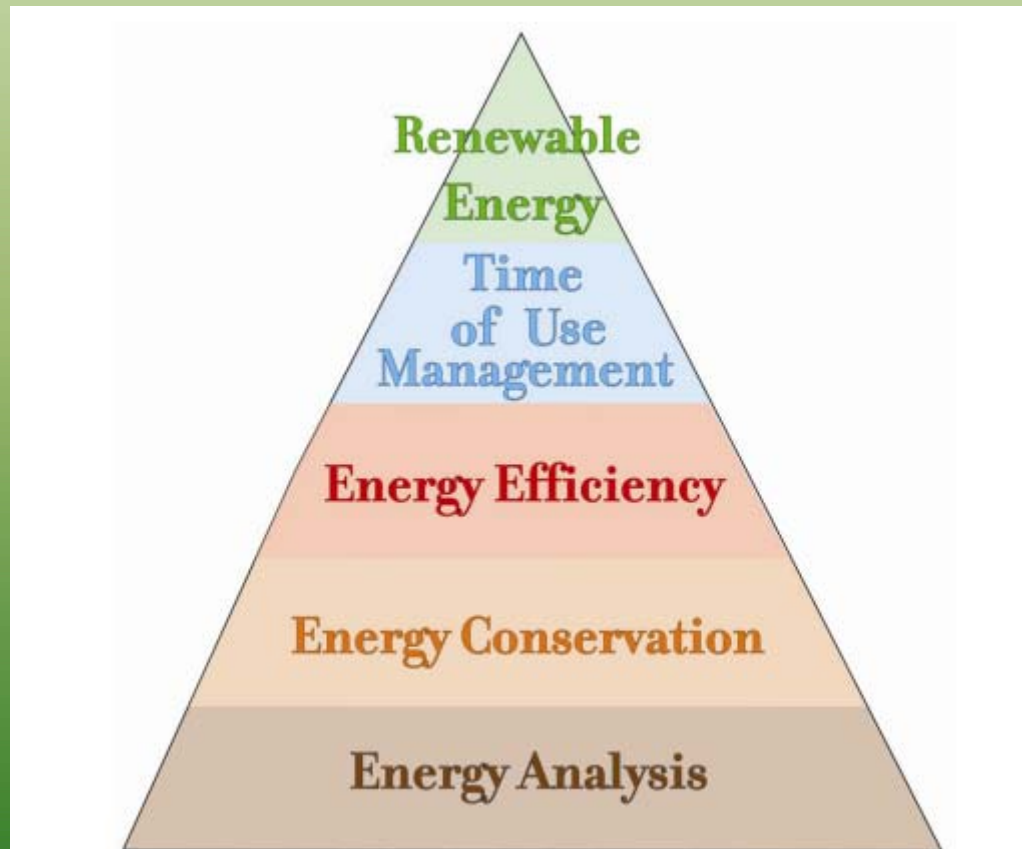


Powering Michigan Agriculture with Renewable Energy

MICHIGAN STATE
UNIVERSITY
EXTENSION

**ENERGY AUDIT
&
RENEWABLE ENERGY ASSESSMENT**

ENERGY PYRAMID



MICHIGAN STATE UNIVERSITY

- **MI Agricultural Energy Use Significant**
 - MI Dairy Farms Energy Use
 - >\$100/cow energy usage
 - 355,000 milking cows in MI
- **Training & Certification - MSU Biosystems & Agricultural Engineering Department**
- **Agricultural Emphasis**
- **MSU contributor to development of national standard**

MICHIGAN STATE UNIVERSITY

- **Other MSU departments, State agencies, utility companies & organizations involved**
- **Initially Dairy & Greenhouse Energy Auditors**
- **Energy Audit process applicable to others**
- **Process also applicable to Renewable Energy Assessments**

MSU Certified Farm Energy Auditors

- Variety of Energy Audits
- Dairy, Greenhouse, Grain Drying, Irrigation, Poultry, Swine & Rural Business
 - Rural Business – Pop < 50,000
- Renewable Energy Assessments
 - Wind, Solar, AD & Geothermal
 - Funding Applications
 - USDA, DOE, State of MI

Why do an Energy Audit or
Renewable Energy Assessment?

What are benefits?

What is the process?

