NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

FARMSTEAD ENERGY IMPROVEMENT

Code 374
(No.)

DEFINITION

Development and implementation of improvements to reduce, or improve the energy efficiency of on-farm energy use.

PURPOSE

To reduce energy use.

CONDITIONS WHERE PRACTICE APPLIES

The practice applies to non-residential structures and energy using systems where reducing energy use is the identified goal.

CRITERIA

General Criteria Applicable To All Purposes

Impact to cultural resources, wetlands and Federal and state protected species shall be evaluated and avoided or minimized to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

Implement recommendations for components of a current energy audit performed in accordance with the American Society of Agricultural and Biological Engineers (ASABE) Standard S612, Performing On-farm Energy Audits.

Where required, certify that the replacement or retrofit system and related components or devices meet or exceed currently applicable federal, state, and local standards and guidelines. Components of major activities by farm enterprises defined in ASABE S612 shall meet the appropriate NRCS or industry standard, such as:

- Florida NRCS Conservation Practice Standard, Pumping Plant, Code 533

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

- Florida NRCS Conservation Practice Standard, Combustion System Improvement, Code 372
- Heating, Ventilating and Air Conditioning (HVAC) per American Society of Heating, Refrigerating and Air Conditioning Engineers Standard 90.1-2010
- Ventilation fans per ASABE EP 566.1
- Greenhouse HVAC per ASABE EP406.4
- Motor efficiency per National Electrical Manufacturers Association MG 1-2009, Rev. 2010

Criteria Applicable to Evaporative Cooling Pads

Design evaporative cooling pad area systems with the necessary components including, but not limited to, pads, water supply, exhaust fans, pump, distribution pipe, return gutter, sump, and bleed-off line.

All evaporative cooling pad systems shall provide for recirculation and reuse of cooling water.

Cooling pad area. Design the amount of pad area needed in accordance with the manufacturer's recommendations. Locate the pad so that all air entering the house will have to pass through the pad. Provide a method of closing off the pads during the winter when heating, not cooling, is required. The pads should be continuous along the entire length of the wall. Do not separate the pad and exhaust fans by more than 200 feet. A distance of 150 feet or less is preferred.

Airflow through Cooling Pads. The required face velocity of the air will depend upon the pad material. Follow manufacturer's recommendations. This velocity will determine the number of square feet of pad area needed for a house of a given configuration. The fan capacity should be based on the type of material used for the cooling pad and in accordance with the manufacturer's recommendations.

Exhaust Fans. Regardless of the type of pad material used, the fan should have the capacity to provide a minimum of one air change per minute in the greenhouse. Exhaust fans should not be spaced more than 20 – 30 feet apart. Equip the fans with automatic shutters to eliminate back drafts when fans are not in operation. Properly screen and guard fans to protect personnel from coming into contact with moving parts.

Water flow rate. Design adequate water supply and distribution system for the pad surface area to maximize operating efficiency. The amount of water needed will vary with the type of system used, but, normally, complete pad surface wetting occurs when about 1/3 gallon per minute water per foot of pad length is recirculated. Design the water flow to cover the pad surfaces with a water film. Quantity of water will be in accordance with the manufacturer's recommendation.

Pump. Design pump in accordance with manufacturer's recommendations. A valve should be placed in the line from the pump so the water flow through the distribution pipe can be adjusted.

Gutter. Design gutter to collect water for return to the sump.

Sump capacity. Design sumps with a capacity of 1 to 1¼ gallons for each linear foot of pad in order to hold the water that drains back to the sump when the system stops. If water distribution pipes are more than 75 feet in length, the sump should be located near the center of the line.

Safety. A safety disconnect switch shall be installed near each fan and pump.

Bleed off. A continuous water bleed-off rate of 0.05 gpm for every 1,000 cfm of airflow is recommended to prevent salt and mineral concentration buildup.

CONSIDERATIONS

General

Energy conservation and energy efficiency improvements should consider greenhouse gas emissions and ambient air pollutants. Methods may be implemented to account for greenhouse gas emissions credits, if applicable. Actual greenhouse gas emission reductions would require separate documentation.

In order to reduce energy imported onto a farm, consider possible use of renewable energy resources.

Plan progressive implementation of energy measures with ranking metrics such as life-cycle energy savings, payback period, or cost-effectiveness, etc., based on the landowner's goals and objectives.

Evaporative Cooling Pads

Consider the use of climatic sensors that can automate the use of this system. Automation will allow the system to shut off when not required and thus conserve energy and water. Thermostats and other control sensors should be near the center of the room and away from unrepresentative climate modifiers.

Consider screening the return flow before it enters the sump and covering of the sump to keep out debris.

