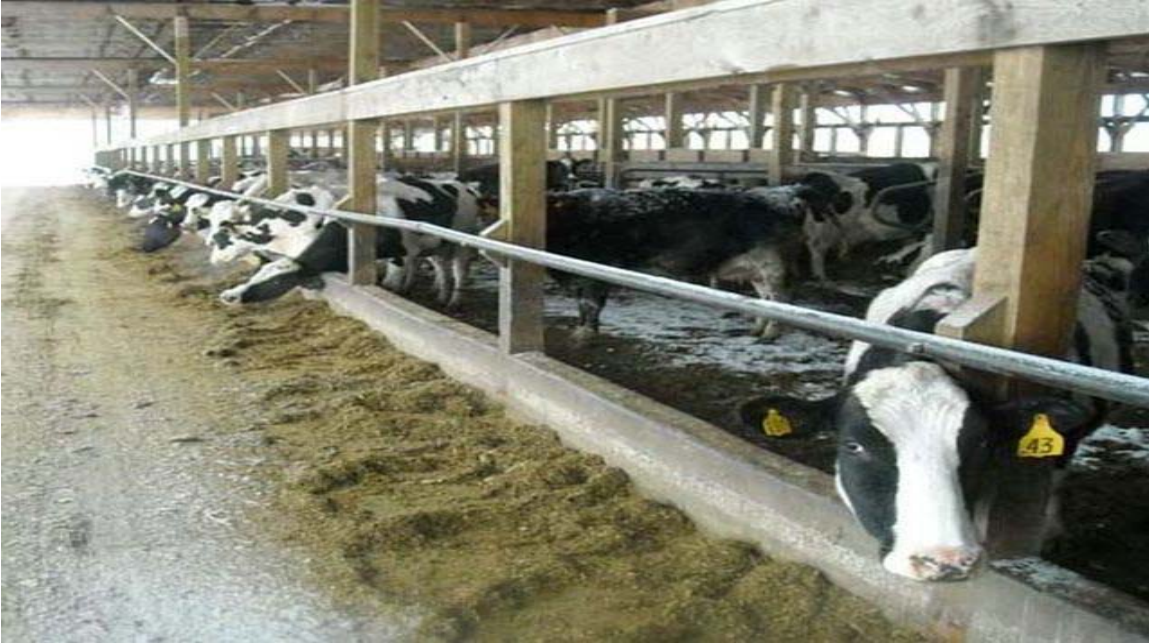


## Broad Acres Farm Energy Audit



<u>Farm Owner's Name:</u>	Nick Michaud	<u># Employees:</u>	
<u>Fed tax ID# or SS#:</u>		<u>FT:</u>	2
<u>Farm Type:</u>	Dairy	<u>PT:</u>	0
<u>Address:</u>	405 Hanson Road	<u>Building Ft<sup>2</sup>:</u>	18,000
<u>City/Town:</u>	China	<u>Telephone:</u>	
<u>State/Zip:</u>	Maine 04358	<u>Cell:</u>	207.649.9786
		<u>Email:</u>	
<u>Annual Milk Production:</u>	275,575	<u># Head:</u>	150
		<u># Acres:</u>	
<u>Electric Utility Co:</u>	Central Maine Power Co.		
<u>Prepared by:</u>	Walter C. Isgro Efficiency Maine Energy Management Consultant	<u>Follow-up Date</u>	June 2009

**Audit Scope:** The primary analysis focuses on electric equipment, lighting and appliances. Recommendations may be offered for other systems such as insulation and fossil fuel heating systems. Results are approximations based on information provided by the owner, the owner's agents and observations during the audit.

**Overview:**

The Broad Acres Farm is located in China, Maine on the Hanson Road. The Farm resides on flat area that borders the road. The farm produces about 275,575 gallons of milk each year. The farm supports 150 cows, 120 of which are milk cows.

The milk house is connected to the milk parlor. The milk parlor is accessible from the milk room and main barn which occupies 18,000 Ft<sup>2</sup>. The main barn is open style construction that requires no mechanical ventilation. Energy efficient lighting was observed during the audit.

