



## Energy-Saving Tips: Greenhouse Operations

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*The following information is supplied by the [California Energy Commission](#).*

### Reducing Greenhouse Energy Bills

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Increased natural gas prices over the last year have hit the greenhouse industry hard. There are some economical ways to reduce natural gas use. A calibrated, fast response thermometer for measuring air temperature and the following options will guide you to cost-effective ways to reduce energy use.

#### Best Use of Existing Equipment

Timely maintenance of existing equipment is the fastest and least expensive way to cut energy costs. Identify potential problems by surveying the air temperature at crop height. Temperature variation will be most easily observed in the early morning hours when outside air temperature is lowest and the sun has not begun to influence heating needs. If everything is working correctly, air temperature should be consistent and at the desired level. If the average temperature is higher than needed, reduce the thermostat setting accordingly. Keeping a greenhouse one-degree warmer than needed increases gas bills by 10% to 15% under typical California conditions. One note of caution - if you have been operating the facility with this error for several seasons your production scheduling may be inadvertently based on this higher temperature. Reducing growing temperatures may slow the next crop.

Differences between average air temperature and thermostat set point temperature are caused by an error in thermostat calibration or locating the unit in a relatively cold location in the greenhouse. Aspirated enclosures allow thermostats to accurately sample air temperature and reduce error caused by thermostat location. Put a tag on the thermostat indicating the date of calibration and temperature correction factor.

Air temperatures at crop height should be consistent around the facility. Cold areas are often caused by air leaks. Check weather stripping on doors, lubricate fan louvers and ensure they close tightly, patch holes in covering, check lap seals in glass covered houses, and install seals on ridge vents. Seals cost a few cents per square foot of floor area and are a good investment. Make sure that thermal blanket systems close completely. Poor heating system maintenance can also cause cold areas in the greenhouse. Inspect steam and hot water pipes to be sure they are not

accidentally buried in trash and debris. Poor hot air distribution from convection heaters can also cause poor air temperature uniformity. Clean fan blades to get original air output and check jet tubes for leaks.

Air temperature should also be fairly uniform from crop to roof. Higher air temperature near the roof indicates inadequate air movement in the greenhouse. Poor air circulation allows cold air to settle to the floor and warm air to rise to the roof. Most of the heat in a greenhouse escapes through the roof so high air temperature near the roof acts just like an improperly calibrated thermostat to increase energy use. Reducing air temperature near the roof by one degree Fahrenheit may lower fuel use by 10%. Air can be mixed with a horizontal fan system or a jet tube unit.

Heating systems may still effectively heat a greenhouse but suffer from poor efficiency if they are not regularly maintained. Over time, boiler tubes become fouled, soot builds up in furnace heat exchangers, and burners lose proper adjustment. Flush boilers to remove scale and deposits. Check the burner combustion efficiency of unit heaters and boilers with a flue gas analysis kit. Clean heat exchangers with a wire brush and vacuum with a special cleaning compound. An 1/8 inch layer of soot can increase fuel use by 10%. Repair or replace malfunctioning steam traps. Check insulation on steam and hot water pipes located outside the greenhouse. If you do not have a regular heating system maintenance program in place, work with your equipment supplier to design a program for your specific system.

### **Purchase Energy Saving Equipment**

After maintaining equipment, the next step to reduce energy costs is to consider capital investment in new equipment. Most of the options increase the insulating effect of the greenhouse by adding a second or third layer of covering. For example, a polyethylene subroof installed under the roof trusses will reduce fuel use by 20% to 30%. All heating and ventilating systems must operate below the added subroof. Energy savings will repay installation costs in one or two seasons. Thermal blankets that are extended inside the walls and roof at night can reduce energy use by 35% to 50%. Insulated thermal blankets have even greater potential for savings. All of these systems are expensive and some greenhouses may not be strong enough to support them. Work with commercial greenhouse equipment companies to determine costs and estimated savings. Rigid board insulation applied to the inside of north walls and below bench height on other walls reduces energy use by 5% to 10%.

Installing moveable benches reduces energy costs per plant produced by increasing the number of plants that can be grown in a greenhouse. Bench space often occupies about 65% of total greenhouse area, the rest of the area is devoted to aisles. Moveable benches allow access to plants but increase useable bench space to about 85% of the greenhouse area, cutting energy use by 30% per plant sold.

### **Other Information**

- UC Publication: **Reducing Energy Costs in California Greenhouses** (PDF)

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