

54

Energy Savings Technologies for Agriculture



*Preliminary Recommendations
under
Ag Energy Co-operative's
and FireFly Energy's
Demand Side Management
“Lessons Learned” Energy Program*

Dear Agricultural Operator,

Together with the stakeholders listed, we launched our Demand Side Management “Lessons Learned” Energy Program at the beginning of 2006. We developed the Program to discover opportunities to reduce energy consumption by more than 15% through conservation and efficiency. 15% equates to over \$30,000,000 annually.

At this point, energy audits have been completed and as a result of those audits, the firms conducting the audits identified 54 Energy Savings Technologies for further consideration. We plan to test many of these suggestions and to later report our findings to you. Nevertheless at this time we wish to share the suggested Energy Savings Technologies with you.

These technologies fall under 8 headings:

- Dairy opportunities
- Swine opportunities
- Poultry opportunities
- Boiler opportunities
- Insulation opportunities
- Electrical opportunities
- Heat recovery, monitoring and tracking opportunities
- General opportunities

We wish to give a special thanks to Steve Clarke of OMAFRA’s Kemptville office for developing an energy audit program and reporting system and for his help in coordinating a large number of the audits.

Sincerely,

A handwritten signature in black ink that reads "Mike".

Mike Bouk
Executive Director

The Different Phases of Our DSM “Lessons Learned” Energy Program

Phase 1: Selection of agricultural operators and energy auditors - *Completed*

Phase 2: Completion of energy audits and issuance of listing of suggested Energy Savings Technologies - *Completed*

Phase 3: Selection of pilot projects as “Learning Locations” to validate suggested Energy Savings Technologies.
Alternatives – A number of projects are underway:

1. Geothermal: Groundsource heat pump to heat a broiler chicken barn
2. Lighting: Controlled metal halide light intensity with high/low/off and duration with new controls in a commercial dairy farm
3. Lighting: Controlled fluorescent light intensity with photocell variable output and duration with new controls in a commercial turkey farm
4. Heating and Ventilation: Energy efficient infrared heat and combined fan and natural ventilation in a commercial turkey barn
5. Variable Frequency Drive: Used to control speed of cooling recirculation fans, vacuum pump, and milk pump in a commercial dairy farm
6. Demand Management: Used to control demand, saving both kW demand and kWh by careful regulation of refrigeration load in a commercial apple grower storage facility.
7. Creep Heat Control: Energy efficient creep heat system using heat pads and heat lamps.
8. Standby Boiler Isolation: to reduce standby heat losses in a commercial greenhouse boiler system.
9. Heat Recovery Ventilation: Use of an HRV in a greenhouse to recover heat from ventilation air.

The Different Phases of Our DSM “Lessons Learned” Energy Program

Phase 4: Issuance of “Lessons Learned” resulting from pilot projects – A website is being developed that will provide farm and technology background. The technology will be monitored and energy savings results will be kept up-to-date.

Phase 5: Development of Enercompare benchmarking program for agricultural operations. This is an interactive, internet based software program to compare your energy use in a number of ways.



Phase 6: Roll out of findings – Presentations at the Growing the Margins Energy Conference in London, Ontario from April 12 to 13, 2007. Keep watching www.agenergy.coop for announcements about more presentations and workshops.



Suggested Energy Savings Technologies

Energy prices will continue to rise resulting in increased heating fuel, energy (kWh) and demand (kW) charges. Agricultural operators and producers need to look at energy efficient technologies and energy management to reduce the impact these rising costs will have on the bottom line of their operation. The technologies listed in the table serve as a guide to begin exploring alternatives to existing equipment. The technologies will not apply to all farms. The annual savings are estimated. They give an indication of the savings potential that can be expected by implementing a technology and will vary under each farm's operating conditions and management.

Dairy Opportunities	Estimated Annual Savings
Lighting: upgrade light systems to EE HID, fluorescent T8 and T5's. Use photocell sensors and timers to provide long day photoperiods. Automatic dimmers can be used with the photocells on tube fluorescent lights to control light output based on ambient daylight levels and to simulate dusk and dawn.	5 – 80%
Milk Heat Reclaimer: water cooled condenser extracts heat from the bulk tank refrigeration system using water. The warm water can be used to preheat the water heater reducing its operation.	20 – 50%
Milk Pre-Cooler or Plate Cooler: well water pre-cooler cools the milk before it enters the bulk tank to reduce refrigeration compressor operating time. The resulting warm water can preheat the water heater and reduce its operation.	30 – 50%

