NRCS Energy Efficiency Tools: Dairy and Beef Operations

Present by:
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Introductory Page to the Self-Assessment Tool

www.uwex.edu/energy/esa

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Beef and Other Livestock Operations

- **This tool is not fully completed, however it will be a combination of a Ventilation tool and the lighting and livestock waterer tools.**
- **Jenny Hermans will be presenting on these tools later.**

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Dairy Self Assessment Tool

- **Why assess a Dairy?**
  - -They have many energy consuming operations and utilize multiple energy sources
  - -They have daily operations, 365 days a year resulting in significant energy use
  - -Most dairies are in the process of upgrading or expanding
  - -Most farms will have feasible energy efficiency improvement potential with a 5 year payback or less

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Dairy Self Assessment Tool

- **What should be assessed?**

Based on a New York survey of 32 dairy farms (14 tie-stalls and 18 free-stalls operations), vacuum pumps used 17%, milk cooling required 25%, lighting consumed 24% and ventilation was 22% of the electricity used. Water heating was split almost equally between electric, heating oil and gas (propane and natural gas) and represented 13% of the energy used.

- **Hot water systems**
- **Milk cooling and refrigeration**
- **Vacuum systems**
- **Lighting**
- **Ventilation and exhaust systems**

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The Average Wisconsin Dairy

Number of Milking Cows	**80**
Milkings per day	**2**
Hours per milking	**1.5**
Milk shipped per day	**5600 lbs (70 lbs/cow-day)**
Number of Milking Units	**5 (on a pipeline)**
Size of Vacuum Pump	**10 hp**
Size of Refrigeration	**2 - 5 hp compressors**
Size of Bulk Tank	**800 gal.**
Hot Water Usage	**115 gal./day**

Assessing the Average Dairy

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Step 1: Enter the farms zip code