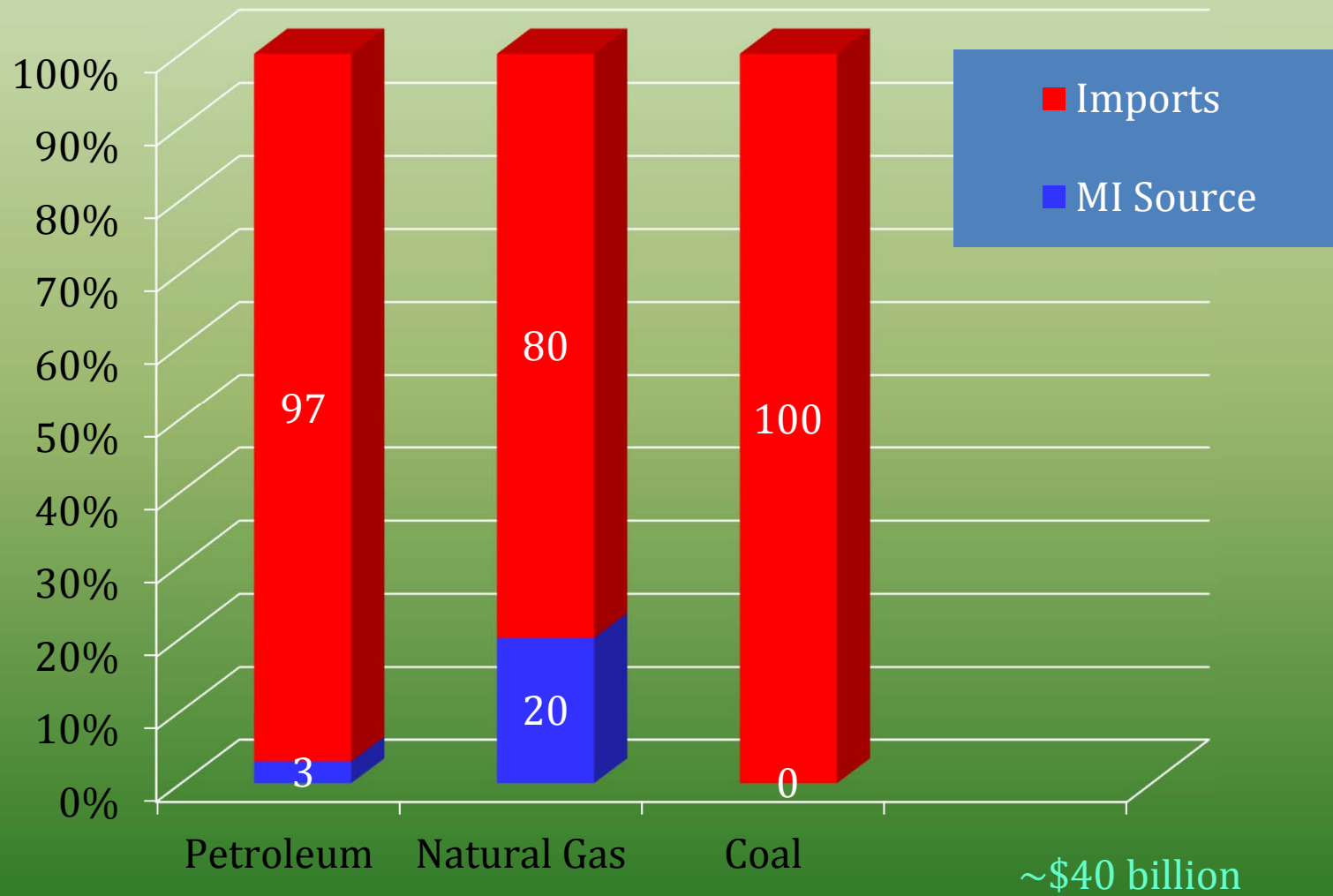
Why Do an Energy Audit?

- Energy Usage = \$
- Energy Cost increases inevitable
- Energy Savings are viable opportunities
- Energy saving improvements improve operations
- Long-term & environmental benefits
- It is the right thing to do

Why Do an Renewable Energy Assessment?

- Energy Usage = \$
- Energy Cost increases inevitable
- Renewable Energy Systems are viable
- Solar – 20kW system \$120k, now \$70k
- Long-term & environmental benefits
- It is the right thing to do

Michigan Energy Sources



What are Benefits?

- Documents current energy usage by components – establishes baseline
 - Based on historical utility records
 - Lighting, heating, motors, etc.
- Considers energy saving alternatives
- Or renewable energy opportunities

What are Energy Audit Benefits?

