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Geothermal and Solar Power Case Study – Refsal/Marteniuk Farm, Laingsburg, Michigan

Farm overview

Refsal/Marteniuk Farms is owned and operated by the Refsal and Marteniuk family and has been in the family since the 1979. The farm is located at 6905 Friegel Road, Laingsburg, MI 48848. The Refsal/Marteniuk farm consists of 75 acres. The farm buildings and pastures comprise 13 acres, with 60 acres tillable and a couple of acres of wetlands. Currently the farming operation consists of about 100 small ruminants (approx. 70 ewes and 30 does). During the fall (after the crops are harvested from the 60 acres that are leased out), the sheep are turned out to forage on crop residue.



Figure 1. Refsal/Marteniuk Farm. Credit: Kinder Engineering.

The goats are primarily fed dry hay and grain, but are also used as a means of utilizing garden weeds, tree trimmings and grazing and weed control around buildings and the barn yard. The offspring are sold primarily to the ethic market since the farm is close to E. Lansing and Michigan State University.

In addition, the livestock allows the owner to use the animals as a teaching tool for both teaching veterinary students in basic veterinary techniques, such as dehorning, foot trimming, pregnancy evaluation, etc., and as a basis of documenting how certain problems can be identified and managed when talking to producers at extension meeting on small ruminant care.

Project overview

The owner first had an Agricultural Energy Audit and Renewable Energy Assessment done by the Michigan State University's Agricultural Energy Program to determine the energy efficiency measures that could be done on the farm and to determine the expected energy production and financial impacts and funding opportunities for the renewable energy project. Implementing the energy efficiency measures can increase the positive impact of the renewable energy project.

The owner selected Harvest Energy Solutions of Jackson, Michigan to construct the array because they did everything in house and do not use subcontractors. They were also most helpful in assisting in the owner with the Consumers Energy and directing the owner to the USDA REAP program. The PV Solar system selected was the SolarWorld's Sunmodule Pro-Series. SolarWorld manufactures and produces the cells and assemble the panels themselves at a facility in Oregon.

A new 20 kW solar array was installed on the roof of the storage barn in November of 2014. The array has generated 18,700 kWh of A/C current from November 12, 2014 to date. The facility used approximately 28,000 kWh over the same time period. The solar energy created by the project amounts to approximately 66% of the facility's total electrical usage.

The estimated electricity generation for that period of time from the National Renewable Energy Laboratory's PV Watts® Calculator is 21,831 kWh. The National Renewable Energy Laboratory is a national laboratory of the U.S. Department of Energy.

This project has been chosen to participate in Consumers Energy's Experimental Advanced Renewable Program (EARP). The owner entered into a long-term offer agreement to sell the output from their system to Consumers Energy at a fixed rate. For this project, the fixed rate is \$0.2430. At \$0.2430/kWh, the 21,831 kWh generated to date saved \$5,305 of electrical energy costs in less than a year.



Figure 2. Solar panels on barn. Credit: Kinder Engineering.

The farm also applied for and received a USDA Rural Energy for America Program grant for 25% (\$18,538.00) of the project's cost of from the USDA and was also a finalist for the 2015 Governor's Energy Excellence Award in the Agricultural category.

Energy savings and greenhouse gas reduction

The renewable energy produced lead to greenhouse gas reductions on the farm and decreases the farms carbon footprint. Greenhouse gases (GHG) contribute to the greenhouse effect by absorbing infrared radiation. GHGs are produced from the burning of fossil fuels. Renewable energy projects help to reduce GHG emissions 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 pounds of carbon dioxide (MTeCO₂), an internationally accepted measure. The greenhouse gas reductions, in pounds, from each fuel source can be seen in the table below.

Fuel Source	Annual Fuel Savings	MMBtu	CO ₂	N ₂ O	CH ₄	Total CO ₂ -Equivalent	SO ₂	NO _x
Electricity (kWh)	21,831	74.51	35,571	0.59	0.66	35,766.60	114.8	36.6

The 20 KW solar system was quoted at \$74,150 or \$3.73 per kW. The owner stated that there were no additional charges during construction and that they were happy with choices made and would not have done anything different. Some advice from the owner to someone looking at renewable energy system include contacting references and get at least 3 bids for any major project.