

FARM ENERGY

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Greenhouse Energy Conservation Checklist

High 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. The following checklist can help you make energy-saving improvements to a greenhouse operation.

Reduce Air Leaks

- Keep doors closed – use door closer or springs.
- Weatherstrip doors, vents and fan openings.

- Lubricate louvers frequently so that they close tightly. If you burn fuel oil at a cost of \$1.50 per gallon, a 48" fan louver that fails to close properly leaving 1" gaps allows 23,000 Btu/hr of heat to escape, costing \$0.35. 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.
- Close holes under the foundation of plastic houses.

Double Covering

- Line the "inside" sidewalls and end walls 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 Curtain

- Install a thermal curtain for 20%-50% savings. Cost at \$1.00 – \$2.50 per square foot will result in payback within 1 to 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 thermal curtain.



An energy curtain can significantly reduce nighttime heat loss from a greenhouse. Photo: John Bartok, Jr., University of Connecticut

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 behind heat pipes to radiate heat back into the growing area. Leave air space next to the 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. Top level 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 off 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 greenhouses 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 or variable frequency drive motors to reduce electric consumption by 2-5%.
- Check for proper belt tension and alignment.
- Replace incandescent bulbs with low wattage (compact) fluorescent or HID bulbs. Can save 67% 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 Resources for Greenhouse Energy Conservation and Efficiency

- [Introduction to Greenhouse Efficiency and Energy Conservation](#)

Efficiency Checklist and Topics:

- [Farm Energy Efficiency Checklist and Tips](#)
- [Farm Lighting Energy Efficiency Checklist and Tips](#)
- [Farm Shop Energy Efficiency Checklist and Tips](#)
- [Grain Drying Energy Efficiency Checklist and Tips](#)
- **Greenhouse Energy Conservation Checklist**
- [Home Energy Efficiency Checklist and Tips](#)
- [Irrigation Energy Efficiency Checklist and Tips](#)
- [Livestock Buildings Energy Efficiency Checklist and Tips](#)
- [Livestock Watering Systems Energy Efficiency Checklist and Tips](#)
- [Tractor and Field Operations Energy Efficiency Checklist and Tips](#)

Contributors

Author

- John Bartok, Jr., Agricultural Engineer, [University of Connecticut](#)

Peer Reviewers

- [Tina Smith](#), Extension Specialist in Greenhouse and Floriculture, [University of Massachusetts](#)

- Vern Grubinger, Professor, [University of Vermont Extension](#)

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