691.10 Fire Mitigation. PV systems that do not comply with the requirements of 690.11 shall include details of fire mitigation plans to address dc arc-faults in the documentation required in 691.6.

Informational Note: Fire mitigation plans are typically reviewed by the local fire agency and include topics such as access roads within the facility.

691.11 Fence Bonding and Grounding. Fence grounding requirements and details shall be included in the documentation required in 691.6.

Informational Note: See 250.194 for fence bonding and grounding requirements enclosing substation portions of an electric supply station. Grounding requirements for other portions of electric supply station fencing are assessed based on the presence of overhead conductors, proximity to generation and distribution equipment, and associated step and touch potential.

ARTICLE
692 Fuel Cell Systems

Part I. General

692.1 Scope. This article applies to the installation of fuel cell systems.

Informational Note: Some fuel cell systems can be interactive with other electrical power production sources, are stand-alone, or both. Some fuel cell systems are connected to electric energy storage systems such as batteries. Fuel cell systems can have ac output(s), dc output(s), or both for utilization.

The rising demand for electric power has led to the development of power sources that are viable alternatives to, or can be interconnected with, electric utility distribution systems. Article 692 covers the installation of on-premises electrical supply systems in which the power is derived from an electrochemical system that consumes fuel to generate an electric current.

The principle of operation is that dc is generated through a chemical reaction in which hydrogen-rich fuel such as natural gas, liquefied petroleum gas (LP-Gas), or hydrogen is consumed. The consumption of the fuel gas is via an electrochemical process, as opposed to internal combustion prime movers, which consume fuel using a combustion process. A power inverter converts the dc to ac. The installation requirements of Article 692 allow power derived from fuel cells to be safely delivered into residential and light commercial occupancies as the sole source of electric power or as an integrated source with a utility or other power source.

692.4 Installation.

(A) Fuel Cell System. A fuel cell system shall be permitted to supply a building or other structure in addition to any service(s) of another electricity supply system(s).

(B) Identification of Power Sources. Fuel cell systems shall be marked with a plaque or directory installed in accordance with 705.10.

(C) System Installation. The construction and operation of equipment, associated wiring, and interconnections shall be performed only by qualified persons.

Informational Note: See Article 100 for the definition of *qualified person*.

692.6 Listing Requirement. The fuel cell system shall be approved for the application in accordance with one of the following:

(1) Be listed for the application
(2) Be evaluated for the application and have a field label applied

Part II. Circuit Requirements

692.8 Circuit Sizing and Current.

(A) Nameplate Rated Circuit Current. The nameplate(s) rated circuit current shall be the rated current indicated on the fuel cell nameplate(s).

(B) Conductor Ampacity and Overcurrent Device Ratings. The ampacity of the feeder circuit conductors from the fuel cell system(s) to the premises wiring system shall not be less than the greater of (1) nameplate(s) rated circuit current or (2) the rating of the fuel cell system(s) overcurrent protective device(s).

(C) Ampacity of Grounded or Neutral Conductor. If an interactive single-phase, 2-wire fuel cell output(s) is connected to the grounded or neutral conductor and a single ungrounded conductor of a 3-wire system or of a 3-phase, 4-wire, wye-connected system, the maximum unbalanced neutral load current plus the fuel cell system(s) output rating shall not exceed the ampacity of the grounded or neutral conductor.

692.9 Overcurrent Protection.

(A) Circuits and Equipment. If the fuel cell system is provided with overcurrent protection sufficient to protect the circuit conductors that supply the load, additional circuit overcurrent devices shall not be required. Equipment and conductors connected to more than one electrical source shall be protected.

(B) Accessibility. Overcurrent devices shall be readily accessible.

Part III. Disconnecting Means

692.13 All Conductors. Means shall be provided to disconnect all current-carrying conductors of a fuel cell system power source from all other conductors in a building or other structure.

Δ **692.17 Switch or Circuit Breaker.** The disconnecting means for ungrounded conductors shall consist of readily accessible, manually operable switch(es) or circuit breaker(s).