Although the milk room and milk parlor are insulated and are separated by an insulated wall, the parlor is separated from the barn by a tarp instead of a permanent wall. The tarp is opened at milking time to allow the cows to enter the parlor. The milk room is heated with a portable k-1 heater equipped with a distribution fan. The milk parlor is heated with a stand along k-1 heater and a portable LPG heater equipped with a distribution fan.



Stand alone K-1 heater

Tarp wall in milk parlor



Portable K-1 heater



## Farm Energy Analysis

### Electric

Terminology:

1. kWh = kilo Watt hours

\*What the kWh meter measures: equipment Wattage times monthly run hours divided by 1,000

Example: 100 Watts on for 240 hours per month = 100 times 240 = 24,000 divided by 1,000 = 24 kWh.

2. KW = kilo Watt demand. One KW = 1,000 Watts.

\*What the demand meter measures: Combined wattage of equipment running in 15 minute increments.

Example: 1 horse power, (HP) = 746 Watts. A 5 HP vacuum pump = 3,730 Watts or 3.73 KW.

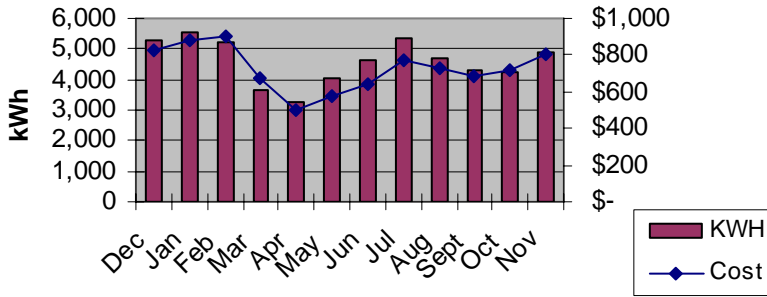
The highest KW demand measured in any 15 minute increment during the reading period is billed.

Farm operations are separately metered from the house. The Electric Summary table displays actual metered kilo watt hours, KW demand and costs for the farm during a 12 month period.

<b>Broad Acres</b>					
<b>Electric Summary</b>					
Meter #	LG34564014	Nov 26 days	Rate:	<b>MGS</b>	
Meter #	AB05133542	Dec 8 days			
Year	Month	KWH	Cost	KW	Cost
2007	Nov	4,016	Included in Dec bill	Included in Dec bill	Included in Dec bill
2007	Dec	5,275	\$ 826.62	24.01	\$ 252.36
2008	Jan	5,523	\$ 885.09	23.99	\$ 228.86
	Feb	5,241	\$ 897.69	22.64	\$ 215.99
	Mar	3,643	\$ 674.51	21.63	\$ 201.52
	Apr	3,241	\$ 502.89	19.72	\$ 122.26
	May	4,040	\$ 577.03	19.41	\$ 120.34
	Jun	4,643	\$ 643.04	21.42	\$ 132.80
	Jul	5,350	\$ 770.40	23.24	\$ 147.29
	Aug	4,667	\$ 731.83	22.04	\$ 150.97
	Sept	4,295	\$ 687.08	21.51	\$ 147.34
	Oct	4,259	\$ 720.01	23.66	\$ 162.07
Meter	Nov	4,865	\$ 806.01	23.19	\$ 158.85
Farm Only	<b>Total</b>	<b>59,058</b>	<b>\$ 8,722.20</b>	<b>266.46</b>	<b>\$ 2,040.65</b>
<b>Monthly Averages</b>					
	kWh	4,922		KW	22.21
	\$ per kWh	\$ 0.15		\$ per KW	\$ 7.66
	kWh per cow	41		KW per cow	0.19
	kWh \$ per cow	\$ 6.06		KW \$ per cow	\$ 1.42
	\$ per cwt	\$ 0.04		KW % of Total	23%

Potential Farm load is approximately 34.5 KW. (One KW = 1,000 Watts.) Average monthly KW is approximately 22.21 KW or 0.19 KW per cow at a cost of \$0.51 per cow. KW costs are 23% of the total. An average of 41 kilowatt hours monthly is used per cow at a cost of \$6.06. Total cost includes kWh and KW charges. KW charges are shown separately for display purposes.