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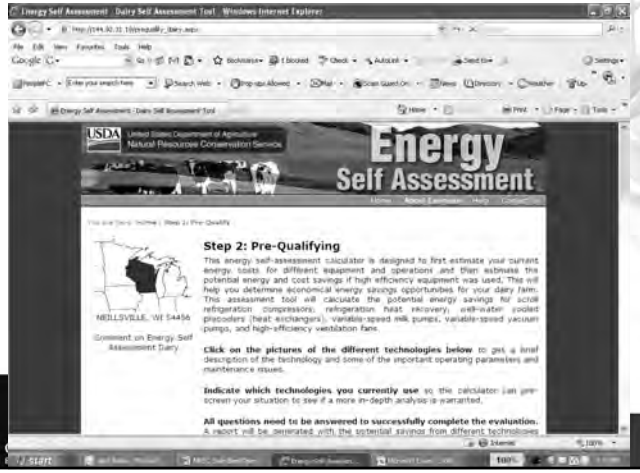
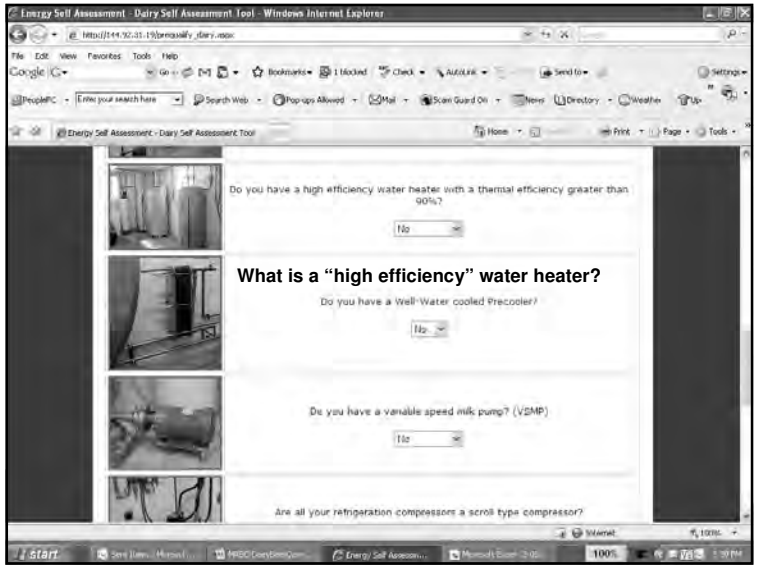
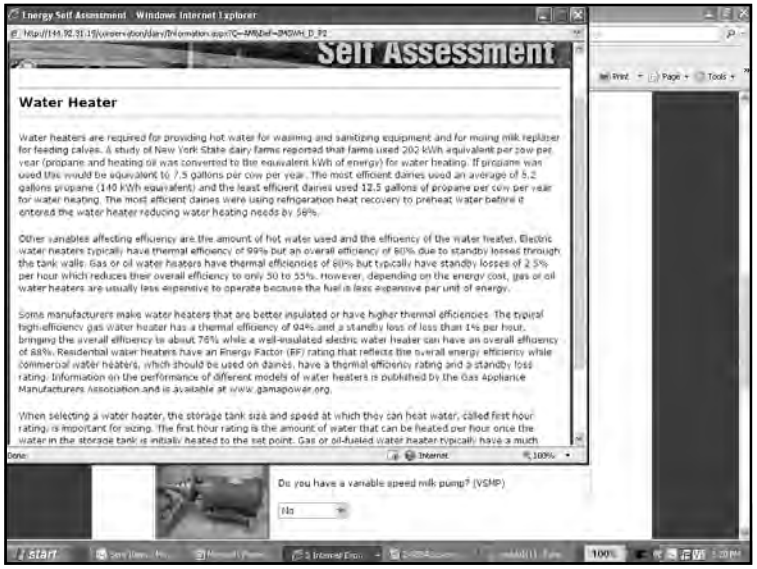
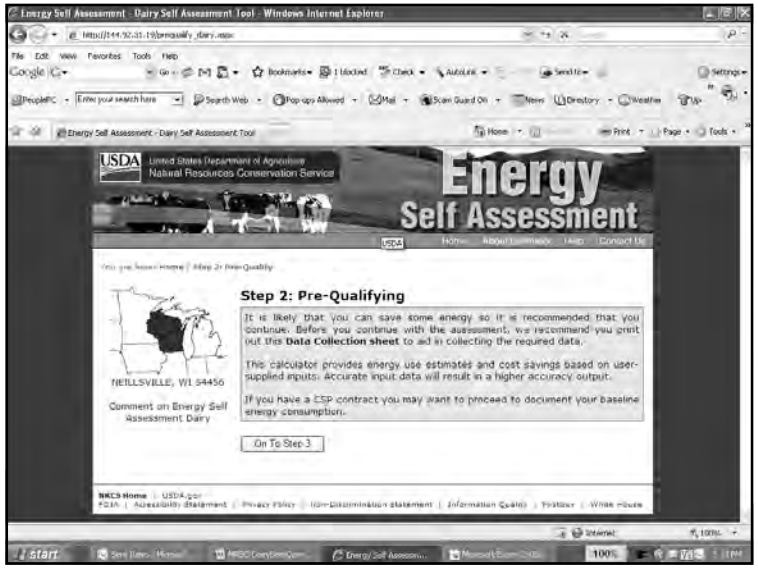
Step 2: Pre-Qualifying









Find the "Data Collection" sheet

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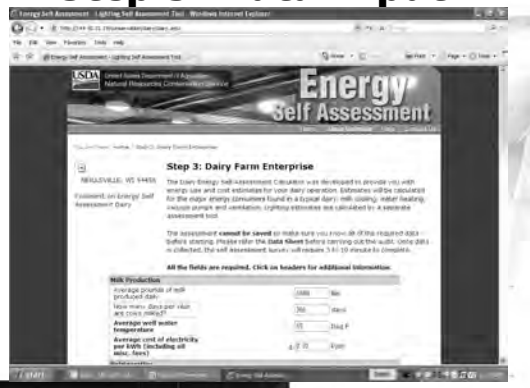
Step 3: Data Input



