FARMSTEAD ENERGY IMPROVEMENT
(Nursery/Greenhouse)
CONSTRUCTION SPECIFICATION
(374)

1. SCOPE

The work shall consist of furnishing materials and installing selected components prescribed in an On-farm Energy Audit completed through a Conservation Activity Plan 122 and/or ASABE Standard S612 as outlined in this specification and the attached drawing and details.

2. EQUIPMENT AND MATERIALS

Equipment and materials installed shall match the type and size recommendations found in the On-farm Energy Audit. Changes require an approved revision by the audit TSP.

3. INSTALLATION

Installation shall conform to all applicable codes, laws and regulations.

Installation shall be a per drawings and manufacture's requirements.

All changes need prior approval.

Changes to audit recommendations must be obtained in writing by the landowner from the audit writer prior to approval and implementation.

Installation shall be by a qualified professional (Manufactures' Representatives, Equipment Companies, Ag Building Companies, Electricians, etc.)

Replacement of light bulb only, are normally done by the landowner.

4. SPECIFICATIONS

The following specifications supplement the information given on the drawings. The qualified professional that does the work shall meet the requirements applicable to their work and must also meet these specifications. Unlisted components shall meet the requirements specified in the Energy Audit.

CFL Bulbs

Technology: Compact Fluorescent (CFL) or Cold-Cathode Compact Fluorescent (CCFL)
Socket Base: E26
Luminance: 400 lumens minimum
Efficacy: minimum of 50 lumens/Watt at 100% output
Dimming Range: 10 to 100% of output
Output Angle Distribution: 120 to 160˚
Durability: 20,000 hours minimum
Other: Sealed lens that provides circuitry protection from both airborne particulates and clean-up operations or wet environments such as around sprinklers or misters.

LED Bulbs

Technology: Light-Emitting Diode (LED)
Socket Base: E26
Luminance: 400 lumens minimum at 100% output
Efficacy: minimum of 60 lumens/Watt at 100% output
Dimming Range: 10 to 100% of output
Output Angle Distribution: 120 to 160˚
Durability: Must have verifiable independent testing that shows a durable life in excess of 30,000 hoursin a greenhouse/nursery environment.
Other: Sealed lens that provides circuitry protection from both airborne particulates and clean-up operations or wet environments such as around sprinklers or misters.

Linear Fluorescent

Bulb Technology: T8 or T5 linear fluorescent

Ballasting: The fixture must use an electronic ballast. Magnetic ballasts are specifically prohibited due to their known inefficiency.
Fixture Output: Each fixture must use one electronic ballast to drive a minimum of 8 feet total length of bulbs.
Other: The fixture must be permanently installed with 'hard' wiring. Switches or electronic controls must be installed. The fixture (with bulbs) must be ENERGY STAR qualified and bear the logo.

Pulse Start Metal Halide
Technology: Pulse Start Metal Halide
Base: Halogen approved that must contain all parts if bulb bursts
Luminance: Average or mean> 385 original
Distribution: 120 to 160˚
Durability: 12,000 hour or > durable life
Other: Sealed system against moisture. Location not installed in close proximity to paper, cloth or other combustible materials.

Ventilation-Exhaust Fans
The new fan must be a model previously tested by the Bioenvironmental and Structural Systems Laboratory (BESS Lab [http://www.bess.illinois.edu/]) or the Air Movement and Control Association (ACMA [http://www.amca.org]).

Efficiency in cfm/W at 0.05" static pressure will vary with size of fan and must meet or exceed audit requirements as shown on drawings.

Fans shall be securely mounted and those located within 7 feet of a floor shall have a protective cage on both sides and/or louver combination.

Ventilation-HAF(Horizontal Air Flow)
The new fan must be a model previously tested by the Bioenvironmental and Structural Systems Laboratory (BESS Lab [http://www.bess.illinois.edu/]) or the Air Movement and Control Association (ACMA [http://www.amca.org]).

Efficiency in cfm/W at 0.05" static pressure will vary with size of fan and must meet or exceed audit requirements as shown on drawings.

Fans shall be securely mounted and those located within 7 feet of a floor shall have a protective cage on both sides and/or louver combination.