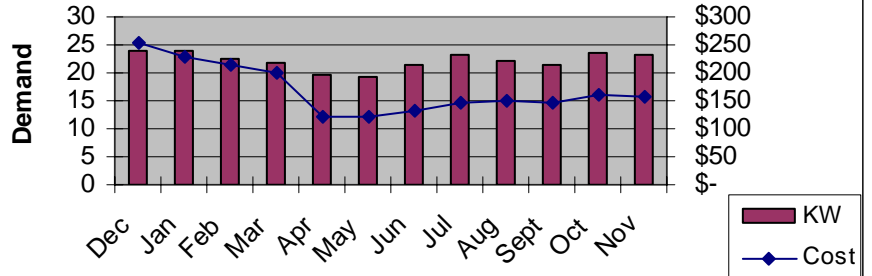
### Broad Acres kWh Summary & Expense



Except for the months of March and April kilo Watt hour use is at or above 4,000 during the period analyzed.

KW demand displays a relatively flat profile which indicates a constant load. Demand is the total measured watts (divided by 1,000) in use during any given 15 minute period during the month. The highest measured Demand is billed each month. Demand may be reduced by staggering equipment use where possible.

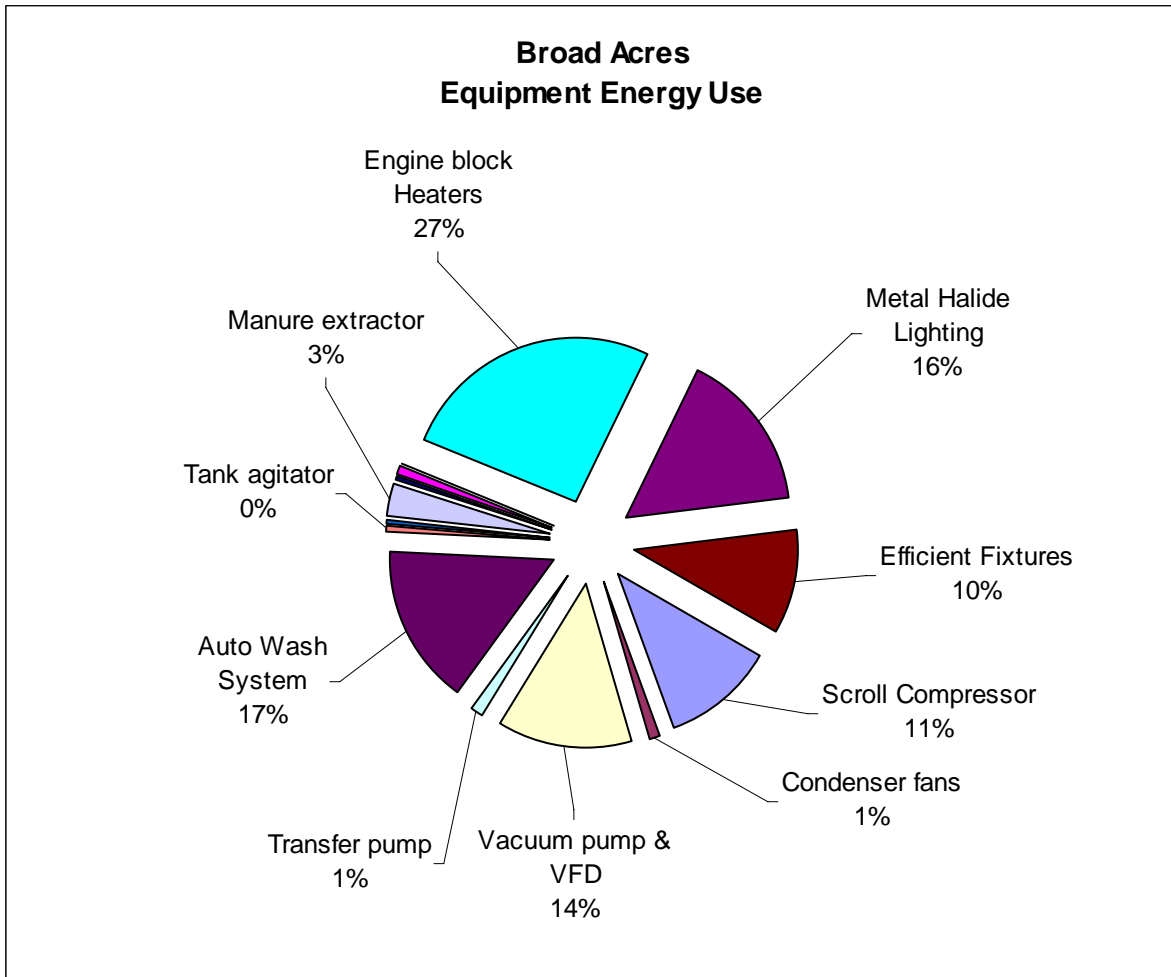
### Broad Acres Kilo Watt, (KW) Demand & Expense