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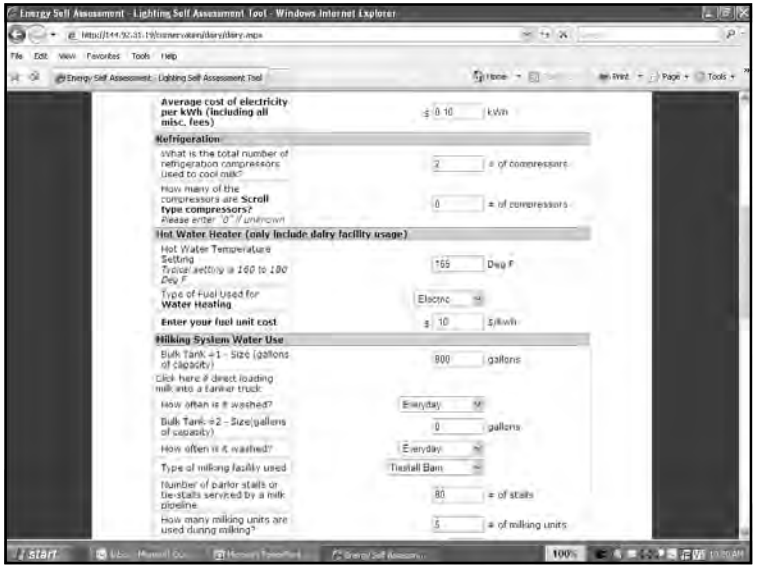
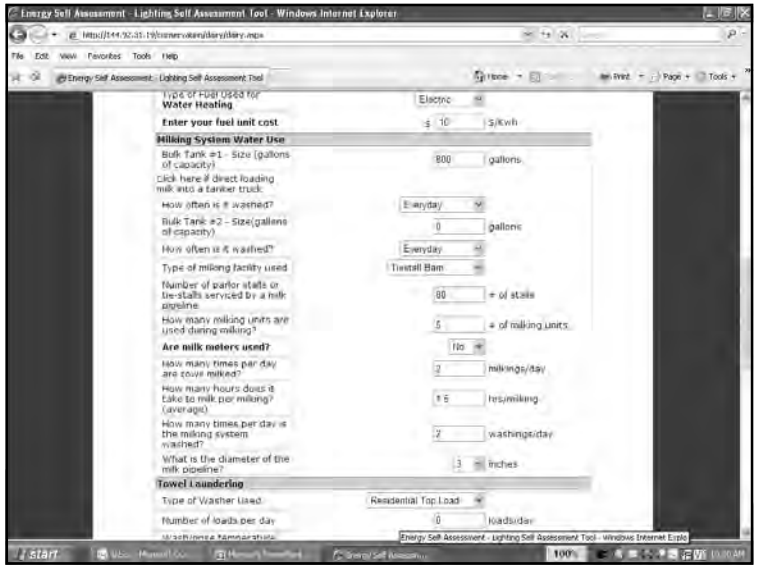
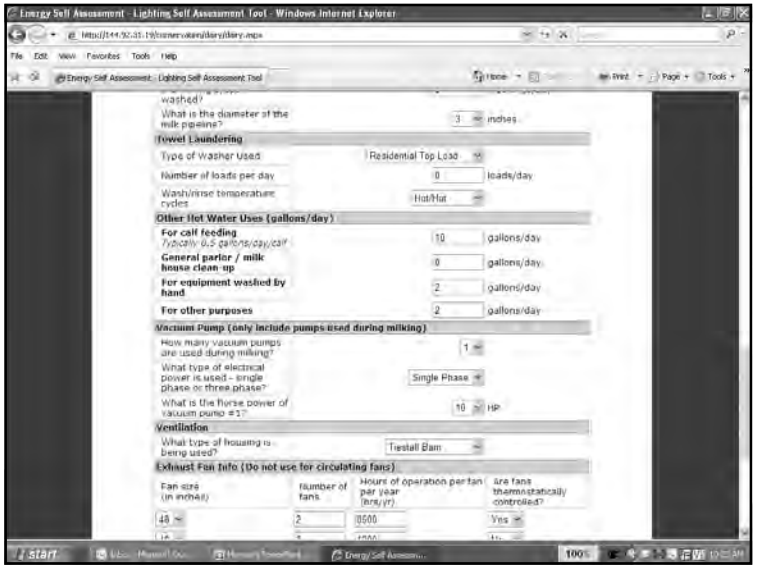
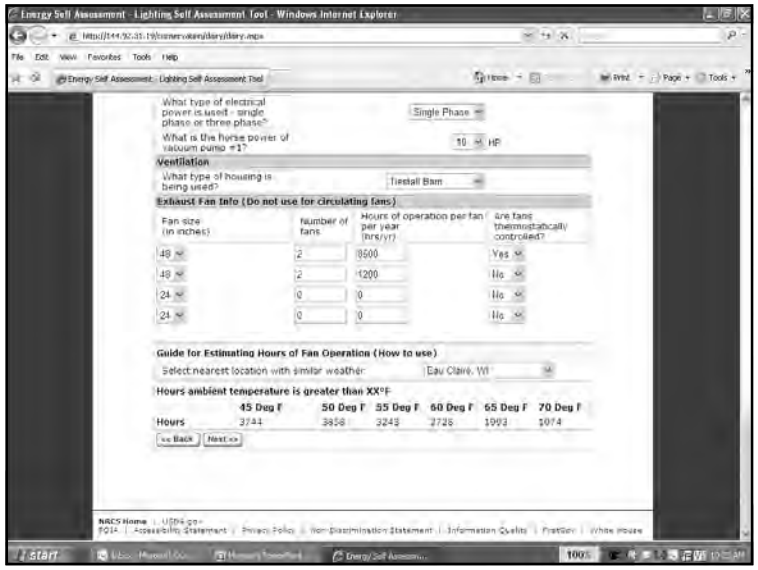
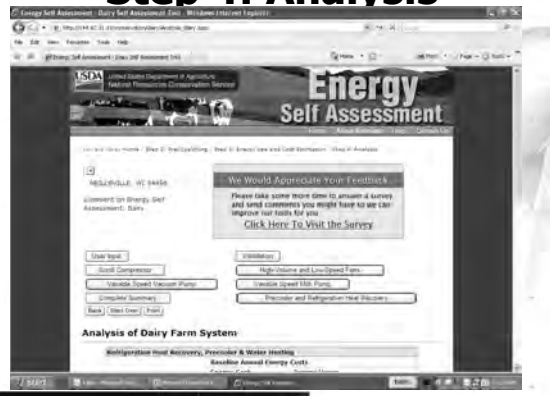




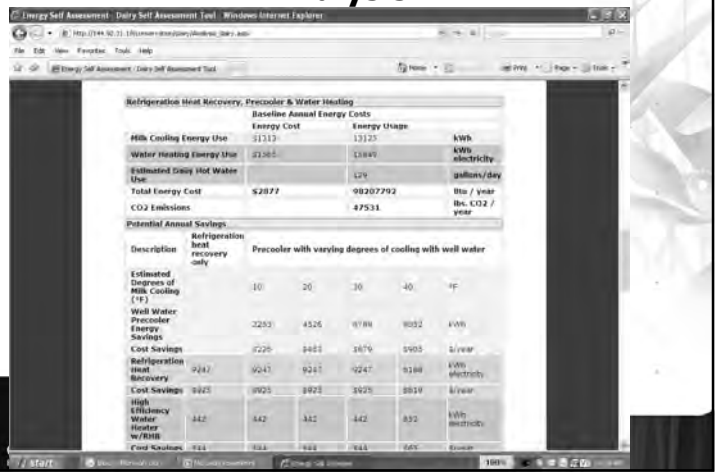




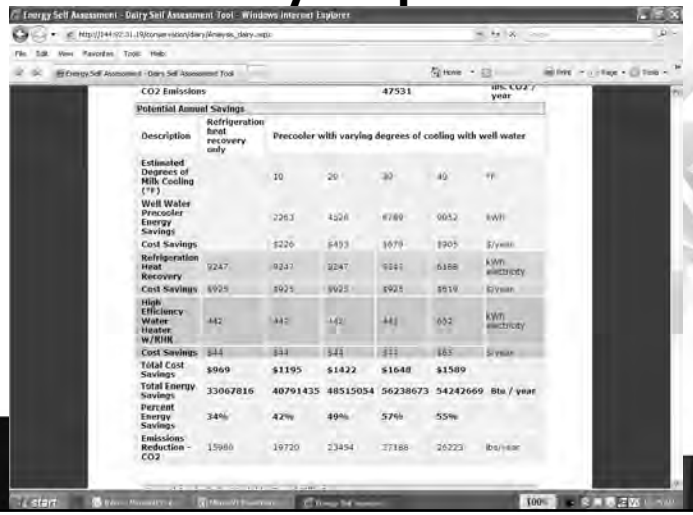
Step 4: Analysis



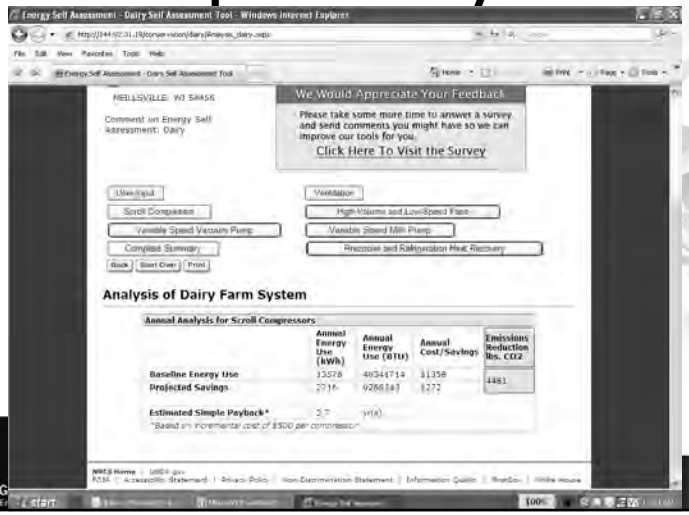
Water Heating, Plate Cooler and RHR Analysis



Summary Output Table



Compressor Analysis



Variable Speed Vacuum Pump Analysis

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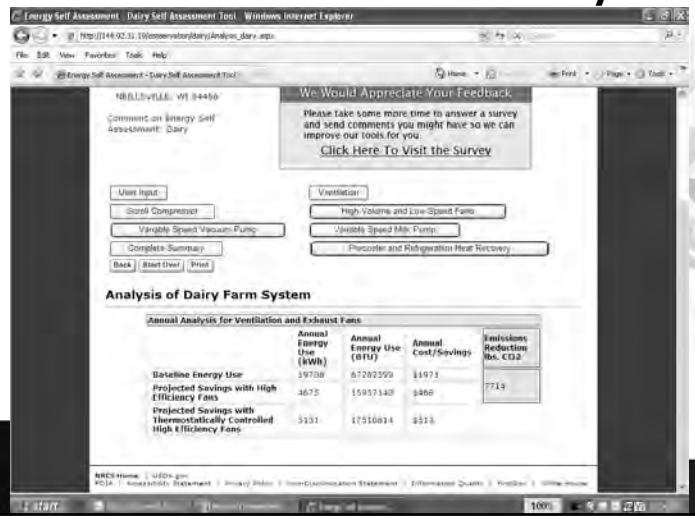
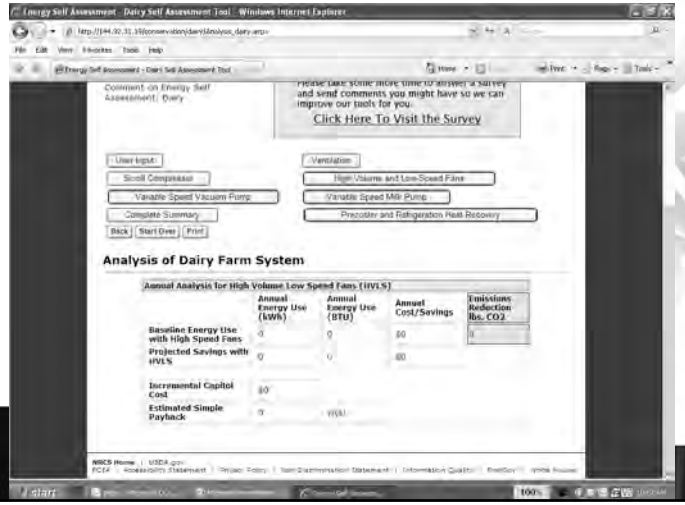
Ventilation and Exhaust Fan Analysis



High Volume Low Speed Fan Analysis



Variable Speed Milk Pump Analysis

Limitations of the On-line Assessment Tool

- **Limited inputs = limited and variable outputs**
- **Interactions between a plate cooler, refrigeration heat recovery, and water heater are difficult to represent in a table/quantatatively**
  - -Without better consultation, producers may be confused
- **Site specific constraints and limitations are difficult to enter**
  - -Example: The farm uses a larger or smaller than normal pipeline wash sink (greatest influence on hot water consumption)

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Limitations of the On-line Assessment Tool

- **Does not hierarchically arrange energy efficiency recommendations or display interaction constraints**
  - -Example: Based on output, the farm may consider putting in a VSD milk pump, however if a RHR and a PC are installed, a VSD milk pump will reduce net energy savings.
- **Does not save data**
  - -Once the producer disconnects, they must start over

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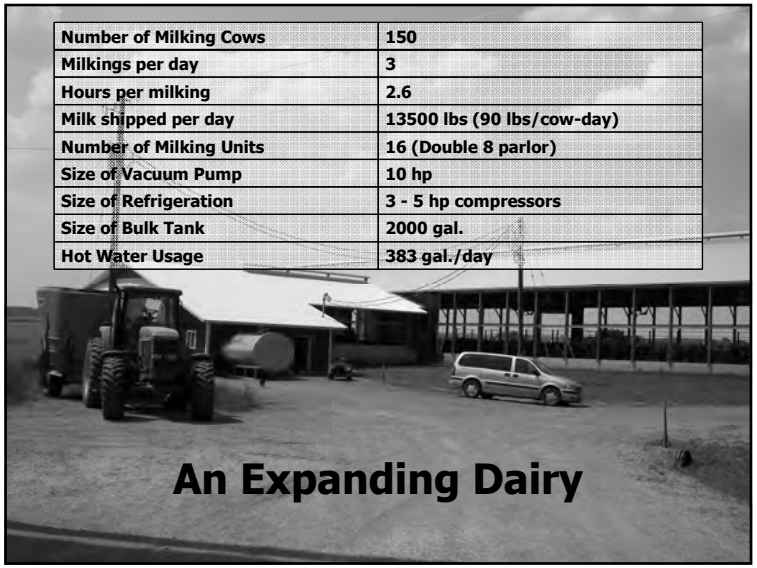
Number of Milking Cows	**150**
Milkings per day	**3**
Hours per milking	**2.6**
Milk shipped per day	**13500 lbs (90 lbs/cow-day)**
Number of Milking Units	**16 (Double 8 parlor)**
Size of Vacuum Pump	**10 hp**
Size of Refrigeration	**3 - 5 hp compressors**
Size of Bulk Tank	**2000 gal.**
Hot Water Usage	**383 gal./day**



An Expanding Dairy

Expansion Model - Prequalifying

On average, how many cows are you milking?	**150**
Do you have a refrigeration heat recovery unit?	**No**
Do you have a Well-Water cooled Precooler?	**Yes (small, single pass)**
What is the temperature of the milk entering the bulk tank?	**75 F**
Do you have a variable speed milk pump? (VSMP)	**No**
Are all your refrigeration compressors a scroll type compressor?	**No**
Do you clean the air-cooled condensor unit for the refrigeration system twice per year?	**Yes**
Do you have variable speed vacuum pump?	**No**
Do you have high volume low speed fans?	**No**

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Comparison of 80 and 150 Cow Dairies

Analysis Summary – RHR, PC, and Hot Water Heating

	80 Cows	150 Cows
Milk Cooling Use	13125 kwh	31,642 kwh
Daily Hot Water	129 gal.	383
Annual Million Btu	98.2 MBtu	266.2 MBtu
Total Energy Cost	$2877	$7798

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Comparison of 80 and 150 Cow Dairies

RHR, PC, and Water Heating Cont.