The fans selected shall be circulating fans, not exhaust fans. Verify selected fans provide a minimum total air flow of 2 cubic feet per minute per square foot except crops such as tomatoes, cucumbers and roses that create more air flow resistance, provide a minimum total air flow of 2.5 cfm/ft2 of floor area

Fans shall have large diameter blades (12" to 24"). Fan motors shall be permanent split capacitor (PSC) motors with low power output (1/15 to 1/10 horsepower).

Fans with shrouds or venturi that produce a longer "throw" distance shall be used where there are heavy plant canopies.

Fans shall have a guard to protect workers and meet OSHA requirements.

Fans location and mounting as per plan.

Systems to include separate electric circuit and on-off switch, as a minimum.

Variable Speed Drive
The associated electric motor (can be a separate item if existing motor was not 3-phase) and drive equipment must be installed and functional. Wiring, breaker switches, etc. for the motor and variable speed drive must be installed and functional. Use shielded wire between the controller and motor. The controller panel(s) and 3-phase inverter must be securely mounted and operate the attached electric motor and equipment.

Automatic Controller System
System controllers must operate multiple components or sub-systems. These controlled

components or sub-systems must be installed and functional. Wiring, breaker switches, etc. for the controller must be installed and functional. The controller panel(s) must be stably mounted and operate the associated components or sub-systems.

Motor Upgrades (Electric)
The driven equipment (pump, fan, etc.) must be installed and functional. The motor and control panel(s) must be securely mounted and functional. Wiring, breaker switches, etc. must be installed and functional.

The horsepower and phase of the motor shall be shown on the drawings.

Heating (Building)
Replace existing heating system with new system meeting required output. Includes all associated costs, including removal, upgrades, etc.

Building Envelope Sealant
The sealing must be performed by a qualified professional. Smaller gaps can be sealed using foam with a minimum of 10 lbs.cf polyurethane or equivalent The type, quality of work, and quantity required prohibits the use of foam sealant merely from an aerosol can. Before application of the sealant, the joints or areas must be reasonably cleaned with compressed air or mechanical means.

Other sealant material can be used that matches existing building construction materials for larger gaps.

Building Envelope-Greenhouse Screens
A mechanical screen system that consists of a drive motor, support cables, controls, and shade material, which may be woven, knitted or non-woven strips of aluminum fiber, polyethylene, nylon or other synthetic material. All screen materials to be ultra-violet light stabilized. System extends truss to truss or gutter to gutter and may include side screens.

Screen material for production greenhouses shall have firebreaks. Material for retail or institutional installation shall be flame-retardant.

Stainless steel wire or fire-retardant monofilament line shall be used for support of the screen material.

Listed below are specific requirements for various shade applications.

Heat retention screens, when closed, the system shall have a tight seal around the perimeter to eliminate heat escaping above the screen.

Shade screen shall be open weave (perforated or open strips) when the greenhouse has an open roof or when it is cooled with roof vents. This allows the heat to escape through the screen material when the curtain is closed.

Blackout Screen (Photoperiod control) must exclude at least 99% of incident light. The seal between the sidewall screen and the overhead screen shall exclude all light.

Sidewall screen systems shall be designed for energy conservation, blackout or for both. The screen shall form a tight seal around the edges.

Greenhouse- Insulate Unglazed Walls
Double bubble reflective insulation with aluminum foil. Minimum R valve of 1. Sufficient connections to hold material without sagging.

5. SAFETY

Electrical wiring shall be installed to meet national, state, or local electrical code, whichever is more restrictive. The work must be done by a qualified professional. Existing services requiring upgraded or extension shall be done at owner's expense.

Equipment shall be installed with all required safety shields and warning signs.

Components exposed to humid or wet conditions shall have additional moisture protection.

Components with liquid systems shall be protected from freezing or means to drain the liquids for winterization.

6. SUBMITTALS

The producer shall provide invoices that verify the type, material, or size of component being installed. This can include manufactures literature.

The producer must provide a copy of approved revisions to the drawings.

The producer shall provide verification that modifications for facility are approved by integrator, if applicable.

The producer shall provide a certification from the qualified professional(s) that the installation was installed as per manufactures requirements.

Qualified professional includes Manufactures' Representatives, Equipment Companies, Ag Building Companies, Electricians, etc.

Producer self-installation, other than changing light bulbs, requires qualified profession sign-off.

7. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE: