FARM INPUTS
Energy

How are energy costs impacting Vermont farmers? What opportunities exist for on-farm energy production?

See Chapter 4, Section 6, Food System Energy Issues, for more information.

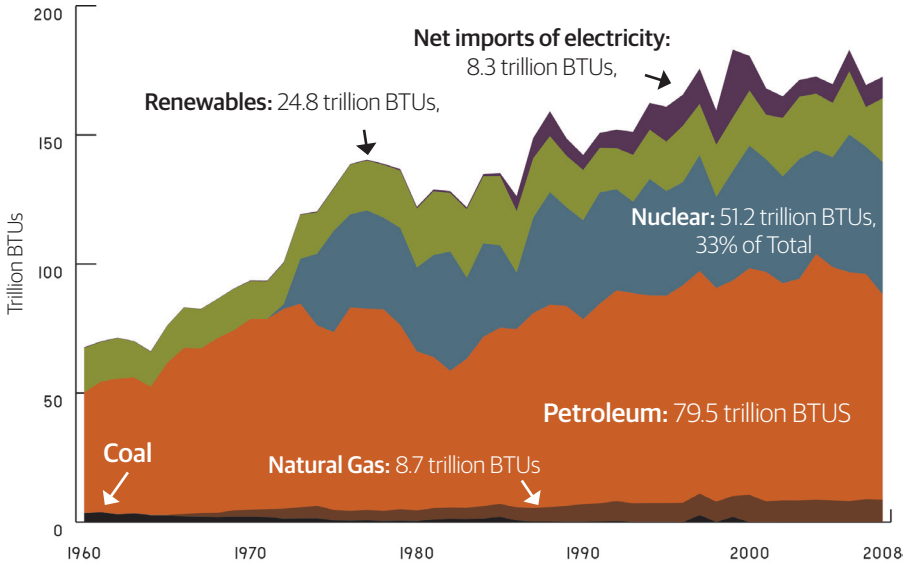
Major productivity gains in America's food system have been made through the increased availability and use of non-renewable energy sources. Food system activities consume a lot of energy, "from the manufacture and application of agricultural inputs, such as fertilizers and irrigation, through crop and livestock production, processing, and packaging; distribution services, such as shipping and cold storage; the running of refrigeration, preparation, and disposal equipment in food retailing and food service establishments; and in home kitchens."[100] The USDA reports that food-related energy use increased from 12.2% of national energy use in 1997 to 14.4% in 2002, and was an estimated 15.7% of use in 2007.

Per capita energy use in the United States declined 1.8% from 1997 to 2002, but **per capita food-related energy use increased by 16.4%. Much of this increase reflects the historic trend of energy-based products and services replacing human labor.** For example, the USDA attributes much of this growth in energy consumption to the outsourcing of food preparation activities at home and within the food service industry to automated food processing. That is, increased consumption of prepared foods and more eating out appear to be the driving force behind the growth in food system energy consumption. Energy used for farm inputs and to run equipment on the farm equaled 14.4% of food system energy consumption in 2002, and it grew about 5% from 1997 to 2002, the third largest increase after food processing and food services.

About 93% of U.S. energy production is generated from nonrenewable energy sources, including coal, petroleum, and nuclear energy. Vermont consumes the least energy of any state in the country (154 trillion BTUs in 2008), but ranks 42nd on a per capita basis. Petroleum (51% of energy consumed in 2008) and nuclear energy (33% of energy consumed in 2008) are Vermont's major energy sources, followed by renewables (16%), and natural gas (6%) (Figure 3.2.15). In the absence of complete information, we use the USDA's estimate of 15.7% to calculate that food system activities in Vermont consumed 24 trillion BTUs of energy in 2008.

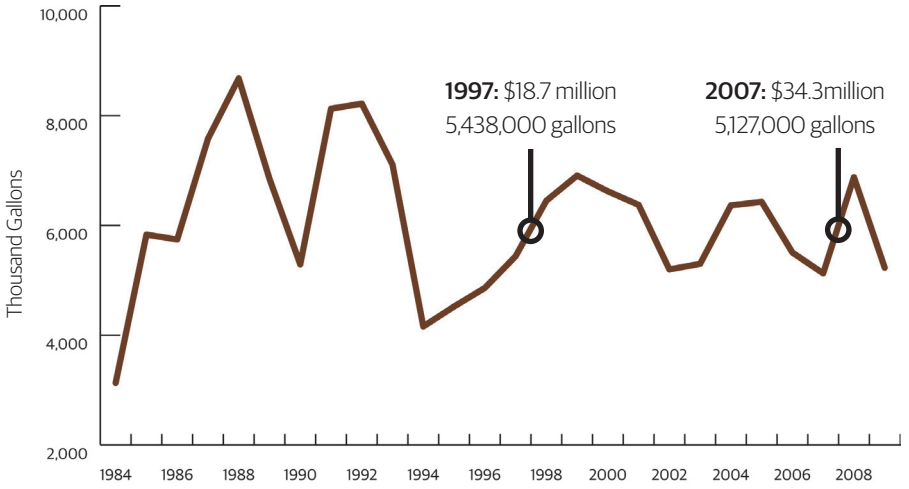
The amount of money Vermont farmers spent on fuel increased 83% from $18.7 million in 1997 to $34.3 million in 2007, even though less fuel was purchased in 2007 (Figure 3.2.15). Between 1984 and 2009 Vermont farmers purchased an average of 6,074,462 gallons of diesel fuel per year. Data about on-farm electricity and thermal energy consumption is not readily available.

