

## Greenhouse Energy Conservation Checklist

Increasing energy costs make conservation and efficient use of facilities an important part of today's greenhouse operation. New greenhouse designs, better glazing, improved heating and ventilating equipment and new management systems should be included when upgrading or adding on. With typical annual energy usage being 75% for heating, 15% for electricity and 10% for vehicles, efforts and resources should be put where the greatest savings can be realized.

### Reduce Air Leaks

- **Keep doors closed** - use door closer or springs.
- **Weatherstrip doors**, vents and fan openings. For example, a 48" fan louver that fails to close properly leaving 1" gaps, allows 23,000 Btu/hr of heat to escape costing \$0.35 if you are burning \$1.50 fuel oil.
- **Lubricate louvers** frequently so that they close tight. A partially open louver may allow several air changes per hour. Additional fuel is needed to heat this air. Shut off some fans during the winter and cover openings with insulation or plastic to reduce infiltration of air.
- **Repair broken glass** or holes in the plastic covering.

### Double Covering

- **Line sidewalls and endwalls** of greenhouse inside with poly or bubble wrap to achieve the thermopane effect. Install double wall polycarbonate structured sheets to get insulation effect and reduce recovering labor.
- **Use poly with an infrared inhibitor** on the inner layer for 15% savings. Payback is 2-3 months.
- **Add a single or double layer of plastic** over older glasshouses to reduce infiltration and heat loss by 50%.

### Energy Conserving Blanket

- **Install a thermal blanket** for 20%-50% savings. Cost is \$1.00 - \$2.50/sq ft. Payback is 1-2 years. Tight closures should be maintained where curtains meet sidewalls, framing or gutters. Use a U-shaped trap to prevent heat from escaping overhead. Heat and water lines should be insulated or located below the blanket.

### Foundation and Sidewall Insulation

- **Insulate the foundation** - place 1-2" polyurethane or polystyrene board to 18" below ground to reduce heat loss. This can increase the soil temperature near the sidewall as much as 10 degrees during the winter.
- **Insulate the kneewall** or sidewall to bench height. Use 1" to 2" of insulation board. Applying 2" of foam insulation to a 3' high kneewall on a 28' x 100' greenhouse will save about 400 gallons of fuel oil/year.
- **Insulate behind sidewall heat pipes** - Use aluminum faced building paper or insulation board behind to radiant heat back into the growing area. Leave air space next to wall to prevent frost damage to the wall.

## Site Location

- **Locate new greenhouses in sheltered areas** to reduce wind-induced heat loss, if this does not reduce light.
- **Install windbreaks** on the north and northwest sides of the greenhouse. The windbreak can be a double row of conifer trees or plastic snow fence.

## Space Utilization

- **Increase space utilization** to 80% - 90% with peninsular or movable benches.
- **Install multi-level racks** for crops that don't require high light levels.
- **Grow a crop of hanging baskets** on overhead rails or truss-mounted conveyor system.
- **A roll-out bench system** can double growing space. Plants are moved outside during the day.

## Efficient Heating System

- **Installation of floor or under-bench heat** will allow air temperature to be set 5° - 10°F lower.
- **Yearly maintenance** - Check boiler, burner and backup systems to make sure they are operating at peak efficiency. Have furnaces cleaned and adjusted and an efficiency test run before heating season. A 2% increase in efficiency for a 30' x 150' greenhouse will save about 200 gallons of fuel oil.
- **Clean heating pipes** and other radiation surfaces frequently.
- **Check accuracy of thermostats** – correcting a reading that is 2°F high will save \$100-\$200.
- **Install electronic thermostats** or controllers with a 1° F accuracy. Potential yearly savings of 500 gallons of fuel oil in a 30' x 100' greenhouse when changing from a mechanical to electronic thermostat or controller.
- **Aspirate thermostats or sensors** for more uniform temperature control. Differential between on and off can be reduced as much as 6°F.
- **Install horizontal air flow (HAF) fans** to get more uniform temperature in the growing area.
- **Insulate distribution pipes** in areas where heat is not required.
- **Check and repair leaks** in valves, steam traps and pipes.

## Efficient Cooling System

- **Build new greenhouse with open-roof design** to eliminate the need for fans.
- **Install roll-up or guillotine sides** to reduce the need for fan ventilation.
- **Use shading** to reduce the need for mechanical cooling.
- **Install evaporative cooling** to get better temperature control during the summer.
- **Select fans that meet AMCA standards** and have a Ventilation Efficiency Ratio greater than 15. Use the largest diameter fan with the smallest motor that meets ventilation requirements.
- **Keep doors closed when fans are operating.**
- **Locate intake louvers to give uniform cooling.**

## Conserve Electricity

- **Have wiring system inspected** for overloading, corroded parts and faulty insulation.
- **Replace 3 hp or larger motors** with high efficiency ones to reduce electric consumption by 2-5%.
- **Check for proper belt tension** and alignment.
- **Replace incandescent bulbs** with low wattage fluorescent or HID bulbs. Save 2/3rds on electricity.
- **Install motion detectors** to control security lights so they are not on all the time.

## Trucks and Tractors

- **Regularly scheduled tune-ups** can save 10% on fuel usage. Keep tires properly inflated.
- **Avoid lengthy idling.** Idling can consume 15-20% of the fuel used.
- **Run equipment in the proper gear** for the load.

## Water Systems

- **Locate hot water tanks** as close as possible to the largest and most frequent use. Insulate pipes.
- **Heat water to the lowest temperature needed**, usually 120°F is adequate.
- **Use pipe size large enough** to supply necessary water at minimum friction loss.
- **Eliminate water leaks** – A dripping faucet at 60 drops/min. will waste 113 gallons/month.

## Management

- **Lower night temperature** – Fuel consumption is reduced 3% for each 1°F night temperature is lowered.
- **Delay starting the greenhouse** by a week or more. Build a germination/growth chamber to start seedlings.
- **Keep growing areas full** at all times.

**Additional information** can be found in **Energy Conservation for Commercial Greenhouses** – NRAES-3, 100 pages, \$20.00 available from the Department of Natural Resources Mgt. & Engr., 1376 Storrs Rd., UConn, Storrs CT 06269-4087. Make check payable to UConn. Price includes postage and handling.

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**<http://www.hort.uconn.edu/ipm/greenhs/bartok/htms/Greenhouse%20Energy%20Conservation%20Checklist.htm>**

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