Fact Sheets

Energy

Selecting an Energy/Shade Screen System

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Energy/shade screens are one of the most popular methods of reducing greenhouse fuel usage. Savings of 30-50% in heating costs are common in many installations. Often referred to as energy blankets or curtains, screens save energy by reducing the heat loss surface area, providing an extra insulation barrier and trapping an insulating layer of air on both sides of the screen material. If the material contains some aluminum, the infrared part of the heat within the greenhouse will be reflected back toward the plants reducing heat loss another few percent. The aluminum strips can also save energy in the summer by reflecting the incoming heat back out of the greenhouse.

With a typical cost of $2.00-2.50/sq ft installed, the payback usually works out to 1-3 years. This can be influenced by the fuel cost, length of the heating season, climate and the night greenhouse temperature.

Select the best system
Although energy screens can be installed in free-standing greenhouses and hoophouses, they are most common in gutter-connected ranges. The standard system uses nylon monofiliment or stainless steel cables to support the blanket material. The material can either rest on top of a network of cables or be suspended by hooks from the cables. A gearmotor powers a drum or rack and pinion that moves the leading edge of the blanket material.

Energy/shade screens can be installed gutter to gutter or truss to truss. Factors to consider with the gutter to gutter system are:

•Less volume of greenhouse has to be heated.
•Less material is needed but it forms a larger bundle in the storage position.
•Installation is easier as work is done at a lower height.
•Equipment cannot be supported from the lower truss cord.

Truss to truss systems are generally more common. They can be installed flat at the gutter or up near the roof glazing (6-12" spacing). Configurations of slope-slope or slope-flat-slope are used.
These systems:
•Usually require more material.
•More space has to be heated.
•Heating, lighting and watering equipment may not have to be moved.

In many gutter connected greenhouses a lightweight truss can be installed below the screen (energy truss) to support heating, HAF, water, electrical systems and hanging baskets. Adequate gutter height is needed as this truss usually takes up about two feet of space. It is important when building a new greenhouse to anticipate the installation of the screen by keeping the truss area free of electrical, plumbing and other obstructions.

Some growers in northern climates are installing two screen systems. The lower screen has a high energy rating and the upper one is mainly for shade but provides additional energy savings when extended at night. This may provide an additional 10 to 15% savings in fuel. Sidewall screens are also becoming popular especially with the taller gutter-connected houses. These usually roll-up under the gutter or at the wall purlins.

Screen drive systems

Three types of drive systems are used to move the screen, cable and drum, push pull and chain and cable. The cable and drum system operates like a clothesline. It uses a gear motor that rotates a shaft near the center of the greenhouse. A stainless steel cable wrapped around a grooved drum connects shafts at each bay. The cable is attached to the leading edge of the screen. It extends the screen when the cable pulls the leading edge. It gathers and retracts the screen when moved in the other direction. Depending on the layout of the greenhouse, one drive motor can handle up to 40,000 sq ft of screen material.

Push and pull systems are used for truss to truss systems. Pinion gears on cross shafts move the toothed racks back and forth over the distance between the trusses. The leading edge of the curtain in each space between the trusses is connected to the racks and provides back and forth motion.

The chain and cable drive system is similar to the push and pull system with the exception that lengths of roller drive chain moved by a gearmotor and sprockets pulls or pushes the leading edge of the curtain between the trusses or across the width of the greenhouse.

There are screen systems available that can be installed in hoophouses. These are usually more difficult to install due to the shape of the structure and the amount of overhead space available. They also eliminate the space for hanging baskets.

I have seen a simple system installed in a hoophouse that uses a light weight steel cable stretched horizontally at each bow at 8-9' above the floor. The cable is attached to the bow with band clamps. The screen material is attached to the hoops at one side and rolled on a piece of tubing across to the other side forming an insulating ceiling. The inflated poly usually creates a seal at the sidewall. The ends of the screen roll over a fixed section of poly attached at the endwall and first cable to create a seal. Cost of this system is less than $1.00/sq.ft. for the materials.

Select the right screen material

Although the same mechanical support system can be used for energy savings, shading or photoperiod control, the screen material is different. The most common materials for energy screen are composite fabrics of alternating strips of clear and aluminized polyester or acrylic held together by a finely woven mesh of threads. Other materials available include knitted and woven bonded polyester, metalized HDPE (high density polyethylene) and polyproplyene. Things to look for when selecting a material include the warranty life (usually 5-10 years), strength and flexibility.