Consider shading the evaporative pads and sump to aid in algae control. Regular drying of the evaporative pads will also help control algae.

Consider treating recirculating water where disease and plant pest are concerns.

Consider using high pressure fog systems which can be designed and operated to maintain more uniform temperatures and humilities in greenhouses than are possible with fan and pad systems.

Consider locating pads on the prevailing summer wind side and locate the fans on the downwind side of the greenhouse. If an adjacent greenhouse is within 25 feet of the evaporative cooling pads, the benefit of wind effect is negligible. Facing fans into prevailing winds will decrease capacity by 10% to 15%. Exhaust fans should not discharge toward the evaporative cooling pad of another house unless separated by 50 feet or greater.

Consider locating pads at both ends of the house with exhaust fans at the midpoint for more efficient cooling in very long houses.

PLANS AND SPECIFICATIONS

Plans and specifications to implement the energy conservation and efficiency measures shall be in accordance with this standard and describe the requirements for properly installing the practice to achieve its intended purpose. Plans and specifications shall include, but not limited to, the following:

- written specifications that describe the site specific details of installation,
- identify and describe the existing system and related components or devices,
- identify and describe the replacement or retrofit system and/or related components or devices,
- document system energy usage and resulting potential energy savings from the implementation of this practice,
- include a plan view showing the location of the measures in relationship to other structures or natural features where appropriate, and
- detail drawings of the measures and appurtenances, such as piping, inlet and outlet connections, mounting, foundations, and other structural components where appropriate.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of this practice, its intended life, and safety requirements.

Replacement or retrofit systems and related components or devices shall be operated and maintained in accordance with the manufacturer's recommendations.

Check thermostats using an accurate thermometer each spring and fall to ensure proper operation. Check humidistats at least weekly using a psychrometer.

Clean exhaust fans as often as necessary to prevent accumulation of dust. Operating efficiency of exhaust fans can be reduced 30% to 50% by the buildup of dust on fan blades or by shutters that do not operate freely.

Never allow any obstructions that would limit the flow of air into a fan within a distance of one blade diameter of a fan.

Check the fan ratings to be certain the proper volume of air is drawn through the cooling pads at the required static pressure resistance. Be sure to follow the manufacturers' specifications. Fans must be properly maintained to perform at rated capacities.

If using aspen fiber cooling pads, replace with new pads whenever the void area in the pads is 10% or greater of the original total pad area. Replacement is necessary because cooling efficiency is reduced as an increasing volume of air enters the greenhouse through the void space rather than through the cooling pads.

Be certain that the rated air flow passes through the cooling pad, not through open doors, cracks, or other openings in the greenhouse. Check pads and supporting frames to insure tightness of fit and good condition of pads. Cracks around pads should be sealed and pads with holes exceeding 1/4-inch diameter should be repaired or replaced. Only air that passes through the cooling pad is cooled; air entering through other openings is not cooled.

Use fungicides in the water supply system to retard the growth and buildup of algae in the cooling pads. Algae and other bacteria will hasten the deterioration of the pads and also increase resistance to air flow.

Check the sump screen regularly to ensure that it is reasonably free of debris.

Maintain records to document the implementation of energy improvements. Retain and update records for a minimum of five (5) years from the beginning of operation of measure implementation. Recommended records to be retained include, but not limited to, the following:

- monthly utility bills, fuel purchases, and yield of agricultural commodities, and
- documentation of maintenance conducted on the replacement, or retrofitted system and related components or devices.

REFERENCES

Florida NRCS Conservation Practice Standards
Combustion System Improvement, Code 372
Pumping Plant, Code 533

General Manual Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26

National Cultural Resources Procedures Handbook

National Environmental Compliance Handbook

National Food Security Act Manual

National Planning Procedures Handbook Florida Supplements to Parts 600.1 and 600.6

American Society of Agricultural and Biological Engineers. 2003. Heating, ventilating and cooling greenhouses. ANSI/ASAE EP406.4 JAN2003 (R2008). ASABE, St. Joseph, MI.

American Society of Agricultural and Biological Engineers. 2008. Guidelines for selection of energy efficient agricultural ventilation fans. ASAE EP566.1 AUG 2008. ASABE, St. Joseph, MI.

American Society of Agricultural and Biological Engineers. 2009. Performing On-Farm Energy Audits. ANSI/ASABE S612 JUL2009. ASABE, St. Joseph, MI.

American Society of Heating, Refrigerating and Air Conditioning Engineers. 2010. Energy standard for buildings except low-rise residential buildings. ANSI/ASHRAE/IES, Standard 90.1. ASHRAE, Atlanta, GA.