Farm Energy IQ

Farm Energy Audits

Tom Manning, New Jersey Agricultural Experiment Station

NORTHEAST SARE
Sustainable Agriculture Research & Education

Agricultural Energy Audit - Definition

"…to determine and document current energy usage, and to provide an estimation of energy savings from alternatives in the cultivation, protection, harvesting, processing and storage of agricultural commodities and in the feeding, housing and processing of farm animals and animal products."

Source: American Society of Agricultural and Biological Engineers Standard S612

Questions an Energy Audit Should Answer

- How much energy does the operation use?
- What are the major uses of energy?
- Why?
- What steps will reduce energy consumption?

Conducting Energy Audits

- NRCS certifies Technical Service Providers (TSPs) to conduct agricultural audits.
- NRCS provides funding for agricultural audits based on a fee structure related to size and type of operation
- ASABE S612 discusses qualifications for audit professionals
- Not only is agriculture different from commercial and industrial operations, but different sectors within agriculture use energy in very different ways

Components of an Audit

- Compilation of utility bills
- Visual inspection
- Characterization of equipment and systems
- Interviews
- On-site measurement and testing
  - Blower door
  - Power measurement
  - IR imaging
  - Hours of operation - lights and motors
- Simulation modeling

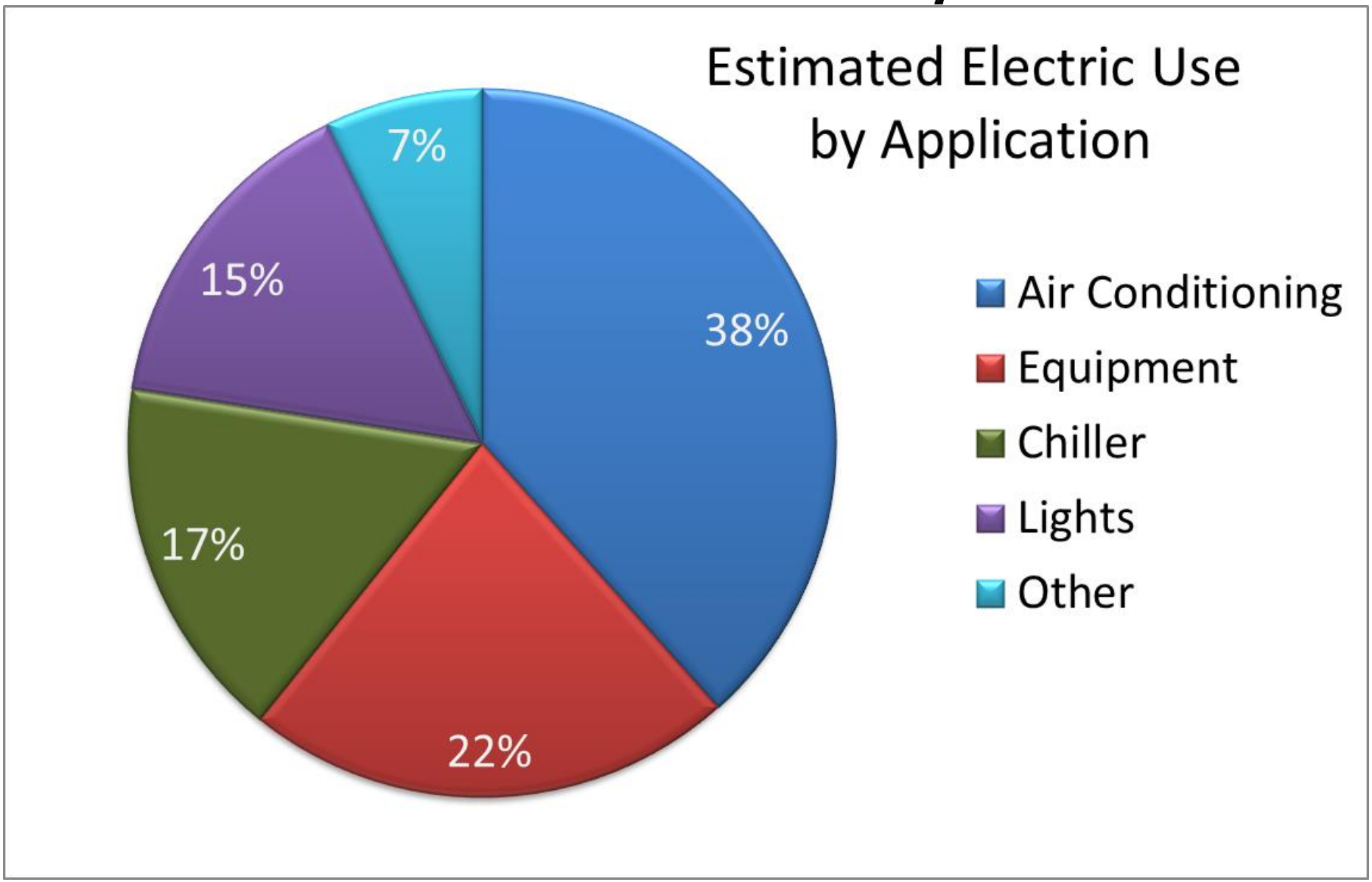
What to Expect from an Audit

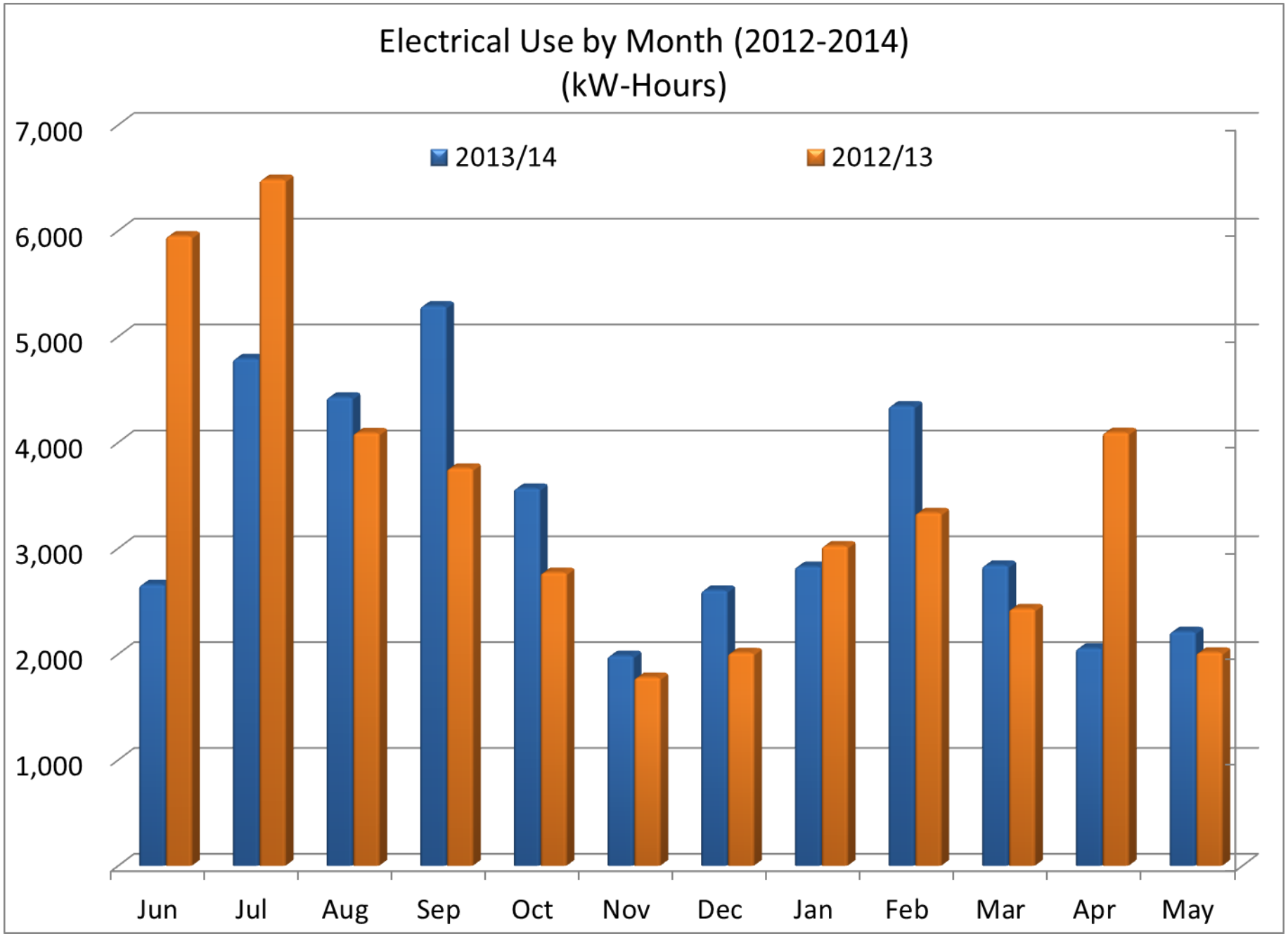
- Facility summary and status
- Summary of use by application or location
- Characterization of equipment and systems
- Identification of trends
- Interviews
- Summary of energy use by energy resource
- Summary of energy costs
- Identification of peak demands
- Compilation of energy use per unit
- Inventory of equipment and systems
- Energy conservation opportunities

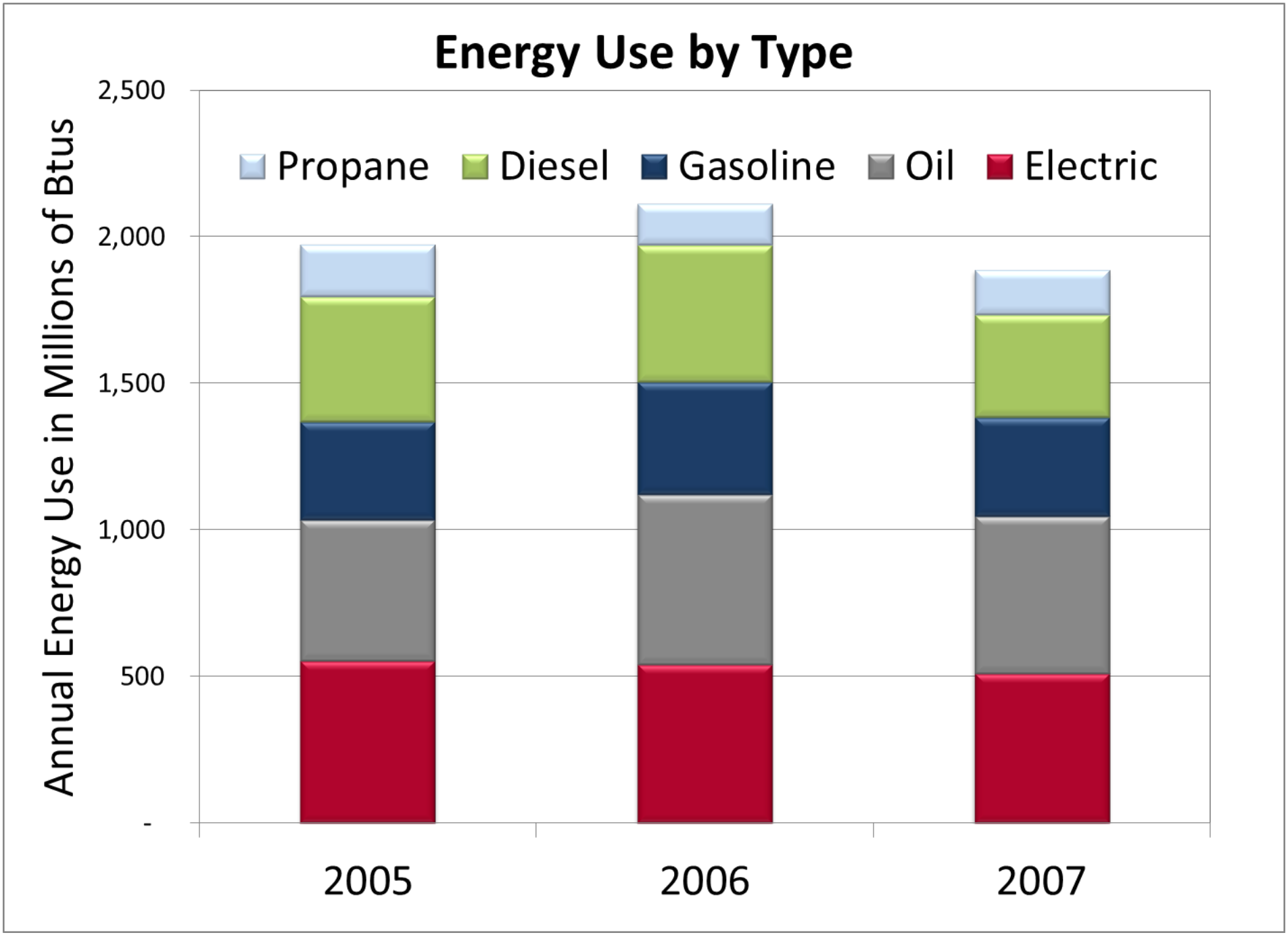
Facility Summary and Status

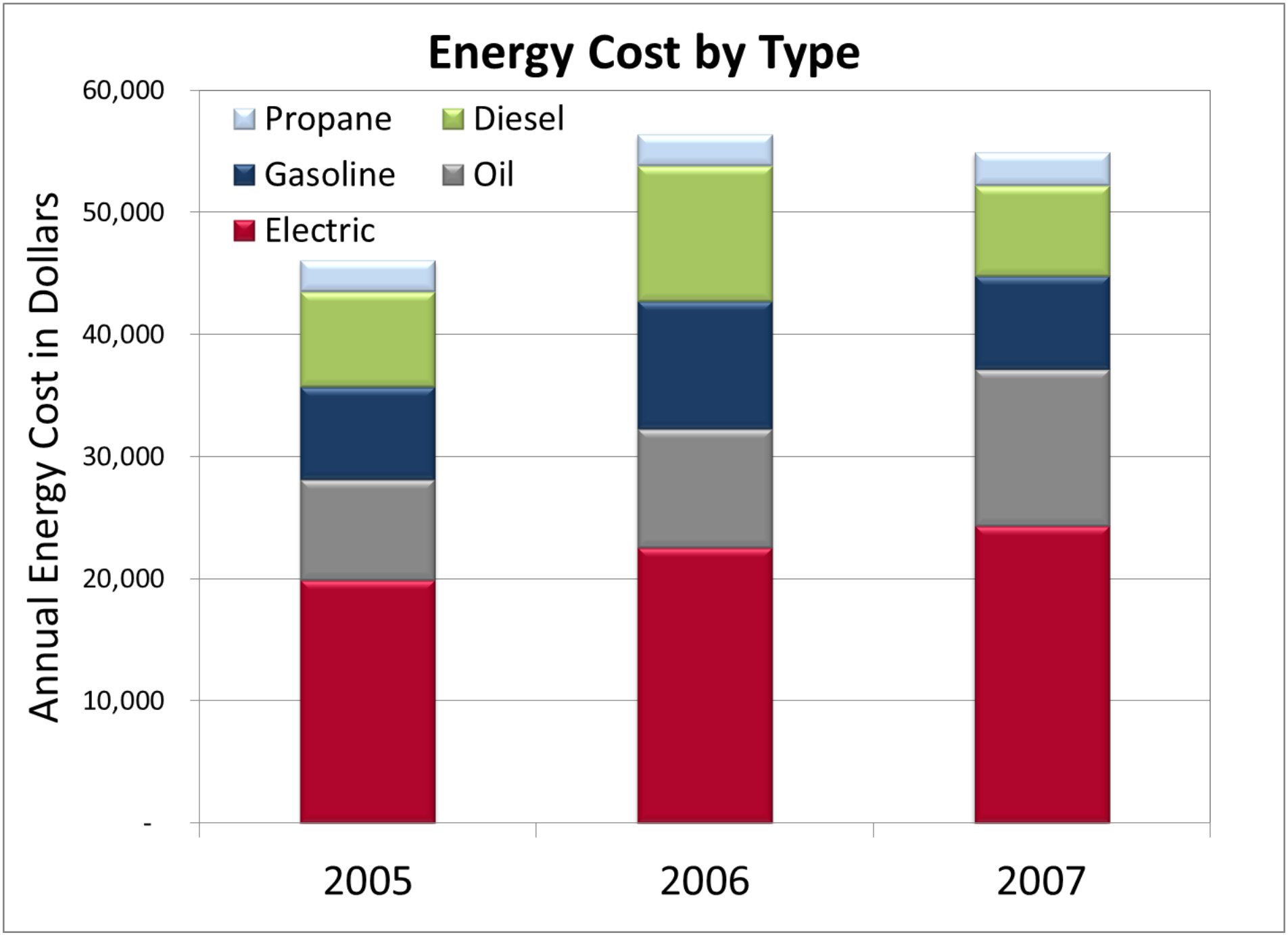
- Overview of the operation
- Building summary
  - Area
  - Use
  - Construction details
- Infrastructure summary
  - Electric supply
  - Fuels
  - Major systems

Breakdown of Electricity Use




Electrical Use by Month (2012-2014)
(kW-Hours)
2013/14
2012/13
7,000
6,000
5,000
4,000
3,000
2,000
1,000
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May


Energy Use by Type
Annual Energy Use in Millions of Btus
2,500
2,000
1,500
1,000
500
-
Propane
Diesel
Gasoline
Oil
Electric
2005
2006
2007


Energy Cost by Type
Propane
Diesel
Gasoline
Oil
Electric
Annual Energy Cost in Dollars
60,000
50,000
40,000
30,000
20,000
10,000
-
2005
2006
2007

Electric Bills - Storage Barn Area: 4,800 ft^2

Meter # G123456789 (acct 0000000)

Billing Period	Amount Billed	kW-hr	KVA	¢/kW-hr	kW-hr per ft^2
Dec 15 to Jan 16	$170.92	1,010	5.1	16.9	0.21
Jan 17 to Feb 15	$176.80	1,059	4.9	16.7	0.22
Feb 16 to Mar 19	$133.65	776	4.7	17.2	0.16
Mar 20 to Apr 18	$127.23	763	4.5	16.7	0.16
Apr 19 to May 17	$57.21	332	2.6	17.2	0.07
May 18 to Jun 18	$218.14	1,105	5.1	19.7	0.23
Jun 19 to Jul 18	$169.86	782	7.9	**21.7**	0.16
July 19 to Aug 16	**$510.64**	2,966	6.9	17.2	0.62
Aug 17 to Sep 13	$457.65	2,639	7.8	17.3	0.55
Sept 14 to Oct 12	$445.43	**3,167**	**8.0**	14.1	0.66
Oct 13 to Nov 13	$189.80	1,086	7.8	17.5	0.23
Total:	**$2,657.33**	**15,685**			**3.27**
Maximum:	**$510.64**	**3,167**	**8.0**	**21.7**	**0.66**
Minimum:	**$57.21**	**332**	**2.6**	**14.1**	**0.07**
Average:	**$241.58**	**1,426**	**5.9**	**16.9**	**0.30**

Equipment Summary

- Equipment summary by location
  - Motors, refrigeration equipment, fans, boilers and furnaces, fans, pumps, other
  - Equipment capacity, efficiency, and runtime
- Lighting summary by location
  - Type
  - Quantities
  - Hours of use

Tabulation of Large Equipment

Location		Equipment	Manufacturer	Model	Motor										
					Manufacturer	Model	HP	kW	RPM	V	A	Ph	Hz	Eff.	P.F.
C	Winery	Pump	Liverani			EP-MINOR	2	1.5	773	220	7.4	3	60		
C	Winery	VFD Pump					1.2	0.9		220	4.38	3	60		
C	Winery	Pump	Liverani		Carpanelli	M112A4	5.5	4.0	1740	220	15.2	3	60		77%
C	Winery	Chiller Pump					2	1.5							
C	Winery	Compressor	Ingersoll Rand	2475N			7.5	5.5		230/460		3	60		
C	Winery	Crusher		ALPHA 80	Baldor	EM3615T	5	3.7	1750	208/230	13.9/13.4		60	90%	78%
C	Winery	Press	Della Toffola		Italmec Motori	IT100	3.6	2.6	1700	220	10	3	60		
					Rossi Motoriduttori	HFV903	1.5	1.1	1420	230	5	3	50		75%
C	Winery	Steam Generator	Electro-Steam	LG-20			2	1.5		208	5.6	3	60		

Heating Equipment Summary

Location / Area Description	# of Heaters	Type of Heater	Btu/hr Output	Make / Model	Fuel Type
Propane Boiler	1	Gas-Fired Boiler	300,000	Slant Fin GG-375	Propane
Outdoor Furnace	1	Wood-Fired Boiler		Big Eliminator 60	Wood
Greenhouse #1	12	Forced Hot Air	180,000	Modine	Propane
Greenhouse #1	2	Forced Hot Air	300,000	Reznor UPAP300	Wood
Greenhouse #1	6	Forced Hot Air	89,000	Reznor WS96/120	Wood
Greenhouse #2	3	Forced Hot Air	180,000	Modine	Propane