Many screen materials are designed to also provide shading during the summer. For comparison of materials, manufacturers list both the shade factor and the energy savings. Shade percentages from 10-100% and energy savings percentages from 20-75% are available. When selecting a shade screen material, consider the crop to be grown and the time of year. For most crops a shade material that provides 30-50% reduction is satisfactory. Too much shade limits the amount of light that reaches the lower leaves in the canopy

Screens can also have an open or closed weave. The closed weave has a higher energy savings and is used in greenhouses with fan ventilation systems. For natural ventilation, an open weave allows the heat to rise through the screen when it is extended. Some growers install a closed weave and then crack the screen open to allow the heat to escape · up through the roof vents. Some porosity is desirable to prevent

accumulation of moisture on top of the screen and the thread used to sew the strips together usually provides this.

Screens can also be used for photoperiod (daylength) control. Polyester or composite materials with an aluminized top layer and opaque bottom layer are popular as they reflect the incoming radiation to reduce the temperature buildup. They also allow water and moisture to pass through. These materials have a 99.9% light exclusion. Sidewalls have to have a similar system to maintain darkness.

Fire safety
Most screen materials are plastic. In a fire these can support combustion and increase the intensity of the fire. Screens have been the cause of the spread of several greenhouse fires. Materials selected should be either have a fire break installed or be fire-retardant. The fire break is usually section of fire-retardant material on both edges of a screen panel. It reduces the flame travel. In controlled tests (Ludvig Svensson), fire break material reduced the peak heat released by more than 20 times over plain aluminum/polyethylene screen material. The fire-retardant material, although more expensive, reduced peak heat release more than 200 times.

In general, a fire break material is the minimum requirement for production greenhouses. A fire retardant material should be used for retail greenhouses open to the public. The closure strip installed along the sidewalls of the greenhouse should be fire-retardant material to prevent the spread of the fire from panel to panel.

Experience has also shown that the polyester monofilament wires can cause spread of a fire. Use either stainless steel or the new fire-retardant polyester wire (FT Wire) for the support cables.

Installation and maintenance are keys to energy savings
A screen system is easiest to install if the greenhouse is empty of plants. The long cables and large pieces of screen require open space during installation. Man-lifts are frequently used to elevate workers to the truss level and require space to maneuver.

Closed weave energy screens need to be installed to provide a tight seal all the way around the edges. There are several ways to get a good seal. In most screen installations, one edge is permanently attached to a truss or gutter. The leading edge usually has a sealing flap. The side edges ride along a ledge of polycarbonate sheets or fire-resistant screen material.

Typical temperatures that would be observed in a heated greenhouse on a cold night might be 60°F under the screen and 35-40°F above. I have been in greenhouses where it was warmer above the screen than below showing that heat was escaping through holes, gaps or around the edges of the screen. Remember that heat supply pipes that are above the screen have to be insulated or moved lower.
Regular maintenance is needed to keep proper tension in the cable system. Pulleys and gear motors should be lubricated once or twice a year. Screen materials tend to wear on rub points and where they are supported by hooks. Repairs may have to be made at these points.

Control the screen by outdoor light level
It is important to properly use an energy/shade screen. It has to be closed and opened at the right time based on weather conditions and the time of year. Operation can be done manually or automatically using a photocell or time clock. Light activated operation is most desirable and doesn't have to be changed with the seasons. A light level of 50 ftc is a good threshold point. Most environment controllers and computers can be programmed to operate a blanket system.

Operation
If a screen is opened rapidly, the cold air from the attic will flow down to the plants. Some plants are susceptible to damage from this cold air. Setting the controls to open the screen slowly over a half hour eliminates this problem. Some growers solve the problem by waiting for the sun to warm the attic before the screen is opened.
To prevent damage to the greenhouse structure, energy screens should remain open when snow is predicted. The heating system should be designed for the heat loss with the screen retracted.
The installation of an energy/shade screen becomes more attractive as fuels prices continue to rise. The key to a good installation is the use of good materials and having tight seals around the edges.

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