**Equipment:** This table displays the estimated kilowatt hour usage and cost for motor and equipment operation during the period analyzed.

Broad Acres											
Annual Electric Summary: Lighting, Motors & Equipment											
Item	Location	Existing Equipment	Qty	Horse Power	Watts	KW	Hours/Day	# of Days	Annual Operating Hours	kWh	Annual kWh Cost @
											\$0.15
1	Milk Room	Scroll Compressor	2	3.00	2,238	4.48	4.00	365	1,460	6,535	\$965
2	Milk Room	Condenser fans	4	0.17	127	0.51	4.00	365	1,460	742	\$110
3	Milk Room Entry Area	Vacuum pump & VFD	1	10.00	7,460	7.46	4.00	365	1,460	7,884	\$1,164
4	Milk Room Entry Area	Transfer pump	1	0.50	373	0.37	4.00	365	1,460	545	\$80
5	Milk Room Entry Area	Auto Wash System	1		6,470	6.47	4.00	365	1,460	9,446	\$1,395
5	Milk Room	Tank agitator	1	0.17	127	0.13	6.00	365	2,190	278	\$41
6	Exterior	Milk truck pump	1	2.00	1,492	1.49	0.25	365	91	136	\$20
7	Barn	Manure extractor	1	7.50	5,595	5.60	1.00	365	365	2,042	\$302
8	Exterior	Grain Auger	1	0.33	246	0.25	0.50	365	183	45	\$7
9	Exterior	Well pump	1	1.00	746	0.75	2.00	365	730	545	\$80
10	Milk Room & Milk Parlor	Electric Space heater	1		240	0.24	1.00	365	365	88	\$13
11	Exterior	Engine block Heaters	2		1500	3.00	14.00	365	5,110	15,330	\$2,264
12	Barn	Metal Halide Lighting	4		458	1.83	14.00	365	5,110	9,362	\$1,383
13	General Lighting	Efficient Fixtures			2027	2.03	12.00	365	4380	6,082	\$898
14					Total KW	34.59	Farm:			59,058	\$8,722

The Equipment Energy Use chart displays approximate percentage of annual operating cost.  
Note: Equipment with annual operating costs under \$40 is not displayed.



**Electric Service:**

The farm is billed at the Medium General Service rate, (MGS). Kilowatt hours, (kWh), kilowatt demand, (KW) and other applicable charges including tax are billed at this rate. (KW Demand can be likened to the speed indicated on a vehicle speedometer. KWh can be compared to the miles traveled.) When 20KW or more is metered in any given 15 minute increment during the reading period demand charges are billed at the highest metered KW for the period.

24KW was the highest measured demand during the period analyzed. Reducing demand by 4.5KW could result in the elimination of demand charges. Example: The two 1,500 Watt engine block heaters total 3KW when running at the same time. The heaters can be controlled by a timer. Engine block manufacturers have recommended operating the block heaters 15 minutes before start up.

