power generation on a massive scale, can have a rotor diameter of up to 400 feet. These turbines can generate up to seven megawatts of power and cost a million dollars or more—each.

These large wind turbines contain generators, lots of wiring, rigging, and elevators. So how does an Intertek inspector know that all of this equipment is safe? That it’s not going to break or catch fire, causing property loss, or worse, human injuries or deaths? Again, there’s no standard in the United States for this segment of the industry, so Intertek does what is known as “field labeling.” They work with the customer and the local authority having jurisdiction (AHJ) to inspect the generator, the wires, the rigging, and everything else. Once these pieces have been tested to the satisfaction of Intertek, the customer, and the AHJ, the turbine is labeled as being safe. But without a detailed standard to precisely iterate the quality assurance and safety-testing measures to be taken, individual field inspections can and do contain a degree of variance.

This sector is still evolving when it comes to safety testing. More development is expected as wind turbine power-generation systems become increasingly prevalent across the United States in coming years.

**A manufacturer’s perspective**

To compete in this emerging space, manufacturers obviously must place an emphasis on the safety and quality of their products. SolarWorld Industries America, based in Hillsboro, Oregon, is a leading producer of photovoltaic modules, cells, and wafers.

Within this sector, there are a variety of procedures whereby photovoltaic modules are employed to capture sunlight and convert it to energy. Some companies use single-crystal silicon, others use polycrystalline, and still others use thin-film methods. In the United States SolarWorld uses single-crystal silicon.

“Our is really kind of an old-school product in which we slice up wafers of silicon,” says John L. Coleman, Ph.D., continuous improvement specialist, module engineering, of SolarWorld. “We follow a semiconductor-type process to develop photovoltaic cells, which is done in our Hillsboro facility. The cells are then shipped down to our module-fabrication facility in Camarillo, California, where we interconnect and encapsulate them.”

The result is a photovoltaic module ready for home or commercial use.
SolarWorld products are safety-tested according to UL and IEC standards. All of its modules are 100-percent tested to ensure that they’re grounded so that no consumer can walk over to an array and get a nasty shock—or worse.

“Each product is tested as per the safety requirements from UL and the IEC,” says Coleman. “Our products go to the appropriate sanctioning body, whose labs put them through a group of qualification tests. Once those labs qualify the product and say it conforms to a particular standard, we go into production with that particular flavor [of module].”

SolarWorld manufactured approximately 30 megawatts of photovoltaic modules in 2007, 100 megawatts in 2008, and is projected for 150 megawatts this year.

To handle the expanding demand (a nice problem for any manufacturer to have), SolarWorld has increasingly moved to an automated manufacturing process; Coleman estimates that up to 90 percent the company’s processes are now automated. In a data-driven manufacturing environment such as this one, analyzing the information coming off of individual pieces of assembly equipment is of critical importance. SolarWorld’s manufacturing execution system (MES) takes the data from these automated processes and feeds them into the STATISTICA software program from StatSoft Inc. STATISTICA allows SolarWorld to look at control charts, capability studies, and other statistical analyses.

**Everyone’s concern**

Safety testing is an area of quality assurance that has serious ramifications for everyone along the alternative energy chain—manufacturers, certification bodies, retailers, and, especially, the businesses and individuals that use these products. Some retailers (Home Depot is a prime example) have been known to take a product’s safety certification one step further by subjecting it to their own testing processes, which are often more stringent than those of the testing labs or even the manufacturers themselves.

Safety testing, if done properly, assuages risks such as liability, corporate reputations, and even death for all key stakeholders in the energy-generation business. These procedures have been in place for more than a century to ensure the safety of everyone that can be affected by the use of energy products. As energy demands increase and the environmental effects of fossil fuels mount, alternative energy sources will increasingly come to the forefront as options for businesses and consumers alike. The booming business for photovoltaic modules and wind turbines will continue as long as the public finds these products to be effective, affordable, and, of course, safe.

**About the author**

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