A Tour of Farms Using Renewable Energy for (Greenhouse) Heat

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"Peak Oil"

OIL AND GAS LIQUIDS
What fuels can we use instead of propane or heating oil?
Efficiency and conservation
Systems I’ll Show

- No Fuel = Sun
- Biological Fuel = compost
- Cord Wood
- Wood Chips
- Wood Pellets
- Corn
- Coal
- Used Vegetable Oil
- On-Farm Biodiesel

[www.uvm.edu/vtvegandberry](http://www.uvm.edu/vtvegandberry)  
click ‘Energy on the Farm’
‘passive solar’ greenhouse; soil >45 degrees all winter
covers keep the soil’s heat near the plants
Requires a tight greenhouse; vents that will seal tightly, etc.
Collecting ridge heat for storage in water
Using the warm water to heat beds
If you want to collect a lot of heat, you need a lot of water
‘biological heat’ from composting
Brian Jerose, WASTE NOT Resource Solutions

(802) 933-8336  jeroze@together.net  www.farmcomposting.com
Wood: abundant, but handling and efficiency are issues
Outdoor ‘hydronic’ wood boilers for heat

Increasing regulation, not all burn clean... see www.epa.gov/woodheaters/
Central Boiler Classic CL7260; $8,000 in ‘05, plus $12,000 insulated tubing, heat exchangers, circulating pumps.
zones to greenhouses, barn, house
Water to air heat exchangers
Sequoyah E3400 wood gasification; meets EPA standards, $11,000 plus...
Waste wood chips
3 million Btu, ~$30,000 grower-built
3,000 gal water stores heat, allows furnace to run hot
2 million Btu furnace cost $100,000, works with uniform chips or sawdust, not waste wood chips
Heat systems must fit with the production system
wood pellets (are not all the same)
Harmon wood pellet furnace
100,000 Btu ~$3500
empty ash pan, clean heat exchanger
wood pellet/corn furnace ~140,000 Btu
‘07 wood pellets $230 ton delivered; more now
outdoor pellet bin saves greenhouse space
Commercial Pellet-Fired Boiler “D’Alessandro”

~200,000 Btu
~$14,000
shell corn: must be clean, dried, pest-proofed
‘LDJ’ corn furnace (or boiler) ~165,000 Btu, 14 bu hopper (or 21 bu) cost $4500 (+1,000 for boiler)
must light burn-pot, then keep it lit
several similar models of corn furnaces available

Keep your old system for backup!
500,000 Btu Year-A-Round corn furnace $10,000
30,000 Btu Amaziblaze stove $1500
70,000 Btu Buckner stove $2500
Corn grain as a local fuel, fossil fuel ratio of $>7$
$240/ton in bags; $220 bulk totes
http://energy.cas.psu.edu/EnergySelector.html

plug in two fuels and their prices to compare value
(based on available Btu content, efficiency of combustion)

Burn #2 Fuel Oil or Burn Shelled Corn?

Burn #2 Fuel Oil

Burn Shelled Corn

#2 Fuel Oil at $3.50 per gallon yields less energy per dollar than Shelled Corn at $6.00 per 50 pounds. It is more cost effective to burn Shelled Corn.
350,000 Btu Keystoker coal furnace $5,600
Replacing 31 oil furnaces, 6 so far; can get coal + oil dual fuel units
hard coal (anthracite) $255/ton delivered
Waste vegetable oil
350,000 Btu Clean Burn waste oil furnace $7,600
500,000 Btu Clean Burn waste oil boiler $11,600
Preventive maintenance is key
oil quality and settling is important
Greenhouses heated with waste oil replaces 3,000 gal fuel oil annually, cost is $1/gallon
Evaporator converted to used vegetable oil
veg. oil storage tank, heated line, generator
To use vegetable oil in *conventional* furnaces, must convert oil into biodiesel

...also need to paint burner flame chamber silver, adjust nozzle size and air pressure
Making 2,000 gal/year of biodiesel on this farm, cost is $1.85/gallon @ $20/hr

veg. oil + alcohol + lye = biodiesel + glycerine
Titration test on each batch of oil tells how much lye to add
methanol / methoxide are hazardous
“off the shelf” biodiesel kit
“Community-Scale” on-farm biodiesel processor
Virgin oil will be needed

canola seed pods
Oil seed crops have potential in the Northeast; they have their challenges like any other crop.
Steep learning curve: harvest, drying, processing equipment, safety, regulations…
Our ‘learning community’ is a huge asset
www.uvm.edu/vtvegandberry

‘Energy on the farm’