

# VAPOUR COMPRESSION EVAPORATION

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## **PREAMBLE**

The production of maple syrup is very energy intensive. The cost of fuel in a typical oil-fired, Open Pan Evaporator (O.P.E.) for a 4000 tap operation can represent 20% of the total syrup production costs. Vapor Compression Evaporation (V.C.E.) offers a method of capturing lost energy and improving the fuel consumption of an O.P.E. Most of the energy goes up in steam and this unit will recapture lost energy to reuse. The V.C.E. unit can be cost effective with payback of less than five years with improved fuel efficiency equal to Reverse Osmosis (R.O.), and the Steam Away Unit. The V.C.E. will prove to be competitive with the Reverse Osmosis, Piggy Back and Steam Away.

In the 1977 Economic Analysis reports on Processing Maple Syrup with a Vapor Compression Distiller, the report compares a conventional evaporation method to vapor compression. The comparison reports a significant savings in energy.

In the 1989 report Development and Evaluation of a Prototype Vapor Compression Evaporator for the New York Maple Syrup Industry, the report evaluates a prototype V.C.E. and reports actual data that supports the 1977 report of considerable energy savings.

After a visit to New York's Cornell University Maple Research Station in 2001, and observing the above-mentioned prototype which had been shelved for some time, we collected documentation on the unit. The Cornell prototype was a stand-alone unit and our thought was to design a unit that would adapt to an Open Pan Evaporator.

## **CURRENT STATUS**

We formed a group (Maple Innovations) consisting of myself; another sugar bush operator, Darrell Halladay; and an engineer, Peter Keays and all have backgrounds in maple syrup production. We have received support from the North American Maple Syrup Council - Research Fund and Environment Canada.

The testing was done at Lord's Mills Sugar Bush - a 72 acre sugar bush just north of Brockville, Ontario. The sugar bush is limestone with a mixed age of maple trees, some over 150 years and some I released 20 years ago and am now tapping. The pan is a 30" x 10' back pan with a 36" x 36" finishing pan - all oil fired.

We have tested the unit over year 2007 with the last test done during the maple syrup season of 2008. The prototype is adapted to a conventional open pan. The main components of the prototype are the hood and the blower. We designed and built a low profile airtight hood that would contain, insulate and withstand a small vacuum. The blower is at the heart of the system compressing the steam and raising the temperature. The compressed steam will pass through the O.P.E. to boil sap. The ideal or

best we can expect according to our math model is 65% improvement or 65% fuel savings. We compressed the steam with a blower taking into account safety with a blow-off and many gauges for temperature and pressure. The output pressure was 80 inches of water, but above 80 the motor started to overload. The results

are varied with a low of 15% and a high of 65% improvement. We will continue the testing and research on the unit. One option is to run the steam through the flue gases to raise the heat of the steam. We anticipate more conclusive results following the maple syrup season in spring 2009.

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### October Specials - Used Equipment

30"x4' Oil fired complete evaporator on wheels w/oil tank, oil burner, stainless pan, preheater and hood	\$ 975
2'x6' Small Brothers evaporator w/stainless pans	\$ 2,550
2½'x8' Grimm w/wood arch converted to oil and stainless pans (can be fired with wood or oil)	\$ 3,800
3'x8' Oil fired evaporator w/Grimm stainless pans (welded raised flue pan and soldered syrup pan) used 1 yr	\$ 6,500
6'x6' King copper syrup pan, made in 1987 (excellent condition)	\$ 1,200
5'x10' Grimm raised flue pan (good condition)	\$ 3,000
6'x10' Grimm stainless raised flue pan (good condition)	\$ 3,000
4'x9' Stainless hood and preheater	\$ 750
Delaval model #78 vacuum pump w/5 hp electric motor (52 cfm) excellent	\$ 1,275
Universal Masport Senior vacuum pump w/1 hp electric motor (excellent)	\$ 975
Memtek RO machine w/three 4" membranes, 100+/- gph	\$ 1,900

**Bulk syrup bought and sold.**