**KW monitors:**

<http://www.watthackers.com/wp/10-energy-saving-devices-to-put-your-house-on-a-diet/>

<http://www.theenergydetective.com/what/features.html>

<https://www.wattsupmeters.com/secure/index.php>

KW demand can be controlled through electric load shedding, (intentionally reducing electric load for a given period.) and thereby reduced by identifying electric equipment that can be turned off when a certain goal is set on the monitoring system. For example if typical demand is measured at 25 KW and the goal is to reduce demand by 5KW, set the monitor at 20KW. Determine which equipment totaling 5 KW; (5,000 watts) can be shed for a short period without interfering with business. When the KW monitor alerts you that 45KW has been reached, turn the designated equipment off. Demand is measured in 15 minute increments during the reading period.

Note: Circumstances may exist where demand reduction is not possible.

Check with your electric utility company to learn how reducing and controlling your demand effects your cost and rate.

**Electric Rates:**

CMP web site for Medium General Service: (Describes how KW demand is measured and billed.)

<http://www.cmpco.com/MediaLibrary/3/6/Content%20Management/Suppliers%20And%20Partners/PDFs%20and%20Doc/mgsp.doc>

RATE MGS-P MEDIUM GENERAL SERVICE - PRIMARY		
BASIC RATE PER MONTH	Winter Billing Months <u>December - March</u>	Non-Winter Billing Months <u>April - November</u>
Service Charge		
Single Phase	\$69.44	\$69.44
Three Phase	\$107.49	\$107.49
Demand Charge	\$8.82/kW	\$6.04/kW
kWh Charge	\$0.010130/kWh	\$0.010130/kWh

**LPG :** LPG bills were not supplied for this audit.

**Water Heating System:**



The primary water heater was recently changed from an 80 gallon electric heater to a tank less (LPG), fired on demand unit. A heat recovery unit, (HRU), was observed during the audit. If the HRU is serviceable and is not equipped with an electric heating element, well water can be preheated. Preheating water before it reaches the on demand heater may greatly reduce the amount of LPG required to raise the temp to 185 degrees F with the pre-cooler.

The 80 gallon electric water heater is next to the HRU. If this heater is not in use it is recommended that either the breaker be removed or the wiring to ensure the unit does not turn on.



**Lighting:**

Existing Farm Lighting is energy efficient. Four, 400 Watt metal halide, (MH), fixtures are installed in the barn. The MH fixture cost over \$1,300 to operate annually and account for 17% of total electric cost.

\*Important CFL Information:  
[http://www1.eere.energy.gov/femp/procurement/eep\\_fluor\\_tips.html](http://www1.eere.energy.gov/femp/procurement/eep_fluor_tips.html)

Broad Acres Existing Fixtures											
Item	Location	Fixture Type	Ballast	Qty	Fixt Watts	KW	Avg Daily Hours	# of Days	Annual Hrs	kWh	Annual Cost @
											\$0.15
1	Barn	MH400	Var	4	458	1.83	14	365	5,110	9,362	\$1,383
2	All Areas	Various energy efficient fixtures	elec							6,082	\$898
<b>Total</b>										15,444	\$ 2,280.83

Proposed Retrofit											
Item	Location	Fixture Type	Ballast	Qty	Fixt Watts	KW	Avg Daily Hours	# of Days	Annual Hrs	kWh	Annual Cost @
											\$0.15
1	Barn	Orion	Elec	8	27	0.22	14	365	5,110	1,104	\$163

Proposed Savings Analysis				
Item	kWh	\$	Install Cost	E Maine Incentive
1	8,258	\$1,220		

In order to calculate simple payback,

1. Determine your cost for replacement lighting,
2. Look up the Efficiency Maine incentive,
3. Subtract incentives from your initial cost,
4. Divide the final cost by potential savings.



Ninety five percent of energy consumed by an incandescent bulb produces heat and a small amount of infra red light invisible to the human eye.

## **Building Envelope:**

R-value is a measurement used to signify resistance to heat loss of materials.

The main barn is open stall type. The Milk Room is insulated with blown foam; R-40 ceiling, R-20 walls. Doors are steel insulated. Windows are double glazed.

The Milk Room is heated 12 hours per day, December through March with a 500 BTU portable K-1 heater. (BTU = British Thermal Unit; a standard measurement of heat per hour.) About 2.5 gallons of K-1 are used each day. One gallon of K-1 contains 135,000 BTU.

