Boiling it Down

by Winton Pitcoff

Energy Efficiency *in the* Sugarhouse

Stripped down to the basics, maple syrup is really one of the simplest foods to produce, and nothing that sugar makers have done over the last several hundred years has changed the sole ingredient (sap from maple trees), the production method (boiling to the proper density) or the final product (pure maple syrup). However, the tools and technology have changed significantly, particularly around ways to reduce the amount of energy used and therefore the cost required for the production of syrup.

Boiling requires heat, and heat requires fuel, which is often the largest expense for a sugar maker. For most of maple syrup's history, that fuel has been wood, first simply stacked under a hanging kettle and eventually burned in a firebox in a tight, efficiently designed evaporator. Each change along the way—from adding insulating firebrick to the evaporator to attaching a forced draft system that helps wood burn more efficiently and directs more heat to the bottom of the pans and less up the chimney—has reduced the amount of heat wasted and the amount of fuel required to bring sap to a boil.

Advances in energy-efficient technology in the sugarhouse have progressed rapidly in the last 50 years, with the advent of evaporators that heat with oil, gas, wood pellets, wood chips and even recycled vegetable oil. However, energy costs in the Northeast are at least one-third higher than the rest of the nation, and maple producers need to consider ways to further reduce their use of fuels. Many sugar makers take advantage of reverse osmosis machines that concentrate the sap before it even reaches the evaporator, as well as steam hoods that preheat and further concentrate the sap before it enters the evaporator pans. The energy savings with these can be quite remarkable.

Assuming it takes 400,000 Btu of energy to boil off 42 gallons of water, even a relatively modern evaporator operating at 70 percent efficiency will burn more than 4 gallons of oil to make a gallon of syrup from sap with 2 percent sugar content. Using a reverse osmosis unit to remove 65 percent of the water from the sap before boiling, however, reduces that need to 1.4 gallons of oil. Adding a steam hood can bring that number down to just 0.9 gallon of oil per gallon of syrup produced, saving more than 75 per-

cent in oil costs. Sugar makers using wood-fired evaporators will see a similar reduction in the amount of wood they need to burn.

While the initial purchases for energy-saving equipment can be costly, for sizable sugaring operations this technology can often pay for itself quickly in fuel savings. Many grant programs exist for improvements related to on-farm energy efficiency, including the USDA's Rural Energy for America Program and Environmental Quality Incentives Program, as well as some state-based incentive programs.

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Along with the cost savings, the environmental benefits of such energy conservation methods are significant. Reducing fuel oil use by just a single gallon prevents 22 pounds of CO_2 from being released into the atmosphere, so the cumulative effect of thousands of sugar makers turning to more efficient production methods can be significant.

Since using less fuel means the evaporator is running for a shorter time, some labor costs as well as wear and tear on the equipment itself are reduced. Having the sap boiling for a shorter time can also mean better control over flavor and grade for the experienced sugar maker.

A number of resources are available for sugar makers interested in evaluating the energy efficiency of their operation and considering opportunities for improvements. The Massachusetts Farm Energy Program has published a best practices manual, which is available at *http://bit.ly/P9f7py*. An online tool for calculating potential energy savings can be found at *http://bit.ly/1dBnh5v*. In addition, "Guidelines for the Improvement of Combustion Efficiency for Maple Producers" (*www.uvm.edu/~pmrc/Combustion.pdf*), a paper commissioned by University of Vermont Extension, offers an analysis of the rate of return for various energy efficiency improvements sugar makers can make. F

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