- Prioritizes list of energy improvements
- Potential Energy Savings
- Cost Estimates yield Payback Period
- Documents value of energy improvements already in place
- Qualifies improvements for funding incentives

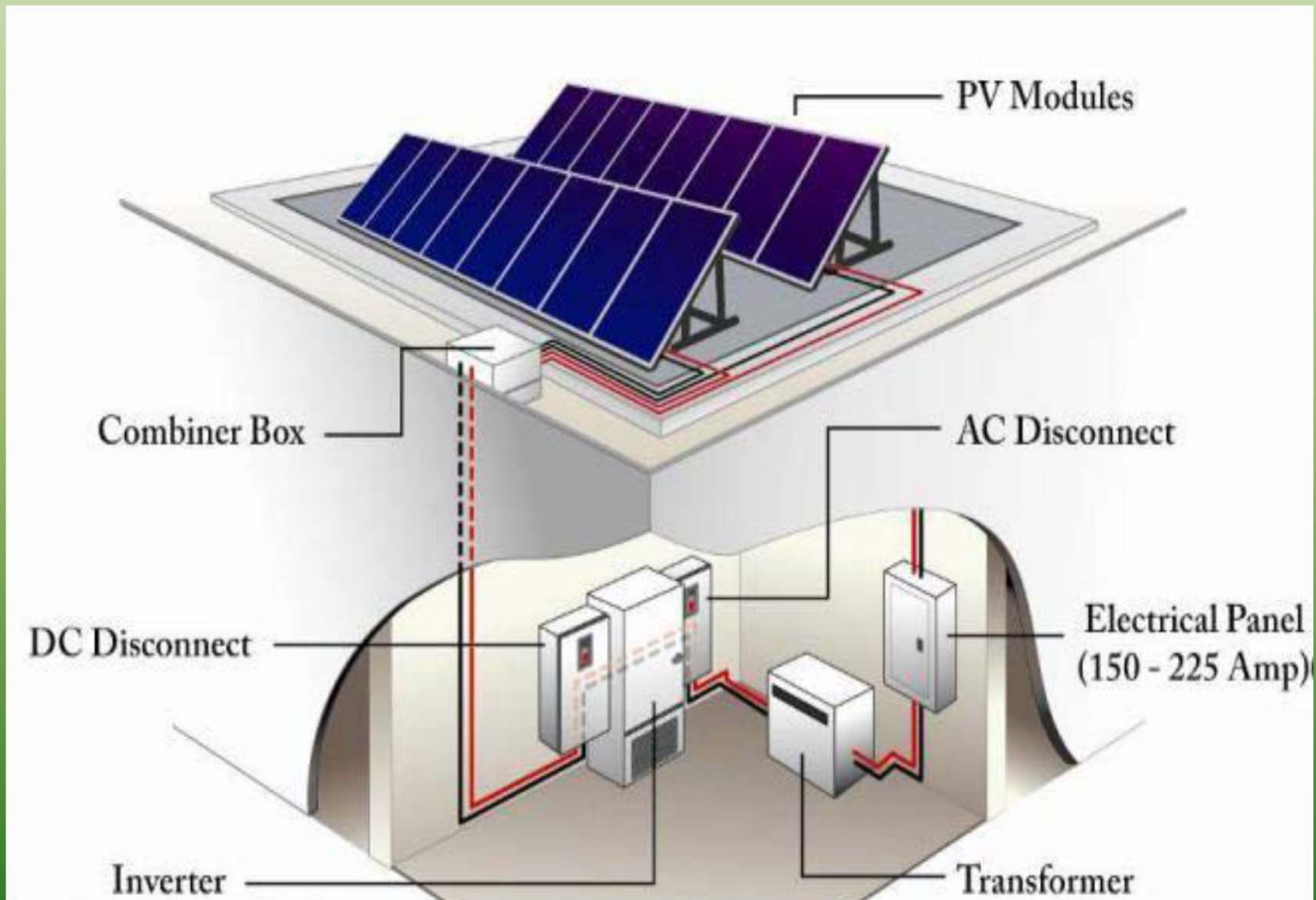
What are Energy Audit Benefits?

- Operational Improvements
 - Additional lighting
 - Long-day lighting
 - LED grow lights
 - Phase converters
 - Variable frequency drives
 - Sales tax exemption?

What are Renewable Energy Assessment Benefits?

