Dealing With Rising Energy Costs

How do you deal with high energy costs in your greenhouse? Since profit equals price minus cost, to increase profits, you have to cut costs or increase prices. This article presents a number of options for dealing with rising energy costs.

By Robin Brumfield

Energy costs have skyrocketed in recent years. With a whopping increase of 103 percent since 2003, gasoline has increased the most, but other energy types have gone up as well (see Figure 1, below). This is a constant concern for many growers.

What is the cost of energy? In a survey of 30 greenhouse businesses, I looked at total costs and found their energy costs averaged 8½ percent of sales (see Figure 2, below). This includes heating fuel, gas/diesel, electricity and trucking costs.

Fuel Increase Since 2003

Fuel type	Percent increase
Electricity	7.7
Natural Gas	33.8
No. 2	44.1
Propane	29.9
Kerosene	54.1
Gasoline	102.5

Figure 1. While gasoline costs have increased the most, costs for other types of energy have gone up as well. (Source: Department of Energy)

Key Costs As Percent Of Sales

Cost category	Percent of sales
Energy	
• Heating Fuel	5.3
• Gas/Diesel	0.5
• Electricity	1.9
• Trucking	0.8
Energy Total	8.5
Labor	24.6
Materials	32.4
Return to operator's labor/mgt. and equity capital	11.0

Figure 2. This information is based on 2003 financial data from growers in the Northeast.

Waste gas is an alternative fuel choice. (Photo: A.J. Both)

Conserve And Reduce

Energy costs can be saved in many areas of the greenhouse. Here are some suggestions for conserving energy and reducing fuel costs:

Fuel Costs

- Select the cheapest fuel supplier.
- Switch to a different fuel.
- Use a dual fuel system.
- Buy in the off season.
- Consider buying on the spot market, a possible 20-percent savings.

Electricity

- Inspect wiring.
- Replace inefficient motors.
- Replace incandescent bulbs with low-wattage fluorescent bulbs to save two-thirds on electricity.

Trucks

- Regular tune-ups save 10 percent on fuel.
- Avoid lengthy idling and save 15-20 percent on fuel.
- Run at the proper gear.
- Consider hiring trucks or having customers pick up products.

Watering Systems

- Locate hot water tanks near most frequent use.
- Heat to 120° F.
- Eliminate leaks.

Conserve Energy With Your Structure

There are many ways to conserve energy when it comes to greenhouse structures. While newer structures have better seals around the coverings and openings than older houses, it is also possible to make existing structures more energy efficient.

A single layer of film over glass can reduce annual heating costs 5-50 percent, whereas a double (inflated) layer can reduce costs 40-60 percent. (Photo: Lawrence Martin)

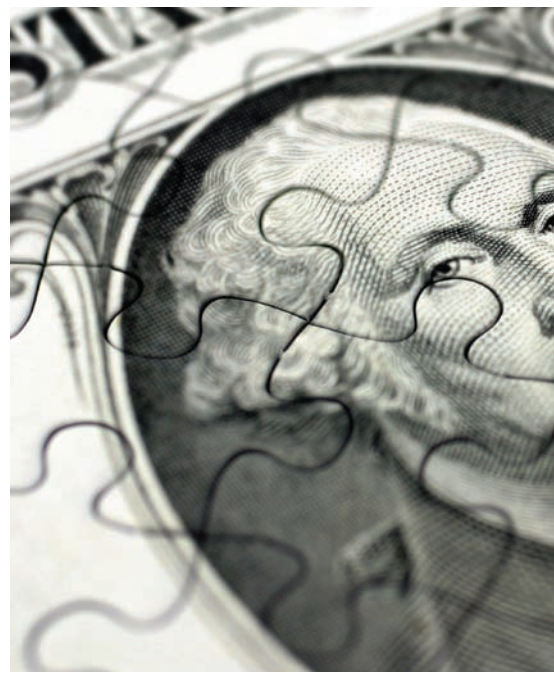
Double poly. Double polyethylene (poly) coverings reduce heating costs about 50 percent compared to single poly coverings. Polyethylene films vary from 35- to 60-percent heat loss. Select a film that reduces water condensation to enhance light transmission and improve heat retention. Maintain proper inflation between layers to maximize the covering's insulation value.

Retrofitting. A single layer of film over glass can reduce annual heating costs 5-50 percent, whereas a double (inflated) layer can reduce costs 40-60 percent. Remember, there is a tradeoff between increased energy efficiency and reduced light transmission with additional layers of poly. ➧

Winterize openings. A tight greenhouse with few air leaks around vents, fans or doors will cost less to heat.