	80 Cows	150 Cows
PC Savings (Current)	**0 kwh**	**10,900 kwh**
PC-30 F cooling	6790 kwh	16,400 kwh
RHR Savings	9247 kwh	22,400 kwh
High Efficiency Water Heater	440 kwh	1650 kwh
Total Cost Savings	$1650	$3000

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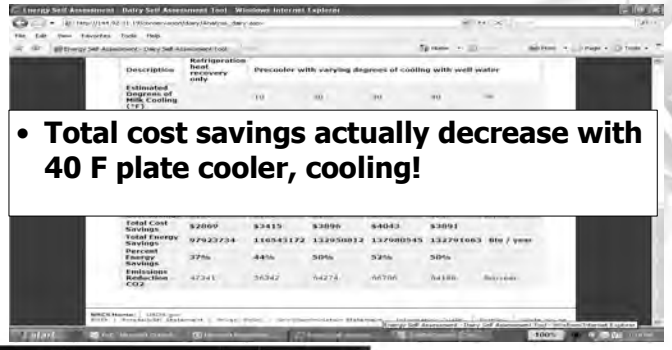
Note the net energy savings loss



- **Total cost savings actually decrease with 40 F plate cooler, cooling!**

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Comparison of 80 and 150 Cow Dairies

Annual Analysis for Scroll Compressors

	Annual Energy Use (kWh)	Annual Energy Use (BTU)	Annual Cost/ Savings	Emissions Reduction lbs. CO2
Baseline Energy Use				
80 Cows	13578	46341314	$1358	
150 Cows	20185	68891923	$2019	
Projected Savings				
80 Cows	2716	9268343	$272	4481
150 Cows	4037	13778385	$404	6661
Estimated Simple Payback*	3.7	Yr(s)		
	3.7	yr(s)		

Based on incremental cost of $500 per compressor

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Comparison of 80 and 150 Cow Dairies

Annual Analysis for Variable Speed Vacuum Pump

	Annual Energy Use (kWh)	Annual Energy Use (BTU)	Annual Cost/ Savings	Emissions Reduction lbs. CO2
Baseline Energy Use				
80 Cows	9882	33455728	$980	
150 Cows	22791	77784567	$2279	
Projected Savings				
80 Cows	3748	19618491	$578	9484
150 Cows	13874	47350805	$1387	22892
Estimated Capital Cost	$5650			
Estimated Simple Payback	9.5	yr(s)		
	4.1			
Return on Investment	10%			
	25%			

Note: Multiple pumps will require one variable speed controller per pump

A single vacuum pump may be large enough to operate the milking system. Check with your dairy equipment dealer.

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Comparison of 80 and 150 Cow Dairies

Annual Analysis for Ventilation and Exhaust Fans

	Annual Energy Use (kWh)	Annual Energy Use (BTU)	Annual Cost/ Savings	Emissions Reduction lbs. CO2
Baseline Energy Use				
80 Cows	19706	67262399	$1971	
150 Cows	61975	211521931	$6198	
Projected Savings				
80 Cows	4675	13957140	$486	7714
150 Cows	9720	33174360	$972	16038
Projected Savings Thermostatically Controlled	5131	17510814	$513	
	9720	33174360	$972	

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Comparison of 80 and 150 Cow Dairies

Annual Analysis for High Volume Low Speed Fans (HVLS)

	Annual Energy Use (kWh)	Annual Energy Use (BTU)	Annual Cost/ Savings	Emissions Reduction lbs. CO2
Baseline Energy Use with High Speed Fans	49950	170479350	$4995	62741
Projected Savings with HVLS	38025	129779325	$3802	
Incremental Capitol Cost	$8000			
Estimated Simple Payback	2.1	yr(s)		

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In Closing

- **The self assessment tool is an excellent starting point for Dairy Producers to find EE opportunities**
- **It will only take a farmer 20 to 30 minutes to conduct a full assessment**
- **The combination of tools available now provide a producer the opportunity to analyze all operations**
- **Please go to our website and evaluate the too**

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Does anyone want to join me at the pool?

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