Four scroll compressor fans in the Milk Room are vented to the outdoors. When the fans operate heat from the portable heater and the compressors is blown outdoors.

**Recommendation:** Determine a practical method to recycle heat from the compressors to the Milk Room. A preliminary heat loss estimate for the Milk Room is about 42,000 BTU, that is, the smallest heater size should meet that requirement.

Although the Milk Parlor ceiling and walls are insulated to the same R-value, doors and windows as the Milk Room, the Parlor is separated from the barn with a tarp. The tarp R-value is approximately 0 to 1.

A preliminary heat loss estimate for the Milk Parlor is approximately 76,292 BTU. The Milk Parlor is heated with a portable LPG heater equipped with a distribution fan. The heater has two settings: Low, 125,000 BTU and High, 170,000 BTU. One gallon of LPG contains 90,054 BTU.

**Recommendation:** Replace the tarp with an insulated wall and doors to reduce heat loss and heating fuel requirement.



At least three sources of heat exist that could be recycled:

1. Harvested milk,
2. Scroll compressors,
3. Heated waste water.

A properly sized, dual pass plate cooler is an alternative to an HRU to recover heat from harvested milk. Recovered heat can be used to preheat well water and save LPG.

### **Solar and Wind Energy:**

The location of the Farm may lend itself to the installation of Solar and/or Wind generation. Solar energy may be used to preheat water. Solar could also heat the milk rooms thereby reducing fuel cost.

A wind study should determine feasibility of installing a wind generator to produce electric power.

Solar and wind installers should be consulted to determine costs, savings and payback.

[http://www.energymaine.com/renewable\\_programs\\_solar.htm](http://www.energymaine.com/renewable_programs_solar.htm)

### **Ventilation:**

The main cow barn and other barns use open air ventilation. Ventilation recommendations are not necessary at the time of this audit.

### **Compressor:**

New Scroll compressors have been installed. No recommendation other than heat recycling is necessary at this time.

### **Vacuum Pump:**

A correctly sized, 10HP vacuum pump with a variable frequency drive, (VFD), is installed. No recommendations are necessary at this time.



## **Motors & Pumps:**

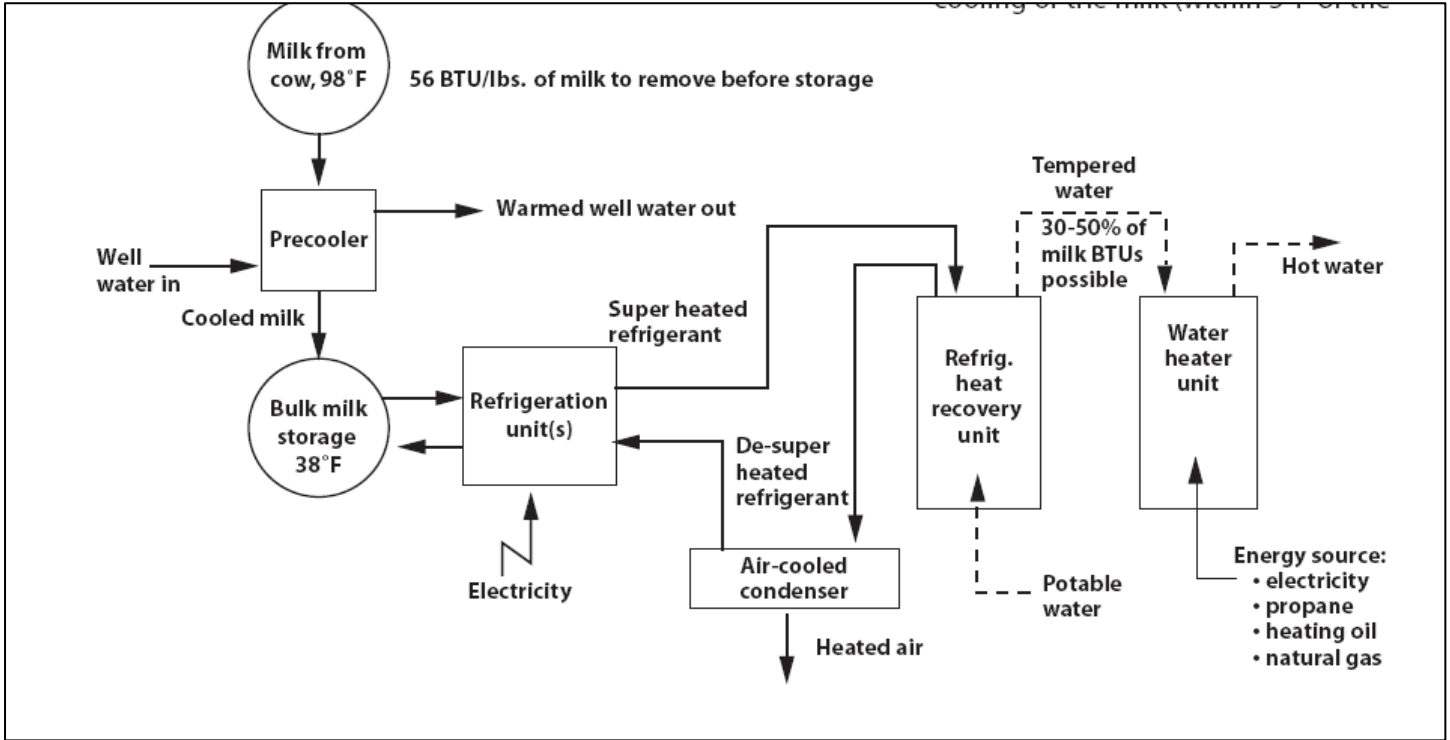
Motors on the farm are responsible for a significant percentage of electric costs. Motors and pumps use about 46% of farm electric energy.