Reduce air leaks. To help reduce air leaks, caulk and weatherstrip door frames, windows and other openings; lubricate louvers; and seal all cracks in walls. Keep vents in good working condition so they close tightly. Repair any holes in plastic, glass or doors and keep doors closed.

Maximize insulation. Use the highest R-value for insulation. Insulate greenhouse end walls, especially the north end wall that provides very little light for crop production. Installing 1-2 inches of 1- to 2-ft.-deep insulation around the foundation wall being careful not to leave gaps or openings and



working neatly around post footings can reduce foundation heat loss by 50 percent. Sidewall insulation can reduce annual heating costs 5-10 percent. If possible, add windbreaks outside the greenhouse along the north wall and insulate secondary fans and vents to reduce heat loss through unused areas during winter.

Up to 85 percent of greenhouse heat loss occurs at night. An energy/shade curtain can reduce energy consumption 20-50 percent. Select a porous curtain material to prevent condensation from the underside of the roof from pooling above the plants. Keep the curtain open during snowstorms to allow heat to reach the roof and prevent snow accumulation.

Maintain Efficient Systems

Maintaining the existing heating system's maximum efficiency is critical to reducing heating costs. Start by checking thermostat accuracy. Aspirated thermostats placed near

Install roll-up greenhouse sides for more efficient cooling. (Photo: Lawrence Martin)

Dealing with rising energy costs can be very puzzling even to the most experienced grower.

the plant canopy can save 2-3 percent of the total fuel bill by improving fan and heater operation. Solid-state electronic thermostats can reduce the differential between the on and off modes to 1° F instead of the 3-4° F of mechanical thermostats. Calibrate sensors to avoid chilling damage to the crop especially if you are lowering growing temperatures.

Perform annual maintenance: Check for physical damage to any system parts. Check the vent pipe and air inlet or discharge pipes for obstructions. Clean and adjust furnaces, motors, pumps, heating pipes and other radiation surfaces at least once per year. A one-eighth-inch layer of soot can increase fuel consumption by as much as 10 percent. Periodically check system performance to ensure the boiler, burner and backup systems are operating at peak efficiency. Also check the operation of mixing valves.

For maximum efficiency, use the system's proper fuel. Insulate boiler or distribution pipes in areas where heat is not needed, and install an air inlet pipe for direct-fired heaters to provide fresh air for combustion from outside the greenhouse. Additionally, under-bench heat allows the temperature to be set 5-10 degrees lower.

Install a sufficient number of horizontal air flow (HAF) fans 2-3 ft. above the plants aligned parallel to the sidewalls of your greenhouse so the air is circulated around the house in a rotational pattern. HAF fans help maintain uniform ➧ temperature and humidity, reduce

Horizontal air flow fans help maintain uniform temperature and humidity. (Photo: A.J. Both)

Left: *Burning wood is an alternative heating method. (Photo: A.J. Both)* ***Right:*** *Put hanging baskets over other floor- or bench-grown crops. (Photo: Lawrence Martin)*

cold pockets and improve plant quality and uniformity.

To achieve efficient cooling, consider adding an open-roof greenhouse or installing roll-up greenhouse sides or evaporative cooling. Keep doors closed when fans are on.

Consider Alternative Options

You may want to consider changing your primary heating system, especially if you have an older system. You will need to evaluate the efficiencies of a new system versus your current system as well as the investment and operating costs. Here are some examples of alternative heating fuels and heating systems:

- Solar (hot water heating)
- Other solid biomass (corn)
- Biodiesel
- Waste oil (fast food industry)
- Waste gas (landfill/co-generation)
- Geothermal (hot water/steam)
- Wood (waste wood/firewood)
- Hot water boilers
- Hot water unit heaters
- Infrared radiant systems

Partial Budgeting Formula

Add:	**Before drop**	**After drop**	**Net change**
Reduced Costs = 12% lower fuel costs	$271,152	$238,614	$32,538
Added Revenues			$0
Subtract:			
Added Costs			$0
Reduced Revenues = 11% less revenue	$2,294,310	$2,041,936	-$252,374
Net Return or Loss			**-$219,836**

Figure 3. This figure represents the partial budgeting effect of a 4° F reduction in temperature.

2003 Costs As Percentage Of Sales

	2003	**Now**	**Increase prices 5%**
Sales	$2,294,310	$2,294,310	$2,409,026
Return to labor/mgt and equity capital	$216,606	$134,241	$248,956
Percent profit	9.4	5.9	10.3
Heating fuel	$136,036	$196,014	$196,014
Gas/diesel	$4,407	$8,924	$8,924
Electricity	$33,424	$36,001	$36,001
Trucking	$14,920	$30,213	$30,213
Energy total	**$188,787**	**$271,152**	**$271,152**
Percent energy costs	**8.2**	**11.8**	**11.3**

Figure 4. Costs as a percentage of sales in 2003, currently with an energy increase and with a 5 percent increase in prices.