Dairy Opportunities Continued	Estimated Annual Savings
Variable Frequency Drive on Vacuum Pump (also known as adjustable or variable speed drive): monitors airflow on the vacuum line and adjusts the vacuum pump motor speed to maintain vacuum which varies. Only suitable on lobe/blower type vacuum pump. Not suitable on rotary vane pump.	30 – 50%
Variable Frequency Drive on Milk Pump (also known as adjustable or variable speed drive): Replaces the standard on/off liquid level controller and maintains the milk level in the receiving jar by adjusting the milk pump speed. Reduces refrigeration system operation.	Varies with pump size and daily operating hours
Scroll Compressor: Compresses and moves refrigerant more efficiently and reliably than traditional reciprocating compressors.	15 – 20%
Energy Efficient Water Bowls: Insulated water bowls with 150W or less electric elements.	80 – 90%
Energy Free Water Bowls: Super-insulated water bowls without electric elements. Water circulation as cows drink prevents freezing.	100%
Energy efficient exhaust and circulating fans and optimum control.	10 – 33%
Natural ventilation.	100%
High volume low velocity circulating fans.	50%

Boiler Opportunities	Estimated Annual Savings
<p>Minimum size summer condensing boiler system and optional water storage tank. This small condensing boiler is used to maintain main boiler(s) at a temperature slightly above ambient to prevent damage. By operating a small yet high efficiency boiler for longer periods of time, the main boilers do not cycle on/off. This saves both operating dollars and wear and tear.</p>	<p>2 – 10%</p>
<p>Economizers: Flue gas heat recovery for pre-heating water or heating spaces. Heat in the flue gases is recovered. There is significant heat in the gases in the form of moisture. When this moisture is condensed out, the heat is recovered for other uses instead of venting to the atmosphere.</p>	<p>7 – 13%</p>
<p>Condensing boilers: 92-94% efficient boilers. Where heat is required and the boiler can be operated at a supply temperature if 65 C or less, boiler operating efficiencies in the 93% range can be achieved.</p>	<p>8 – 10%</p>
<p>Tune up and Maintenance Program: Rigorous inspections and tune-ups, documentation. Even small changes in efficiency due to dirt, and improper settings can increase costs significantly. This is one of the fastest paying, yet typically ignored, savings opportunities.</p>	<p>2 – 10%</p>



Boiler Opportunities Continued	Estimated Annual Savings
Servo Controls: Separate air/fuel control. Many modulating boilers use a mechanical linkage between the air and fuel supplies. A servo control uses a digital controller and separates the two for more efficiency throughout the modulating cycle.	2 – 8%
Reduce flue standby losses. Flue gas control. An Exhausto controller prevents excess (heated) air from escaping to the atmosphere from the boiler room, through the boiler, during boiler off times.	1 – 3%
Standby boiler isolation: Isolate other boilers from primary boiler hot water. By creating isolation valves, hot water can be diverted from standby boilers until required. Mixing valves will be required to avoid shock.	0.5 – 1%
Blow down heat exchanger for steam boilers.	2 - 5%
Condensate return.	1 - 5%

Insulation Opportunities	Estimated Annual Savings
Seal leakage: Facilities should be carefully evaluated for leaks, including around fan housings, doors, etc.	0.5 – 10%
Insulation of walls & ceiling: Insulate to code.	0.5 – 10%
Insulation of perimeter/foundation: Insulating the first metre of wall height can save significant heat loss. During major renovations or for new construction, insulating below grade to the frost line can also pay off.	0.5 – 5%

Swine Opportunities	Estimated Annual Savings
Lighting: upgrade light systems to EE compact fluorescent, fluorescent T8 and T5's. Use photocell sensors and timers for photoperiod control. Automatic dimmers can be used with the photocells on tube fluorescent lights to control light output based on ambient daylight levels and to simulate dusk and dawn.	5 – 80%
Dual Ventilation: Natural summer ventilation plus mechanical winter ventilation.	80%
Energy efficient exhaust fans and optimum control.	33%
Energy efficient circulating fans and optimum control.	10%
Single or 2-stage infrared or radiant tube heaters direct the heat toward the pigs and the floor where it is needed. Two-stage heaters allow high and low heat output from the burner.	12 – 15%
Replace electric heat lamps with electric or hot water heat pads as primary creep heat source. Use energy efficient type heat lamps to dry piglets off and for first few days.	60%
Creep heat diode (hi/lo) control with thermostat allows the radiant heat output from the heat lamp or pad to be reduced in half to meet the piglet's needs.	20%
Creep heat manual dimmer allows heat output from heat lamps or pads to be adjusted manually.	5 – 50%
Creep heat auto variable, continuous duty dimmer that adjusts heat output as the piglets grow using a program.	30%
High temperature cut-out turns heaters, heat pads and heat lamps off when the room temperature exceeds 26 °C.	3%

