

Best Practices

Small Wind and the 2011 National Electric Code

Article 694 has been published. It's time to learn about it. By MICK SAGRILLO

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While the National Electric Code (NEC) applies to any electric equipment, wiring or device that is connected to the national electric grid, it wasn't until 2010 that an article specific to the unique characteristics of grid-interconnected and battery-charging small wind turbines was adopted. The development of Article 694 began in March 2008 and it was finally accepted in June 2010 by the National Fire Protection Association, the folks who update and publish the NEC as an ANSI Standard.

Over that time, 50 stakeholders from across the country and representing many more disciplines than small wind provided input and guidance for the draft document. Dr. Rob Wills, PE, of WindMonitoring.com and Robert Preus, PE, of Advanced Renewable Technology LLC, co-chaired the Wind-NEC code-writing committee. For their efforts, they were recognized last June by Wind Powering America with the Small Wind Advocacy Award at the 2010 Small Wind Conference in Wisconsin.

Like other sections of the NEC, you will likely need to review Article 694 many times before you are able to absorb all of its ramifications. Briefly, the sections of Article 694 encompass the following:

• **Section I** covers definitions and the scope of Article 694. "Small wind turbines" are defined as those up to and including 100 kilowatts in nameplate capacity at 11 meters per second (24.6 mph) wind speed. All wind turbines that generate electricity, regardless of blade orientation, tower style or where they are mounted, are covered by Article 694.

• **Section II** elaborates on circuit requirements, including voltage and current limitations as well as conductor and over-current protection sizing. As **Article 240** focuses on over-current protection requirements, that article is referenced.

• **Section III** goes over the details of disconnecting the wind turbine from the electrical system. Some wind turbines are designed to never be disconnected from their load, lest rotor rpm increase uncontrollably. This section

recognizes that unique feature of small-wind technology, with an exception for turbines that would be deleteriously affected by the incorporation of a "disconnecting means."

• **Section IV** reviews allowable wiring methods for small wind turbines.

• **Section V** covers grounding and refers to **Article 250**, which details grounding requirements.

• **Section VI** covers required safety marking and signage specific to the installation.

• **Section VII** briefly refers to interconnecting the wind turbine to the utility system, then defers to **Article 705**, which covers this topic and requirements in detail.

• **Section VIII** entails storage batteries and associated controllers. Since **Article 480** more thoroughly covers batteries, that article is referenced as well.

• **Section IX** covers small wind systems that are designed to operate over 600 volts and refers to **Article 490** for more details.

Besides all of the above bolded articles, other articles pertinent to small wind installations include —

• **Article 285** on surge-protection devices, a requirement for small wind systems.

• **Article 300** covers wiring requirements and wiring methods with numerous tables and formulas. For many electrical questions, this is a "core" article.

• **Articles 500 to 516** on hazardous locations are also referenced. Hazardous locations are defined as those where flammable liquids, gases or fibers are a concern.

• Interestingly, there is no mention of **Article 690**, which covers photovoltaic systems. "Interestingly" because 694 was patterned off of 690 and the lessons learned in implementing that article. This is also interesting because many small-wind installers use 690 as an electrical requirement guide in the field.

As small-wind installers, we are required to abide by the rules laid out by all of the articles referenced above. However, as a small-wind installer, don't even try to memorize any or all of these articles — there's simply too much detail to absorb. I've run across few inspectors who could cite the NEC chapter and verse, and it's their job.

A good working knowledge of the NEC and the articles that apply to small wind installations, however, is a requirement for any installation company doing business today. At the very least, become familiar with the articles and what they cover so that you can more easily find what you need in the code book. Knowing what to look for and where to find it in the code book is an essential skill!

In lieu of this, retain the services of a good electrician. Depending on how small wind turbines are permitted in your area, this may be required anyway. 57



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Patterned very roughly on Article 690, the new code has important differences. For instance, over-current protection is scaled for continuous at-capacity operation.