Executive Summary

SAMPLE FARM is a traditional dairy and grain farm. The property is enrolled in the EQIP program through the NRCS and has decided to have an Agricultural Energy Management Plan (AgEMP) for the operation headquarters completed. This report includes the headquarters energy efficiency analysis, which will be used to identify potential conservation practices to reduce the energy consumption from non-renewable sources on site. This audit was completed in accordance with ANSI/ASABE standard S612 to meet the requirements of the NRCS-EQIP, Agriculture Energy Management Plan, as well as the USDA- Rural Energy for America Program (REAP).

Energy efficiency audit summary:
SAMPLE FARM has taken some steps over the years to improve energy and labor efficiency on the farm. This energy audit has identified additional opportunities for reduced energy consumption. The table below summarizes the potential energy conservation measures possible at the dairy and grain drying facilities. These measures will be discussed in detail later in the report.

Table 1: Summary of Recommended Energy Improvements

Recommended Measure	Estimated Reduction in Energy Use			Estimated Costs, Savings, Payback, and Prioritization for Implementation			
	Electric Savings (kWh)	LP Savings (gallons)	Energy Savings (MMBtu)	Install Cost	Annual Cost Savings	Payback (years)	Est. Life (years)
Engine Block Heaters	1,440	-	4.91	$140	$158	0.9	10
Lighting	5,050	-	17.24	$1,115	$555	2.01	15
Refrigeration Heat Recovery	5,634	-	19.23	$3,000	$620	4.8	20
VFD Vacuum Pump	8,293	-	28.3	$8,000	$912	8.8	15
Refrigeration Compressor	3,174	-	10.83	$4,800	$349	13.8	20
TOTALS*	**23,591**	**0**	**80.52**	**$17,055**	**$2,586**	**6.6**	

Table 2: Annual Energy Savings if Recommendations are Fully Implemented

Fuel	Current Usage	Savings	MMBtu Usage	MMBtu Savings	% Savings
Electricity (kWh)	93,449	23,591	318.94	80.52	25.2
LP (gallons)	237	0	21.71	0	0
Totals			**340.65**	**80.52**	**23.6**

The load profile is very similar to what is seen on many traditional dairy farms. The primary energy users on the farm are the livestock waterers, the vacuum pump and the milk cooling system. This is followed closely by the livestock ventilation/ circulation system and the water heater.

Table 5 shows the energy, cost, and baseline greenhouse gas statistics for the dairy's milking and grain drying operation. After accounting for all electric and LP equipment on the farm, energy usage calculations estimate that in total the dairy and grain drying operating systems should use about 93,449 kWh of electricity and 237 gallons of LP, or 341 MMBtu of energy consumption annually. This equals $10,536 in annual cost and the production of 70.04 metric tons of greenhouse gas emissions annually.

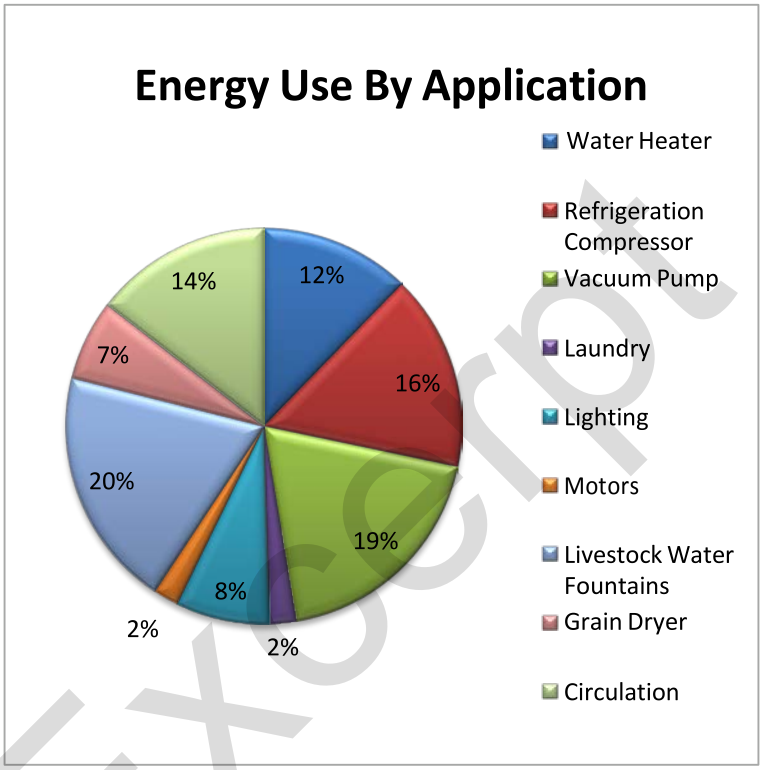

Figure 3: Estimated Energy Use by Application
*Components using less than 1% of total energy consumption are not included