Where all terminals of the disconnecting means may be energized in the open position, a warning sign shall be mounted on or adjacent to the disconnecting means. The sign shall be clearly legible and shall have the following words or equivalent:

DANGER
ELECTRIC SHOCK HAZARD.
DO NOT TOUCH TERMINALS.
TERMINALS ON BOTH THE LINE AND
LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION.

The danger sign(s) or label(s) shall comply with 110.21(B).

Part IV. Wiring Methods

Δ **692.31 Wiring Systems.** In addition to wiring methods included in Chapter 3 of this *Code*, wiring methods and fittings specifically listed and identified for use with fuel cell systems shall be permitted.

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Part V. Marking

692.50 Fuel Cell Power Sources. A marking specifying the fuel cell system, output voltage, output power rating, and continuous output current rating shall be provided at the disconnecting means for the fuel cell power source at an accessible location on the site.

692.51 Fuel Shut-Off. The location of the manual fuel shut-off valve shall be marked at the location of the primary disconnecting means of the building or circuits supplied.

Δ **692.52 Stored Energy.** A fuel cell system that stores electrical energy shall require the following warning sign, or equivalent, at the location of the service disconnecting means of the premises:

WARNING
FUEL CELL POWER SYSTEM CONTAINS
ELECTRICAL ENERGY STORAGE DEVICES.

The warning sign(s) or label(s) shall comply with 110.21(B).

Part VI. Connection to Other Circuits

N **692.60 Connection to Other Systems.** Fuel cell systems connected to other sources shall be installed in accordance with Parts I and II of Article 705.

692.61 Transfer Switch. A transfer switch shall be required in non-grid-interactive systems that use utility grid backup. The transfer switch shall maintain isolation between the electrical production and distribution network and the fuel cell system. The transfer switch shall be permitted to be located externally or internally to the fuel cell system unit. Where the utility service conductors of the structure are connected to the transfer switch, the switch shall comply with Article 230, Part V.

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ARTICLE
694 Wind Electric Systems

Part I. General

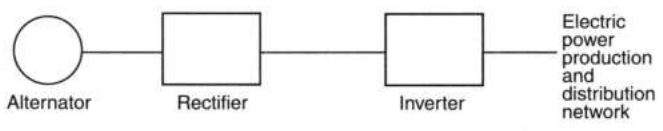
Δ **694.1 Scope.** This article applies to wind (turbine) electric systems that consist of one or more wind electric generators and their related alternators, generators, inverters, controllers, and associated equipment.

Informational Note: Some wind electric systems are interactive with other electric power sources (*see Informational Note Figure 694.1*). Some systems have ac output and some have dc output. Some systems contain electrical energy storage, such as batteries.

Like photovoltaic and fuel cell systems, wind-driven turbines as a stand-alone, or an interconnected power production source, are available for use as part of the premises wiring system. Due to an increased desire for renewable energy, these systems have seen a significant increase in use. According to the U.S. Department of Energy, although the United States reached 10 gigawatts (GW) of wind power capacity in 25 years, it took only 4 years to add an additional 40 gigawatts (2008–2012). As of 2020, the United States' total cumulative wind power capacity of 122 gigawatts was second in the world, as compared to the largest worldwide generator of wind power, China, at approximately 288 gigawatts. Wind power installations often are land based but can also be installed offshore. In 2020 alone, the United States increased its offshore wind power generation capacity over 24%, to roughly 35 gigawatts.

Wind turbine farms are becoming more common. Some are utility owned, while others are owned by private investors. Most wind electric systems consist of a single wind turbine, such as the one shown in Exhibit 694.1.

Many of the requirements in Article 694 are similar to those contained in Articles 690 and 692. The requirements apply to all wind turbines within the scope of the *NEC®*, regardless of the kilowatt rating.



INFORMATIONAL NOTE FIGURE 694.1 *Identification of Wind Electric System Components — Interactive System.*