

**NATURAL RESOURCES CONSERVATION SERVICE
INTERIM CONSERVATION PRACTICE STANDARD
CONSERVATION POWER PLANT**

(No.)
CODE 716

DEFINITION

A facility for producing energy from renewable resources.

PURPOSE

Provide an alternate and dependable source of power that is not generated by fossil fuels, for farm and ranch operations

CONDITIONS WHERE PRACTICE**APPLIES**

Wherever agriculture power needs can be met or supplemented by use of alternative power sources.

This standard applies to the use of wind, solar, bioenergy and hydro power plant alternatives.

For power plants designed to produce 500kW (kilowatts) or less.

For production and use of biofuels for on-farm power plants (e.g. generators or tractors)

CRITERIA**General Criteria Applicable to Purposes**

Prior to any design work an energy audit must be performed to document the energy use of the farming operation and where savings can be made in energy usage. The audit should also estimate the cost and fuel/energy savings.

The efficiency of the power units, type of power utilized, quantity of power produced, quality of buildings or structures, automation features and other accessories installed shall be in keeping with the economic and environmental value of the system to accomplish the conservation objectives.

Prior to the installation of any system that is planned as a grid-connected system, written approval will be secured from the receiving local utility.

All components shall be warranted against material and workmanship defects for a period of no less than one year from installation.

All systems shall provide appropriate backup systems based on the risk associated with the inoperability of the planned power plant facility.

All system designs shall address safety concerns for each component within the process.

All systems shall have a method for disposal and / or utilization of process by-products that will not result in a degradation of environmental resources.

Containment for biofuel feedstock, product and byproduct, as necessary, shall comply with storage / containment capacity criteria as given in Conservation Practice Standard 309, Agrichemical Handling Facility.

Electrical Systems. All electrical systems shall be installed to meet the national, state, or local electrical code, whichever is more restrictive. A licensed electrician shall certify all installations.

Design. The system provider shall complete and supply to the land owner/operator a detailed design of the facility clearly outlining the objectives and anticipated outcomes of implementation. Independent, verifiable data demonstrating results of the use of the facility or process in other similar situations and locations shall be provided.

Power Plants. Power plants shall be selected on the basis of availability of the power resource, operating conditions, critical nature of need, and conservation needs and objectives, including the need for automation.

The system shall be designed to provide no more than 150 percent of the annual peak daily on-farm usage, as documented in the energy audit.

Building and accessories. The design of the power plant and associated housing, if required, shall consider accessibility for equipment, maintenance and repairs, and the need for protecting equipment from the elements, vandalism, fire and flood.

Power units shall be mounted and installed according to the manufacturer's recommendations. All structural features and equipment shall provide adequate safety features to protect workers and the public from injury. Buildings shall meet local building codes.

Wind Turbine. All acceptable wind turbine power plants shall include the following components:

Wind turbine which includes blades, rotor, generator and over speed control mechanism.

- Tower
- Electrical control system
- Backup power

A wind turbine manufacturer, dealer or installer will size the system based on the electricity needs and specific local wind patterns. A list of manufacturers is available from AWEA (American Wind Energy Association). The installation must follow the manufacturer's recommendations identified in the Owners Manual. The installer will have the installation inspected and certified by a licensed electrician.

A minimum wind power Class of 3 is required based on the U.S. Dept. of Energy, National Renewable Energy Laboratory's 50 Meter Wind Class Map unless wind power can be verified to be of Class 3 quality with anemometer data or by an equally objective and verifiable source. All wind turbines are required to have automatic over speedgoverning systems.

Tower. All towers (structures to which turbines will be mounted) need to be of sufficient height that the sweep of the blades is a minimum of 30 feet above and 100 feet away from any obstacle. Guy wires are to be installed according to the manufacture's recommendations. All construction drawings

for the installation of the towers must be certified by a licensed professional structural engineer. All lighting shall meet the minimum requirements of Federal Aviation Administration regulations.

Photovoltaic (PV) Power System. An acceptable PV power plant shall include the following components:

- Photovoltaic array and mounting structure
- Electrical control system
- Backup power
- Protective structures

Solar Insolation Data. Site specific data, (energy received per unit area per day), are preferable for system design. General data can be found at: <http://www.findsolar.com> The daily electrical demand will be used as a guide for determining the size of the PV array.

PV System Components. PV modules must have as a minimum, a manufacturer's warranty against power degradation in excess of 10% of the rated power for no less than ten years after installation. PV modules shall be listed by Underwriters Laboratories (UL) or another nationally recognized testing laboratory.

Hydropower. All hydropower plants shall include the following components:

- Intake control gates with screens to prevent the entry of fish, plants, animals and debris.
- Penstock and flow by-pass system
- Turbine and generator
- Electrical control system
- Tailrace

A hydropower turbine manufacturer, dealer or installer will size the system based on the electricity needs and specific flow conditions at the site.

The equipment shall be designed and installed in accordance with standard engineering practice and the manufacturer's recommendations identified in the Owners Manual. The installer will have the installation inspected and certified by a licensed electrician.

The impacts of the hydropower facility on aquatic habitats and species shall be

assessed. Potential adverse effects on federally listed species and state species of concern shall be mitigated as appropriate, for example, by incorporating screens and fish passage structures into the hydropower plant design.