Table 5: Estimated Energy Summary for Dairy Applications

SAMPLE FARM	Baseline*	Units
Baseline Energy Usage	340.66	MMBtu
Annual Electric Usage	93,449	kWh
Annual LP Usage	237	Gallons
Total Annual Energy Cost	10,535.79	U.S. Dollars
Baseline Greenhouse Gas Emissions	70.04	$MTeCO_2$

***Baseline energy use is calculated and does not include energy used by intermittent uses such as power tools and computers. Therefore, baseline calculated energy use will vary from actual energy use. LP use will be dependent on the amount of grain to be dried, the outdoor temperature and the moisture content of the grain entering the dryer.**

Current Energy Usage

SAMPLE FARM's baseline energy usage by application is shown in table 6 below, with a more detailed description of each energy using application following table 6. Table 6 presents baseline energy usage in gallons of LP, kWh, as well as kW. The kW baseline is the equipment based kW demand, although if the kW is billed the charge will vary by month for the farm as a whole depending on the combination of equipment that was on during the peak periods and the billing structure. The baseline demand does not represent the potential billed demand.

Table 6: Summary of Energy Usage for SAMPLE FARM

Application	kWh Baseline	kW Baseline	LP Baseline	MMBtu Baseline
Water Heater	11,855	4.50	-	40.46
Milk Cooling (Receiver Jar Pump and Refrigeration Compressor)	15,742	5.76	-	53.73
Vacuum Pump	18,469	6.33	-	63.03
Laundry	2,115	5.50	-	7.22
Lighting	7,419	3.33	-	25.32
Motors	1,786	24.21	-	6.1
Space Heating	215	-	-	0.73
Livestock Water Fountains	19,000	0	-	64.85
Circulation	14,046	6.88	-	47.94
Engine Block Heaters	2,400	0	-	8.2
Air Compressors	400	3.73	-	1.37
Grain Dryer	-	-	237	21.71
Total	**93,449**	**60.24**	**237**	**340.66**

A. Water Heating
The farm currently uses an 80 gallon Reliance 6 80 DORT 210 electric water heater with an energy factor of about 0.86 to heat hot water needed for sanitation. Hot water is heated to the required temperature for pipeline washing of 180°F. Hot water is used for 2 times daily pipeline washing, every other day bulk tank washing, and some minimal amounts for daily hand washing, spray down, etc.

B. Milk Harvesting
The farm milks in an individual stall, flat barn parlor. The eight milking units are driven by a rotary vane style vacuum system with a single phase 7 ½ HP motor with an estimated efficiency of 85%. The milk is transferred to the bulk tank using a 1 HP receiver jar pump; the tag was missing making the make and model unreadable. The farm milks 2 times per day, with each milking taking about 3 ½ hours. The vacuum pump runs for an additional hour/day, 30 minutes each milking, for pipeline washing.

C. Milk Cooling
The farm has a 2,000 gallon Mueller bulk tank for milk storage. The bulk tank is cooled with a twelve year old, 5 HP, Copeland reciprocating compressor, with an estimated EER

Greenhouse Gas Reductions:

These energy efficiency measures can also lead to greenhouse gas reductions on the farm and decrease the farms carbon footprint. While farms are currently not required by the state or federal government to reduce greenhouse gas (GHG) emissions this may occur in the future as the discussion of a cap and trade system is ongoing in government.

Greenhouse gases contribute to the greenhouse effect by absorbing infrared radiation. GHGs are produced from the burning of fossil fuels. This includes the burning of coal or natural gas for electrical production as well as the combustion of LP or NG for water and space heat. Energy efficiency projects help to reduce your overall GHG footprint by minimizing the amount of energy or fuel consumed. As there are many such gases with varying degrees of absorption potential, GHG information is represented as a *carbon dioxide equivalent*. Equivalency values are expressed as metric tons of carbon dioxide ($MTeCO_2$), an internationally accepted measure.