## **Milk Cooling/Refrigeration:**

A shell and tube cooler is used to cool milk at the Farm before it is processed through the condensing unit. Milk must be rapidly cooled to 38 degrees F to prevent bacteria growth. A well water pre-cooler utilizes the temperature of well water through a heat exchanger to lower the temperature of milk 20 to 30 degrees before it enters the bulk tank, thus reducing the energy requirement of the refrigeration compressors. A comparison analysis of the shell and tube and plate cooler showed no savings at this time. Information about cooling systems is provided for future reference. Should farm operations expand further analysis may be warranted.

Below is a schematic of a typical pre cooler and a heat recovery unit integrated with a typical milk system. These are essentially competing technologies and a comprehensive energy evaluation must be conducted if both technologies are going to be implemented to ensure energy cost will not increase.



Preliminary comparison analysis of the existing shell and tube cooler and a new plate cooler determined that replacement payback is within acceptable limits at this time. If farm operation is expanded to include more cows a new comparison analysis is recommended.

**Savings and Incentive Summary:**

All figures quoted are estimates based on information supplied by the Farm. Actual costs, savings and incentives may vary.

Broad Acres							
Summary of Estimated Energy Conservation Measures							
		kWh savings	kWh \$ savings	Capital Cost	Incentive	Cost to Farmer	Payback
1	Dual Pass Plate Cooler	7,114	\$1,051	\$3,500	\$2,800	\$700	0.7
2	Lighting	8,258	\$1,220				
<b>Totals</b>		<b>15,372</b>	<b>\$2,270</b>	<b>\$3,500</b>	<b>\$2,800</b>	<b>\$700</b>	<b>0.3</b>
<p><u>Estimates are approximations</u> for planning purposes only. Verify product, installation and labor cost. Verify available grants before proceeding with energy conservation measures.</p>							

**Emissions**

<b>*Annual Emission Rate</b>				
	<b>kWh</b>	<b>CO2 tons</b>	<b>SO2 lbs</b>	<b>NO.x lbs</b>
<b>Existing</b>	55,041	73,645	2,906	985
<b>Proposed Savings</b>	15,372	20,567	812	275
<b>New Emissions</b>		53,078	2,095	710
<b>Legend:</b>				
<b>kWh = kilo Watt hours</b>				
<b>CO2 = Carbon Dioxide</b>				
<b>SO2 = Sulphur Dioxide</b>				
<b>NO.x = Nitrogen Oxide</b>				
<b>*Electric Utility emissions to produce energy required by the farm</b>				



1 ton of CO2 = 27 X 27 X 27 foot cube if it were visible

Your current annual CO2 production = 213 cubes  
 Approximately 5,751 X 27 X 27 feet long. (1 mile = 5,280 feet)

**Incentives:**

Various resource materials such as “Energy Efficiency Pays – A Guide for the Small Business Owner” were delivered to you at the audit. These resources will provide appropriate information on a variety of building systems.

