

# Revising Standards & Codes

by John Wiles

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Applicable codes and standards strongly influence the design, manufacture, and installation of new PV equipment. And when these new products begin to be installed in the field, they, in turn, may have additional impacts on codes and standards. This intricate balance between product innovators who are pushing the envelope for PV component performance and design, and those charged with ensuring system safety, helps guarantee the installation of safer, higher performance, and more reliable and cost-effective PV systems. Here's a peek behind the scenes of the organizations that set standards and write requirements.

## *Safety First & the UL Standards*

Underwriters Laboratories (UL) standard 1703 governs safety issues that relate to PV modules, and standard 1741 addresses PV inverters and charge controllers. These UL standards are not all-inclusive, but reference numerous other standards that establish requirements for the various components and materials used in a product's design and manufacture. Equipment designers diligently reference these standards, which establish construction and test protocols, to ensure that new products meet the requirements for safe installation and operation.

Although a prototype may work well in the laboratory, the manufacturer must refer to numerous codes and standards as the electronic layout and mechanical packaging are developed for the final product. The manufacturer submits the new product to UL for evaluation, and UL conducts safety tests as outlined by the standards. If the product passes the tests, UL "lists" it. (The Canadian Standards Association and ETL SEMKO also perform safety tests of PV electrical equipment using UL standards, and "certify" or list products that meet the standards.)

**Establishing the Standards.** UL maintains volunteer-based Standards Technical Panels (STP), consisting of manufacturers, installers/end users, inspectors, and government laboratories, for the two PV standards. Panel members meet periodically to review the standards and technological advances that could impact products, and to evaluate feedback and comments on listed products.

After the STP recommends modifications to a standard based on these reviews, UL circulates these proposed changes for comment to a wider audience, including inverter manufacturers, end users, and regulatory agencies, and publishes revisions only after an extensive review. The changes usually have a phase-in date, giving manufacturers time to revise any existing products.

Designers, installers, and users of UL-listed PV equipment can formally register comments, suggestions, and complaints

at the UL Web site (see Access). As a member of the STP for UL 1703 and 1741, I monitor all information distributed by the standards panels, and maintain communication for future actions to the standards as equipment designers, PV installers, and inspectors report inconsistencies between the *National Electrical Code (NEC)* and UL standards, or identify where standards pose barriers to safe, reliable, durable, and cost-effective PV installations.

Special UL teams address critical issues even before the larger STP discusses them. I keep PV installers, inspectors, and others informed on the latest codes and standards activities through presentations and articles that I publish here in *Home Power* and the *IAEI News* (see Access).

## *Meeting the Code*

Besides passing the UL standards, PV equipment must also meet *NEC* requirements for installation. Equipment that doesn't meet code requirements for installation, even if it is listed or certified, cannot be legally installed. For this reason, manufacturers should be familiar with both the UL standards and the *NEC*.

Occasionally, a listed product has some feature that will not meet *NEC* requirements for installation. A recent inverter, certified as meeting UL 1741, was made with attached AC and DC power cables that did not meet *NEC* requirements for connection. The inverter had to be redesigned to accept a code-compliant cable. Generally, after an installer or an inspector identifies a noncompliance and alerts the listing agency, the manufacturer modifies the product and the listing agency retests it.

Engineers at the Southwest Technology Development Institute (now called the Institute for Energy and the Environment) assist PV equipment manufacturers in interpreting the UL standards and the *NEC*, and work with PV system designers, integrators, and installers to help them understand how the code and UL standards affect equipment design and installation. Typical issues include terminal and conductor compatibility, wiring compartment sizing, and addressing unclear language or instructions in equipment manuals.

**Changing the Codes.** The *NEC* is reviewed and revised on a three-year cycle. Anyone or any group may submit proposals with technical substantiations for code changes to the National Fire Protection Association (NFPA). The closeout date for proposals for any given *Code* year is in November, two years before the *Code's* publication year. (For example,

all proposals for the 2008 NEC were due in November 2005.) The required submittal form and deadlines for comment can be found in the back of the NEC handbook or obtained from the NFPA.

The NFPA's sixteen-member Code Making Panel (CMP 13), composed of various industry, government, and other experts, evaluates proposals submitted for code changes relating to PV systems found in Article 690. After each proposal is carefully reviewed, the CMP issues a *Report on Proposals* that shows the panel's recommendations. This report is available to the general public for comment and can be found on the NFPA Web site.

After final comments have been coordinated, CMP 13 meets again to review and act on the comments. NFPA's Technical Correlating Committee oversees the entire process and coordinates between various CMPs to ensure a degree of continuity throughout the code.

**Forum Feedback.** A group of more than 100 industry individuals known as the PV Industry Forum develop, review, coordinate, and substantiate PV system-related proposals for the NEC. In addition to members of the PV industry, the forum includes IBEW (electrical union) members, electrical inspectors, and utility representatives.

As the forum's secretary, I collect suggestions from inspectors, electricians, and PV installers for code clarifications and changes, and translate these suggestions into draft proposals with technical substantiation. These draft proposals are distributed to the PV Industry Forum, and the feedback results in a finely tuned set of proposals—and even some new ideas. In November, I submit the reviewed and coordinated proposals for evaluation to the NFPA's CMPs, which generate two reports and the final code language. The forum provides feedback on these documents, an important part of the process that helps the PV industry get a clear, concise set of PV requirements in future editions of the NEC and Article 690. As a voting panel member, Ward Bower of Sandia National Laboratories can provide direct feedback on panel discussions and details that do not appear in the formal reports.

The three-year process results in the next edition of the *National Electrical Code*—a unique and one of the more well-respected safety documents in the world. Other countries, including Mexico and Ecuador, are adopting the NEC as their national electrical code.

## Continuous Change

Both standards revisions and code modifications involve many hours of work by many dedicated people. As innovations continue to appear and the industry keeps expanding, code-makers and standards-setters will be busy reviewing equipment and making sure that installed systems are safe, reliable, and cost effective.

If you have questions about the NEC or the implementation of PV systems that follow the requirements of the NEC, feel free to call, fax, e-mail, or write me. See the SWTDI Web site (see Access) for more detailed articles on these subjects. The U.S. Department of Energy sponsors my activities in this area as a support function to the PV industry under Contract DE-FC 36-05-G015149.

If you want to participate in the ongoing development of the NEC, send an e-mail to Ward Bower (see Access) to join the PV Industry Forum e-mail list.

## Access

John C. Wiles, Southwest Technology Development Institute/Institute for Energy and the Environment, New Mexico State Univ., Box 30,001/ MSC 3 SOLAR, Las Cruces, NM 88003 • 505-646-6105 • Fax: 505-646-3841 • jwiles@nmsu.edu • www.nmsu.edu/~tdi

Sandia National Laboratories, Ward Bower, Sandia National Laboratories, Dept. 6218, MS 0753, Albuquerque, NM 87185 • 505-844-5206 • Fax: 505-844-6541 • wibower@sandia.gov • www.sandia.gov/pv • Sponsor

The 2005 *National Electrical Code* and the *NEC Handbook* are available from the National Fire Protection Association (NFPA) • 800-344-3555 or 508-895-8300 • www.nfpa.org

IAEI News • www.iaei.org

### Standards Organizations:

Canadian Standards Association • www.csa-international.org

ETL SEMKO • www.intertek-etlsemko.com

Underwriters Laboratories • www.ul.com

Various UL standards development processes • <http://ulstandardsinfonet.ul.com/development.pdf>