The greenhouse gas reductions from each efficiency measure listed in the energy savings summary can be seen in the adjacent figure. Greenhouse gas reduction potential is based on the U.S. EPA eGRID2010 Version 1.1; CH4 and N2O factors provided by EPA Climate Leaders based on eGRID2010 fuel consumption and electricity generation data, and U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005, April 2007 (Annex 3, Table A- 69).

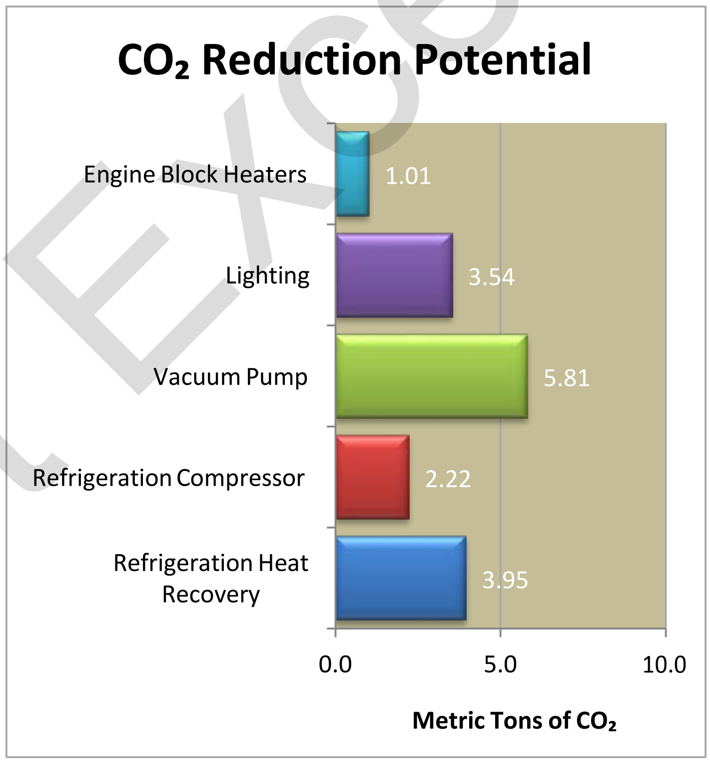

Figure 4: GHG Reduction Potential

Energy Utilization Indicator

Energy Utilization Indices (EUIs) provide a benchmark to indicate how efficiently electrical energy (input) is being utilized based on total milk production (output) and can be used to indicate whether a farm's energy use is in line with that of other similar farms that have been benchmarked. A common and easy to understand EUI for dairy farms is expressed in kWh per cwt milk (hundredweight of milk). The graph below compares the energy usage of just the milking system equipment, including: compressor(s), vacuum pump(s), water heater(s), and milk transfer pump(s). The energy use takes into account energy efficient upgrades such as refrigeration heat recovery unit(s) and plate cooler(s). The benchmark shown in the graph is based on data collected for similar farms only (in herd size and pipeline vs. parlor).

Comparison of Milking System Energy Usage to Benchmarked Data

- The current milking system is estimated to be 21% less efficient compared to data for similar farms.
- The proposed milking system is estimated to be 24% more efficient compared to data for similar farms.

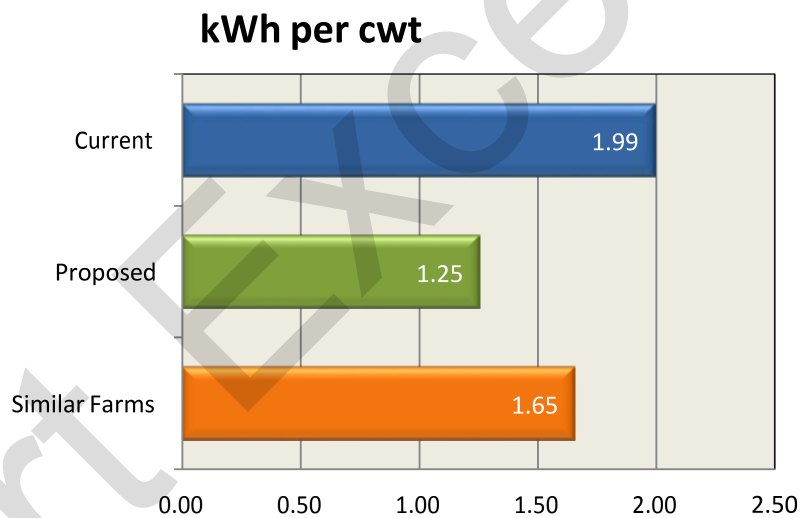

Figure 5. Milking system energy use compared to benchmarked data