- Establishes baseline utility usages
- Educational - provides information
- Energy potential based on supplier or on-line data sources
- Municipal & utility requirements
- Costs, revenue and funding sources

RENEWABLE ENERGY COMPONENTS



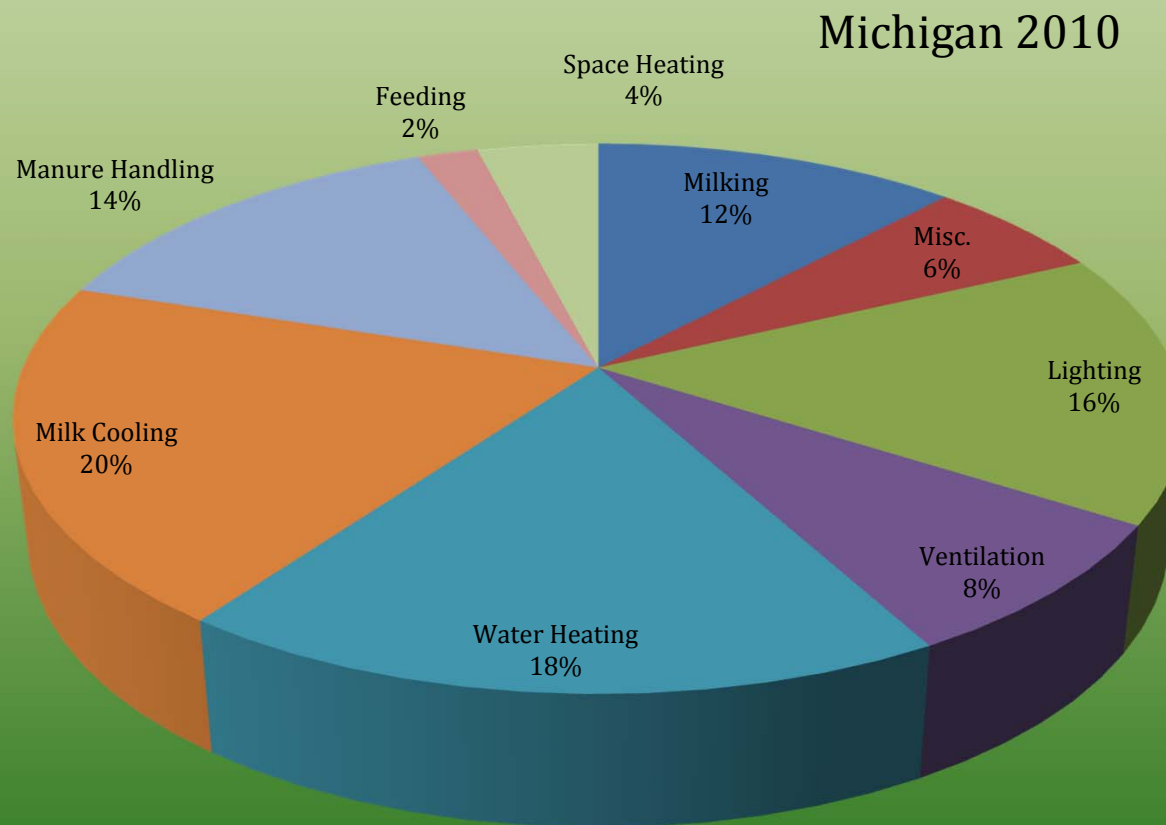
MSU Energy Audit Process

- Operational Understanding - Key
- On-site Review & Data Acquisition
- MSU – Technical Resources
- Energy Baseline & Inventory
- Management Tool for Energy Planning
- Potential Improvements & Costs

