Results of Energy Audits on Grazing Farms in Northeast US

The last technical session for the afternoon was **Results of Energy Audits on Grazing Farms in Northeast US**. Ms. Jennifer Colby was moderator of this session and the first presenter. Ms. Colby is Program Coordinator of the Vermont Pasture Network, University of Vermont, Burlington, VT. She gave an overview of *Developing a tool to assess farm energy impacts*. Tool development approach was based on "Economic uncertainty and financial performance" research by Mark Cannella (2009) and Organic dairy data (Bob Parsons, 2004-2013). The dairy data showed that there was wide variation between farms in milk produced, feedstuffs used and the proportions of each feedstuff, and the amount of equipment and purchased inputs. Daily decisions arrived at by each farmer caused this wide variation in management and output. The pocketbook drives better decisions. Examples of daily farm decisions are:

- Value of a grazing day versus a day feeding stored feed
- Cost of timing forage harvest
- Renting versus purchasing equipment; versus purchasing harvested forages
- Fuel use through stages of feed production, harvesting and feeding, and manure management.

Insert Farm Data in Blue Cells		
	TRACTOR ONLY	
Select Power Unit	130 HP MFWD	
Diesel Use Per Hour	5.72	Gallons
Current Diesel Price	$ 3.80	
Diesel Cost Per Hour	$ 22	
Activity		
Acres Covered	4	Acres
Estimated Hours (REQUIRED)	0	Hrs
Tractor Diesel Use	0	Gallons
Diesel Cost Tractor	$ -	
(based on hours of machine operation)		

Historical energy measures were:

- Fuel use
- Electricity use (often tied to milking parlor)
- Labor expense
- Distinctions between direct and indirect energy.

CIG Energy project goals were to use this opportunity to look at energy in a new way and incorporate that perspective into day-to-day farm-level decisions to reduce energy inputs while making the farm more profitable.

The tool being developed is based heavily on the type of data collected by Lazarus, University of Minnesota. For instance, collecting data on fuel usage by tractors. Tractor horse power rating is used to classify the size of a tractor used on a farm. Then, the screen below captures the amount of fuel used per hour and the cost of that fuel and then determines how much it costs to do an activity with that tractor. This way a specific farm operation use of energy can be captured uniquely for each farm wanting to do an analysis on the cost of performing that operation, such as planting a 20-acre field, in a certain way, such as with complete tillage and planting (as shown below) or using a no-till planter with a burn-down herbicide and compar-ing the costs of each method analyzed.

draft Simple Tools_CIG Energy v 3-6-15

	A	B	C	D
1	**Summary Sheet**			
2				
3			Diesel Cost	
4	**ACTIVITY SHEET**	**DESCRIPTION**	**Power Unit**	**Power Unit plus Implement**
5	ACTIVITY 1:	Plow 20 acres	$ -	$ 115
6	ACTIVITY 2:	Disk Harrow 20 acres	$ -	$ 72
7	ACTIVITY 3:	Field Prep 20 acres	$ -	$ 35
8	ACTIVITY 4:	Start Seeding 20 acres	$ -	$ 161
9	ACTIVITY 5:	no activity	$ -	$ -
10		**TOTAL**	$ -	$ 384

A draft assessment tool has been prepared. They will now refine tool using:

- Case studies

- Farmer input (tomorrow during the con-ference and by survey)
- Testing

They will distribute the tool in the summer of 2015 to farmers wanting to do a self assessment and to service providers that work with farmers on assessing farm energy use and making modifications to daily decisions that they have done in the past if the assessment shows a more efficient way to do them with less energy inputs.

Dr. Eric Garza was the second presenter for this session. He did his presentation via a recorded video as he teaches classes Tuesday through Thursday at Green Mountain College in Vermont and was unable to attend the conference in person. This too was a first for us but was done very efficiently and effectively. He went into the theory behind the assessment tool development. He started out with a simple efficiency equation:

$$\text{Efficiency} = \text{ends/means}$$

This can be converted for farm energy use and substitute dollars as a proxy for energy input and output:

Efficiency = E_o / E_d + E_i,

where E_o = Energy output, E_d = Direct Energy inputs, and E_i = Indirect Energy inputs.

A holistic approach is used to capture all the energy inputs used by a farm to produce food energy. There is a bigger impact on the environment than just what energy use occurs at the farm. For example, there is a pollution cost to produce electrical energy used at the farm. Indirect energy costs include such things as producing and distributing fertilizers, machinery, herbicides, and fuels before they arrive at the farm. It is also necessary to use a common way to quantify different energy costs from disparate inputs, such as fuels, machinery, and labor. For instance, fuel usage has both direct (burning it in a tractor) and indirect costs (extracting, refining, and distributing) associated with it. Farm labor has associated with it the energy burned by the worker to perform the various tasks on the farm, and also, if commuting back and forth from the farm, the energy used to get back and forth. The annual cost of owning a piece of machinery needs a realistic estimate of its expected life span in years that is divided into the purchase cost to arrive at a yearly cost estimate. Other physical structures, such as buildings, roads, bunker silos, and tower silos, use a wide array of building materials so the energy required to build them varies accordingly.

Three different farms were analyzed to show differences in energy efficiency: Vermont lamb farm, NY heifer farm, and VT dairy farm. The Vermont lamb farm used 9.5 kilocalories (Kcal) of energy input to produce 1 kcal of food energy. This is more than double the energy input (3.8 kcal) required on an average meat producing farm in the US. The sheep farm transports sheep to some pastures, utilizing fuel. They also make meat deliveries. These are two areas that the farm may be able to change to increase their return on investment (ROI). Dr. Garza emphasized that the metric used only counts the calorie value of meat sold, not meat produced. Selling all of the meat produced would therefore have an impact on the farm's data, and potentially decrease the amount of energy the farm uses to raise one calorie of food. Here economy of scale also plays a part as larger farms can more efficiently use energy and generally do not sell meat direct to consumers.

The New York heifer raising farm used 10.5 kcal of energy input to produce 1 kcal of food energy. However, this farm was not pasture-based but fed balage and hay to the heifers. The operation would fare much better if they put their heifers on pasture to harvest the forage instead of either buying-in hay and balage or harvesting it themselves. The weight gain the heifers made while at the farm was the proxy for food output value until they left to become producing dairy cows.

The Vermont pasture-based dairy farm was more efficient than the average US dairy farm. It used 0.8 kcal of energy input to produce one kcal of food energy in contrast to national average of 2.2 kcal of energy inputs to produce one kcal of food energy. A dairy cow can produce a lot of milk for its body weight so the dairy enterprise has a built-in advantage in producing food energy from energy inputs.