Figure 3.2.15: Vermont's Total Energy Consumption, 1960-2008



Source: Energy Information Administration, *www.eia.gov/emeu/states/hf.jsp?incfile=sep_use/total/use_tot_vtcb.html&mstate=VERMONT*.

Figure 3.2.16: On-Farm Diesel Consumption, 1984-2009



Source: Energy Information Administration,
www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=KDOVAFSVT1&f=A

Across the state, Vermonters are stepping up to create a new vision of the future premised on the relocalization of food and energy production. A wide variety of technical assistance providers, renewable energy businesses, and funding sources are helping farmers and other food system businesses install renewable energy systems and become more energy efficient. For example, in 2007 the *Vermont Environmental Consortium* developed a *Farm Energy Handbook* that covered such topics as biodiesel production and wind power and distributed it to 1,200 farmers. The *Rural Energy Council*, convened by the Vermont Council on Rural Development from 2006 to 2007, identified 18 key recommendations for advancing renewable energy production and efficiency, including a call for collaborative leadership by the Administration,state agencies, Legislature, business leaders, and policy makers. Vermont is also signed on to the *25 by '25 Initiative*, a national campaign to generate 25% of our energy from renewables by 2025. *Efficiency Vermont* has worked with most of the state's dairy farms to install energy-saving devices and has historically offered an agricultural equipment rebate program for lighting, plate coolers for dairies, and other types of equipment. The *Clean Energy Development Fund*, VAAFM, *USDA Rural Development*, NRCS, and two of Vermont's utilities (*Central Vermont Public Service* and *Green Mountain Power*) have provided funding for the development of anaerobic digesters and other renewable energy projects (e.g., solar photovoltaics).

On-farm renewable energy production provides an opportunity for farmers to reduce input costs and greenhouse gas emissions while generating energy and new revenue. For example, farmers can replace petrodiesel with biodiesel made from oilseed crops such as sunflowers grown in Vermont. Animal feed imports can also be reduced by feeding the meal left after oil is squeezed from oilseeds to livestock. Eight dairy farms enrolled in Central Vermont Public Service's *Cow Power* program are generating over 14,000 megawatt hours of electricity per year through anaerobic digesters that turn the methane in animal manure into energy. Solids left over after anaerobic digestion can also be used as animal bedding, cutting down on another input cost. Food system activities off the farm can also produce energy: waste vegetable oil from fried foods can be turned into biodiesel, and food decomposing at landfills produces methane that can be captured to generate electricity.

Chapter 4, Section 6 discusses food system energy issues in detail, including strategies for advancing the suite of on-farm renewable energy technologies.

North Hardwick Dairy

Taylor and Nick Meyer in a field of sunflowers at North Hardwick Dairy

PHOTO CREDIT: VSJF

Everyone in the Hardwick area knows the *North Hardwick Dairy*—"it's the one on the hill with the wind turbine."

The turbine is evidence of farmer Nick Meyer's focus on meeting his goal of greater self-sufficiency. "I want to produce everything the farm needs on the farm."

The higher and relatively stable milk prices for organic milk allowed the 327-acre, 110-cow (63 adult milkers) farm to plan and experiment. "[Organic] milk price doesn't go up and then drop, up and drop as with conventional milk prices," Meyer explains.

With a 10kW Bergy wind turbine, North Hardwick Dairy makes a dent in its electricity usage (10-12%), and a potential upgrade to a 35kW would cover all the farm's electricity needs.

North Hardwick Dairy uses 4,000 gallons of diesel each year (2,000 gallons of diesel for off-road equipment and 2,000 gallons in their furnace). At an Organic Valley award ceremony to honor North Hardwick Dairy's winning "best organic milk" seven years in a row, Meyer came across a card advertising the BioPro 190, a small automated machine that turns vegetable oil into biodiesel. He purchased a BioPro in 2005 but was unable to get enough used vegetable oil to meet his needs. With a grant from the Vermont Sustainable Jobs Fund, North Hardwick Dairy planted sunflowers and bought an oilseed press. Nick's plan is to use the press to create food grade oil that he would sell to local restaurants for frying and then reclaim the used oil for making biodiesel. In 2011-2012 North Hardwick Dairy will have a chance to test this model.

Sunflowers are planted in May and harvested in October. To maintain optimal storage and pressing moisture, the seed is stored in a huge outdoor bin, where it is dried to about 9% moisture using a fan. The dry seed is put into a seed cleaner. Then, the press produces, along with the oil, a high-protein "licorice-rope looking" meal, ideal for newly weaned calves.

Meyer mixes the oil (whether it's reclaimed or "virgin") with alcohol (methanol) and small amounts of potassium hydroxide and sulfuric acid in the BioPro to create 50-gallon batches of high-quality finished biodiesel. The fuel is ready in about 48 hours, and then it's "washed and dried" to remove residual contaminants. Nick tests every batch to make sure the conversion to biodiesel is complete, and then his fuel is stored for blending with diesel in the tractors and combine. Meyer touts the lubricity value of biodiesel over regular diesel. It costs Nick about $1.55 to make a gallon of biodiesel from used vegetable oil from other sources, and about $2.67 gallon from his sunflower oil. The major cost of the biodiesel is the methanol. If methanol could be sourced at a lower price, says Meyer, then he could be reducing production costs by about $0.50 per gallon.

This summer, Meyer plans to plant 12 acres to produce 10,000-15,000 pounds of sunflower seed. At 50-80 gallons of oil per acre, production would run to 600-960 gallons of oil.