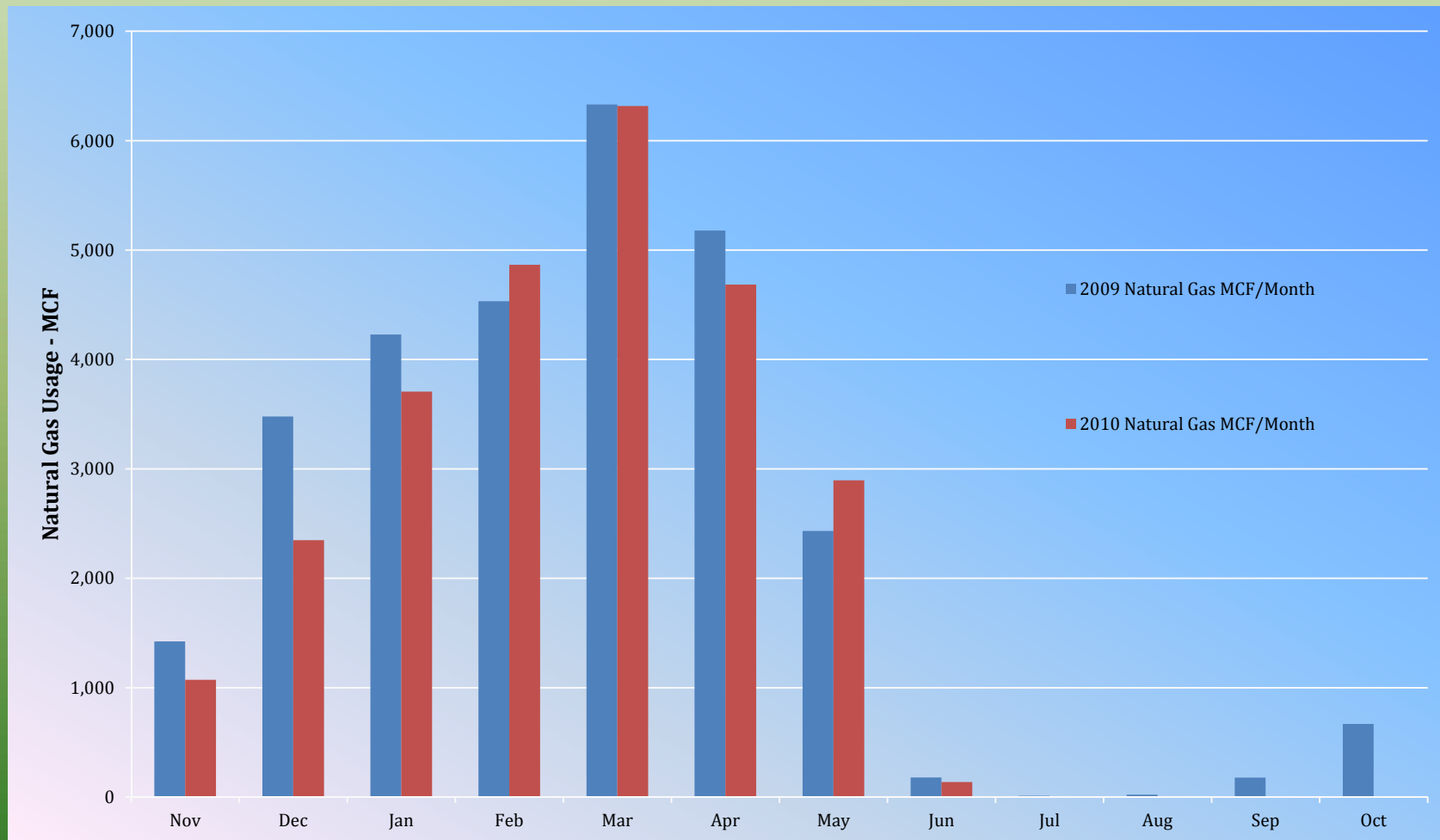
Quantifies Energy Usage

1. Heating Systems
2. Cooling Systems
3. Lighting
4. Water Heating
5. Irrigation
6. Ventilation
7. Any energy use, i.e. wood

Dairy Energy Usages



Energy Usage



Electricity Usage & Solar Potential



Certified Energy Audit

- Conforms to; ANSI/ASABE S612, July 2009
- ANSI – American National Standards Institute
- ASABE – American Society of Agricultural & Biological Engineers
- Tier II Energy Audit
- USDA Acceptance – Nationally
- Utility Company Acceptance

Certified Energy Audit

- Energy Efficiency Recommendations
 - Quantifies Energy Savings
 - Provides Cost Estimates
 - Computes Payback Period

- **10% to 40% Energy Savings**

Defines Energy Alternatives

- Heating equipment options
- Cooling equipment options
- Lighting improvements
- Water heating options
- Irrigation pumps, motors & system upgrades
- Ventilation equipment
- Energy curtains
- Weatherization
- Grain drying equipment