<h2 style="text-align: center;">Poultry Opportunities</h2>	<h3 style="text-align: center;">Estimated Annual Savings</h3>
<p>Lighting: upgrade light systems to EE compact fluorescent, fluorescent T8 and T5's. Use photocell sensors and timers along with automatic dimmers on tube fluorescent lights for photoperiod control and to simulate dusk and dawn.</p>	<p style="text-align: center;">5 – 80%</p>
<p>Dual Ventilation: Natural summer ventilation plus mechanical winter ventilation.</p>	<p style="text-align: center;">80%</p>
<p>Energy efficient exhaust fans and optimum control.</p>	<p style="text-align: center;">33%</p>
<p>Energy efficient circulating fans and optimum control.</p>	<p style="text-align: center;">10%</p>
<p>Single or 2-stage infrared or radiant tube heaters direct the heat toward the birds and the floor where it is needed. Two-stage heaters allow high and low heat output from the burner.</p>	<p style="text-align: center;">12 – 15%</p>
<p>Refrigeration maintained and sized (egg cooler).</p>	<p style="text-align: center;">10 - 50%</p>



Electrical Opportunities	Estimated Annual Savings
<p>Power Factor Correction: Capacitors used to reduce the kW demand charges. Motors and transformers commonly cause a power problem called Power Factor. A PF below 0.9 will mean that the charges for demand (kW) will be increased; the poorer the PF, the higher a recalculated demand charge will be.</p>	0.5 – 20%
<p>Demand Management: Schedule electric loads to reduce peak demand charges. Demand is up to 40% of the charges for electricity. Most operations will be charged for demand if the service is 400 amps or greater. By regulating loads so they do not operate at the same time, significant savings for minimal cost can be achieved.</p>	0.5 – 20%
<p>Lighting: Upgrade process, office, other light systems to energy efficient fluorescent T8 and T5. Anything from turning out the lights to automatically controlled T8 fluorescent saves energy dollars.</p>	5 – 80%
<p>Energy efficient fans and optimum control. Energy efficient fans and staged control. Fan selection is difficult. New ratings systems by independent labs allow comparison using air flow rate outputs per unit energy input.</p>	0.5 – 30%
<p>Variable Frequency Drive vs. 3 or 4-way mixing valve. Use of frequency drives on pumps with varying loads, such as heating and irrigation. Standard controllers use a continuously operating pump with a 3 or 4 way-mixing valve. Removal of the mixing valve and varying the pump flow rate with a VFD can save dollars.</p>	0.5 – 5%
<p>Energy efficient ventilation system design and calibration.</p>	5 - 30%
<p>Conversion to Natural Ventilation: Requires sidewall conversion and removal of exhaust fans.</p>	2 – 50%
<p>High volume low velocity circulating fans.</p>	50%

<h2 style="text-align: center;">Heat Recovery, Monitoring and Tracking Opportunities</h2>	<h3 style="text-align: center;">Estimated Annual Savings</h3>
<p>Ventilation and RH control: Optimized ventilation rate when used for RH control. When controlling for relative humidity, sensor calibration and controller settings have large impact on savings possible.</p>	<p>0.5 – 2%</p>
<p>EFIN (Energy Flow Integrator Network) plus Building Model Analysis: A program to analyze energy consumption by zone. Allows managers to correlate production to energy consumption. This system measures actual energy input to a given zone, allowing evaluation of temperature settings and other management changes, to actual heat input costs.</p>	<p>0.5 – 5%</p>
<p>Heat recovery ventilator: When using mechanical ventilation for humidity control, use a heat recovery ventilator or dehumidifier. An air-air heat recovery ventilator recovers the heat in the exhausted air by preheating the fresh incoming air.</p>	<p>5 – 50%</p>

<h2 style="text-align: center;">General Opportunities</h2>	<h3 style="text-align: center;">Estimated Annual Savings</h3>
<p>Irrigation high efficiency pumps: Pump efficiency.</p>	<p>5 - 20%</p>
<p>Grain Dryer: Cooling air recovery.</p>	<p>5 - 10%</p>
<p>Grain Dryer: Energy efficient column dryer.</p>	<p>5 - 20%</p>
<p>Block heater on generator set.</p>	<p>50%</p>

Who We Are

Ag Energy Co-operative is a high volume, low-overhead farmer-owned co-operative specializing in energy dedicated to the greenhouse and agriculture sector. Established in 1988, we are the largest of our kind in Canada, currently supplying about 1/3 of all heat in the form of natural gas and 1/3 of all electricity consumed by Ontario agriculture.

FireFly Energy is a division of Ag Energy Co-operative, serving all sizes of customers.

For more information on the Demand Side Management “Lessons Learned” Energy Program please visit <http://www.dsmllessonslearned.blogspot.com> or call Ag Energy Co-operative & FireFly Energy at 888-866-7575



Do you know how your facility benchmarks against other similar facilities?

To find out, use Enercompare, an **interactive, internet based software program** to compare your energy use in a number of ways. It takes your monthly production and energy bills and provides a graph to illustrate trends and potential problems.



You can also **evaluate energy saving technologies** and enercompare will estimate payback periods for your site.

Enercompare will also **compare** your total annual energy use per unit of production against other similar facilities, in a confidential manner.



Visit www.agenergy.coop to watch for the launch of this exciting new website!

**This Project is supported by Ag Energy
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