Valuable information and resources available from the “Efficiency Maine - Business Program” can be obtained by Visiting the [www.energymaine.com](http://www.energymaine.com) website.



Or calling 1-866-376-2463

List of agricultural specific cash incentives available to all Maine farms and agricultural-related businesses, <http://www.energymaine.com/pdfs/2007AgriculturalInsertUpdate.pdf>

**Agricultural Prescriptive Cash Incentives**

**Eligibility**

- Agricultural incentives are available to all Maine farms and agricultural-related businesses.
- Products purchased with Efficiency Maine incentives must be installed in your place of business in Maine.
- Pre-approval is ***NOT*** required for agricultural applications.
- Incentives are available for retrofit applications or new construction, unless otherwise specified.

<b>Milk House Equipment</b>	
Plate Heat Exchanger	\$ 500.00
7.5 HP Vacuum Pump with Adjustable Speed Drive Package	\$2,000.00
10 HP Vacuum Pump with Adjustable Speed Drive Package	\$2,500.00
15 HP Vacuum Pump with Adjustable Speed Drive Package	\$3,000.00
Scroll Compressor – 5 HP	\$ 550.00
Scroll Compressor – 6 HP	\$ 660.00
<b>Potato Storage House Equipment</b>	
Adjustable Speed Drive on 3 to 5 HP Ventilation Fan Motor	\$ 250.00
Adjustable Speed Drive on 7.5 HP Ventilation Fan Motor	\$ 350.00
Adjustable Speed Drive on 10 HP Ventilation Fan Motor	\$ 425.00
Adjustable Speed Drive on 15 HP Ventilation Fan Motor	\$ 500.00
Adjustable Speed Drive on 20 HP Ventilation Fan Motor	\$ 600.00
<b>Lighting</b>	
Vapor-tight High Performance T8 Lighting Fixtures	\$ 25.00
<b>Other Equipment</b>	
High Volume Low Speed Fans (14, 16, 18, 20 & 24 foot diameter)	\$ 1,000.00

Specific prescribed cash incentives for lighting, motors, air conditioning systems, etc. can be found at the following web site:

<http://www.energymaine.com/pdfs/Prescriptive-Cash-Incentives.pdf>.

For additional contractor/product information, please consult with an Efficiency Maine Participating Program Ally listed under the “Business Section” which can be viewed at the following web site:

<http://gdsit.gdsassociates.com/energymainearch/>

The Small Business Low Interest Loan Program was designed to assist small commercial, non-profit, and manufacturing facilities (less than 50 FT employees or less than \$5,000,000 in annual sales). Efficiency Maine-approved energy conservation measure loans up to \$35,000 at 3% interest (current fixed rate) are available. The Maine Public Utilities Commission’s Efficiency Maine Program, administers this program. Additional information can be found at the following web site:

[http://energymaine.com/business\\_programs\\_sbllp.htm](http://energymaine.com/business_programs_sbllp.htm)

Other valuable resources for energy information can be located on the website [www.maineenergyinfo.com](http://www.maineenergyinfo.com) which is a cooperative project of nine state agencies to provide easy access to Maine energy information.

In summary, a number of energy reducing opportunities were identified for your farm. We hope you take the opportunity to review and investigate potential savings and incentive opportunities. For specific questions or comments regarding this report, please contact:

**Walter Isgro**

**Efficiency Maine Energy Consultant**

**wisgro@me.acadia.net**

**207-873-6340**

**or**

**Shirley Bartlett,**

**EfficiencyMaine**

**Program Manager**

**[Shirley.bartlett@maine.gov](mailto:Shirley.bartlett@maine.gov)**

**Tel. 207-287-3318**

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