Energy Conservation Measures

Electricity Energy Source	Savings/Year			Cost to Replace	Payback (Years)
	Energy (kWh)	Energy (MMBtu)	Revenue (\$)		
Lighting	124,606	425.2	\$17,694	\$45,502	2.6
Occupancy Sensors	30,358	103.6	\$4,311	\$4,350	1.0
Vending Machines	4,205	14.3	\$597	\$200	0.3
New Slurry Pumps	684,093	2,334.1	\$96,947	\$164,901	1.7
Parlor Vacuum Pumps VFD	98,856	337.3	\$13,840	\$6,699	0.5
Special Needs Vacuum Pumps VFD	3,684	12.6	\$523	\$5,586	10.7
Calf Barn & Old Milk Hse Water Heaters	66,334	226.3	\$4,660	\$4,500	1.0
Liquid Propane Energy Source	Savings/Year			Cost to Replace	Payback (Years)
	Energy (Gallons)	Energy (MMBtu)	Revenue (\$)		
New Pre-Heaters	2,110	193.0	\$4,220	\$11,441	2.7
Parlor Tankless Water Heater	505	46.2	\$1,009	\$4,500	4.5
Calf Barn & Old Milk New Water Htrs	(2,380)	(217.7)	(\$4,759)		
Hot Water Pipe Insulation	1,024	93.7	\$2,048	\$159	0.1
Energy Star Washing Machine	110	10.1	\$221	\$900	4.1
Totals - Electricity & Liquid Propane		3,578.7	\$141,311	\$248,739	1.8

Energy Conservation Measures

Energy Conservation Measures					
Natural Gas Systems	Natural Gas Usage			Savings/Year	
	Cost (\$/yr)	(MCF/Year)	(MMBtu/Yr)	Energy (MMBtu)	Revenue (\$)
Big House - Existing No Energy Curtains	\$29,542	3,555	3,555		
Big House - With Energy Curtains	\$17,268	2,078	2,078	1477.0	\$12,274
Quonsets 2,3 & 4 Existing Unit Heaters	\$7,087	853	853		
Quonsets 2, 3 & 4 New Unit Heaters	\$5,837	702	702	150.4	\$1,250
Quonsets 2,3 & 4 Existing Conditions	\$7,087	853	853		
Quonsets 2,3 & 4 With Weatherization	\$6,535	786	786	66.4	\$552
Electricity System	Electricity			Savings/Year	
	Cost (\$/yr)	(kWh/yr)	(MMBtu/Yr)	Energy (MMBtu)	Revenue (\$)
Existing Lighting	\$1,191	8,952	30.5		
Proposed Lighting	\$311	2,337	8.0	22.6	\$880
Totals - Natural Gas & Electricity Systems				1,716.4	\$14,956

AC Energy & Cost Savings

Station Identification		Results			
Cell ID:	0245365	Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
State:	Michigan	1	2.18	1070	146.59
Latitude:	42.8 ° N	2	3.15	1393	190.84
Longitude:	86.1 ° W	3	4.38	2104	288.25
PV System Specifications		4	5.06	2258	309.35
DC Rating:	20.0 kW	5	5.50	2445	334.96
DC to AC Derate Factor:	0.770	6	5.65	2368	324.42
AC Rating:	15.4 kW	7	5.63	2388	327.16
Array Type:	Fixed Tilt	8	5.36	2311	316.61
Array Tilt:	42.8 °	9	4.92	2097	287.29
Array Azimuth:	180.0 °	10	3.62	1631	223.45
Energy Specifications		11	2.07	915	125.35
Cost of Electricity:	13.7 ¢/kWh	12	1.64	782	107.13
		Year	4.10	21761	2981.26

Qualifies for Funding \$

- Grants, Low-Interest Loans
- USDA Rural Development
 - Rural Energy for America Program (REAP)
 - Funding Through FY 2018
 - Competitive Application Process
- USDA Natural Resources Conservation Services (NRCS)
- MEDC (MI Economic Dev. Corp.)
- Michigan Saves

Qualifies for Funding \$

- Utility Company Incentives
 - Consumers Energy
 - DTE Energy
 - Other utility companies
- Federal & State Incentives
 - Tax Credits
 - Accelerated Depreciation

How is an Energy Audit or Renewable Assessment Completed?

- Contact MSU or Certified Energy Auditor
- Schedule On-site Review Date
- Information List Provided in Advance
- Site Review with Owner/Operator – 3 to 4 Hours
- Acquire Site-specific Information, Energy Data & Understanding of Operation
- Proposed Improvements Information

How is an Energy Audit Completed?

- Minimum Fee
- Reimbursement from some Utilities
- Energy Audit Review with Owner
- Owner Acknowledgement – MSU Program Reimburses Certified Energy Auditor

MSU Contact

- **Aluel S. Go** - Biosystems & Agricultural Engineering Michigan State University
- East Lansing, MI 48824-1323
- (517) 214-6128 (Aluel Go)
- MSU Farm Energy website:
maec.msu.edu/farmenergy/

QUESTIONS?

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