Bioenergy Systems: Energy derived from Biomass. These systems include unit processes to develop biopower and biofuels for on-farm power plants as defined in ANSI/ASABE S593. Biopower generation may be accomplished with energy products from biological and thermochemical conversion platforms. Examples include biogas production, thermochemical conversion, and direct combustion.

Bioenergy systems shall be designed and installed according to standard engineering practice. System designs and installations must be certified by a licensed / registered professional engineer in South Carolina.

Acceptable biomass energy feedstocks may include sources such as crops (both agricultural and silvicultural), crop residues, animal manures, and other organic materials.

Systems that include biogas production and utilization shall meet NRCS Standards for Anaerobic Digesters (365 or 366). Gas utilization equipment shall be designed and installed in accordance with standard engineering practice and the manufacturer's recommendations. As a minimum, the installation will include a flare to burn off collected gas and a means of maintaining the digester within acceptable operating temperature limits.

- The flare shall be equipped with automatic ignition and powered by battery/solar or direct connection to electrical service. The flare shall have a minimum capacity equal to the anticipated maximum biogas production.
- Gas monitoring and leak detection equipment shall be installed to prevent the build-up of hazardous gases.
- Gas-fired boilers, fuel cells, turbines, and internal combustion engines, when a component of the system, shall be designed for burning biogas directly, in a mix with other fuel, or shall include equipment for removing H₂S and other

contaminants from the biogas.

CONSIDERATIONS

General Considerations Applicable to all Projects.

When planning these practices the following items should be considered, as applicable:

- Can the system be protected from natural events such as fire, flood, wind or hail?
- What is the service life of the system and cost recovery?
- Does the manufacturer, dealer or installer have O&M support staff available?
- Aesthetic concerns.
- Is the ambient noise level of the system going to be a concern?
- In lightning prone areas consideration should be given to locating the system away from high points in the topography, installing lightning rods adjacent to the system, and including lightning surge protection in the system specifications.

Wind Turbine. When planning this practice the following should be considered, as applicable:

Potential risks to birds and bats should be evaluated through site analyses, including assessments of bird and bat abundance, timing and magnitude of migration, and habitat use patterns. Project location, design, operation, and lighting should be carefully evaluated to prevent, or minimize, bird and bat mortality and adverse impacts through habitat fragmentation, disturbance, and site avoidance.

Sites requiring special scrutiny include sites that are frequented by federally listed threatened and endangered species of birds and bats, in known migration pathways, areas where birds and/or bats are highly concentrated, and areas that have landscape features known to attract large numbers of raptors.

Refer to the US Fish and Wildlife Service's Interim Voluntary Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines for site selection and construction

of wind turbine installations. This document is available on-line at <http://www.fws.gov/habitatconservation/wind.pdf>

PV Systems. When planning this practice the following should be considered, as applicable:

- Solar trackers, as a component of a PV power system, to provide for greater efficiency of collection.

Hydropower System. When planning this practice the following should be considered, as applicable:

- Water rights and permit issues.

Gas Utilization System. When planning this practice the following items should be considered, as applicable:

- Odor concerns
- Noxious gas accumulations
- Emergency ventilation and exits

PLANS AND SPECIFICATIONS

Plans and specifications for constructing power plants shall be in compliance with this standard and describe the requirements for properly installing the practice to achieve its intended purpose.

A site plan and site specific construction specifications shall be prepared for each system.

OPERATION AND MAINTENANCE

An Operation and Maintenance plan specific to the facilities installed shall be prepared for use by the landowner or responsible operator. The plan shall provide specific instruction for operating and maintaining facilities to ensure the power plant functions properly. All component manufacturers' instructions appropriate for the specific equipment installed at the site shall be attached to the plan upon completion of the job. The plan shall include the provision to address the following, as a minimum:

- Inspection and testing of all power plant components and appurtenances.
- Proper start-up procedures for the operation of the power plant.
- Routine maintenance of all mechanical components.
- Periodic removal of fire hazard material from around the site.

- Routinely test and inspect all automation components of the power plant to assure they are functioning as designed.
- Periodic inspection of all safety features to ensure they are in place and functional
- Provide emergency shut down procedures.
- For PV power plants adjust the tilt angle of the solar modules on a seasonal basis, if applicable.

REFERENCE

ANSI/ASABE S593, May 2006. Terminology and Definitions for Biomass Production Harvesting and Collection, Storage, Processing Conversion and Utilization. American Society of Agricultural and Biological Engineers.

U.S. Army Corps of Engineers, Nation Wide Permit Information, Permit 17 Hydropower Projects

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Wind & Hydropower Technologies Program. State Wind Resource Map.

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Wind & Hydropower Technologies Program. State Resource Assessment Reports.

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Solar Energy Technologies Program. Photovoltaics

U.S. Dept of Energy, Idaho National Laboratory, Renewable Energy, <http://www.inl.gov/renewableenergy/>

U.S. Fish and Wildlife Service. 2003. INTERIM GUIDELINES TO AVOID AND MINIMIZE WILDLIFE IMPACTS FROM WIND TURBINES. <http://www.fws.gov/habitatconservation/wind.pdf>

Naval Facilities Engineering Command. Maintenance & Operation of Stand-Alone Photovoltaic Systems. Revised 1991.

Photovoltaic Design Assistance Center, Sandia National Laboratories, Albuquerque,

NM, March 1993

National Wind Coordinating Collaborative
<http://www.nationalwind.org/default.htm>

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service [South Carolina State Office](#) or visit the electronic [Field Office Technical Guide](#).

NRCS, SC
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