One way to increase costs is to add a fuel surcharge. Consumers are facing their own increased energy costs for gasoline and heating and understand your costs have increased as well.

Use Space Wisely

Group plants according to temperature tolerances so some houses can be run cooler than others. Consider adding higher efficiency bench or floor heating systems in root zones of areas that require higher temperatures. Maximize the use of heated greenhouse space: Keep growing areas full, and don't bring the next greenhouse online until absolutely necessary. Consider peninsular or movable benches, install multi-level racks for low-light crops and put hanging baskets over benches.

Analyzing Costs

To analyze alternative costs, you need to know your production costs. This will allow you to determine the impact on changes in input costs, such as fuel, on the profitability per unit and per square foot. You can develop your own enterprise budget using pen and paper or a spreadsheet. A free greenhouse cost accounting spreadsheet is available at the Rutgers Farm Management Web site: http://aesop.rutgers.edu/~farmmgmt.

When considering switching to alternative fuels, crops, etc., remember to compare apples to apples. For example, compare all fuel sources on a cost-per-heating equivalent, for example, dollars per million Btus ($/MBtu) and alternative crops on an equivalent return for time and space.

Consider dependability and sustainability of alternatives. For example when you evaluate alternative fuels, make sure sufficient quantities of an acceptable quality will be available when needed. If you are considering cool-season crops, make sure you have a dependable market for those crops.

In addition to out-of-pocket costs, calculate the cost of converting to the new alternative and the labor involved in operating the new system. For example, coal and wood-fired boilers or furnaces require additional labor to operate, and the waste product (ashes) will need to be disposed. ➧

Additional Energy Conservation References

Energy Conservation for Commercial Greenhouses
Greenhouse Engineering
www.nraes.org

Energy Conservation for Greenhouse Growers
http://msucares.com/pubs/infosheets/is1618.html

Greenhouse Energy Conservation Checklist
www.hort.uconn.edu

Dealing with the High Cost of Energy for Greenhouse Operations
www.ext.vt.edu

Partial Budgeting Analysis

The partial budgeting analysis in Figure 3, page 28, shows the effects of lowering night temperature 4° F. It reduces fuel consumption and, thus, fuel cost 12 percent (3 percent per degree), or $32,538, but delays crops by 11 percent. Assume delaying crops by 11 percent means that 11 percent fewer crops can be produced and, thus, revenue will be 11 percent lower, or a reduction of $252,374.

Using these assumptions, a 4° F reduction in greenhouse night temperature would result in a net loss of $219,836. This is an example of an energy-saving alternative (lowering night temperature) that creates other problems (delaying crops) and results in a net loss.

Reducing night temperature by just 1° F can reduce greenhouse heating costs 3 percent. Some plants are more sensitive to lower temperatures than others and may cease to grow when a base temperature is met. Consider growing cool-season plants, keeping in mind what consumers want. Avoid overcrowding and provide horizontal air movement to ensure uniform temperatures and dry foliage. Crowding plants to reduce costs will not work if this reduces plant quality and consumer demand. Consider using heated irrigation water in the morning to warm the growing medium and increase nutrient uptake.

Increasing Prices

In 2003, energy costs were 8.2 percent of sales in greenhouses in the Northeast. If everything else is held constant and energy components are inflated based on Department of

Squeezing the most profits out of your greenhouse requires a thorough examination of all of your expenses.

Energy data, energy becomes 11.8 percent of sales. The 2003 profit margins in 2003 of 9.4 percent drop to 5.9 percent with these energy cost increases. One way to recover these costs is to increase prices. An increase of only 5 percent recovers all of the costs and brings profits up to 10.3 percent. (See Figure 4, page 28)

Many growers are not comfortable increasing prices. One way to increase costs is to add a fuel surcharge. Consumers are facing their own increased energy costs for gasoline and heating and understand your costs have increased as well. Furthermore, there seems to be a perception that greenhouse energy costs are a larger percent of sales than they actually are, so this is a good time to add a fuel surcharge.

Summary

Profits may not be the only objective of the business. You will also want to analyze how these alternatives address the firm's other objectives. Here are some questions to ask:

- Which alternative enables me to reach my objectives?
- Which alternative best matches my firm's skills and resources (financial, technical, personnel, etc.)?
- Which alternative best meets my preferences or sense of social responsibility?
- Which alternative minimizes the creation of new problems?
- How will each alternative affect my current activities?
- How much time will be required to incorporate each alternative?

Selecting the final strategy may involve trade-offs among various objectives. One alternative may offer the greatest financial returns, but it may be inconsistent with other objectives. At that point, you must decide which objectives are most important. GPN

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