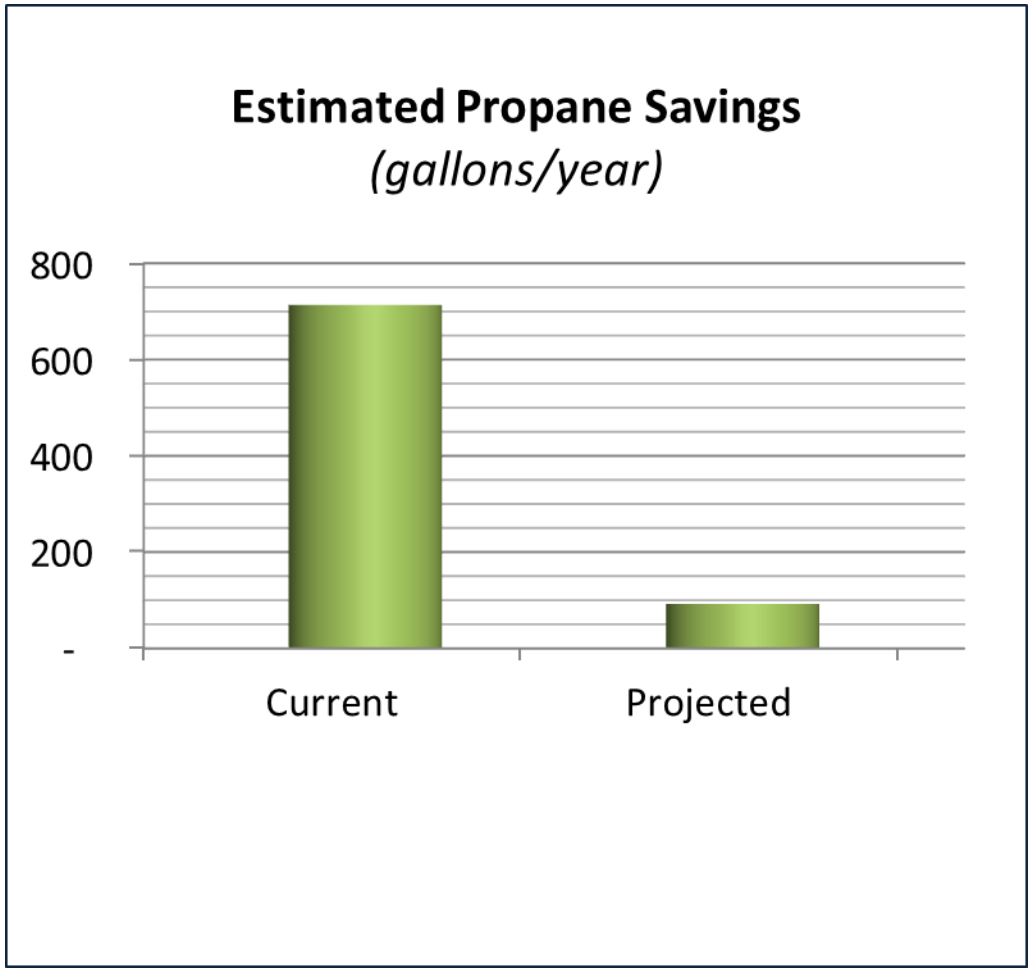
Lighting Summary

LOCATION	Hrs.	CFL/LED				Incand.				Other					Linear Fluorescent					
		Watts	Qty.	kWh	Total	Watts	Qty.	kWh	Total	Watts	Qty.	kWh	Total	Type	Watts	#	Bulbs	Type	kWh	Total
Tasting Room					**580**				**1,672**					**190**						
Mezzanine	7	17	13	565		56	2	286		15	1	131		Exit						
Bar	7	10	10	256		60	17	2,608		15	2	263		Exit						
	7			-		60	9	1,381		120	1	88	120	Rope						
Bathroom	1	13	3	14						25	1	9	25	Fan						
Closet	0	100	1	-															-	
Office	2	30	4	88															-	
Lab/Office																			-	**820**
Lab	9														105	2	2	T12	1,381	
Office	9														50	4	2	T8	1,315	
Winery	10									15	2	263		Exit	105	5	2	T12	3,835	**1,050**
Exterior	12					150	3	164	**450**	450	1	164	450	HID						**-**
TOTALS:				**923**	**580**			**4,439**	**2,122**			**919**	**595**						**6,531**	**1,870**

Energy Conservation Opportunities

Location	Recommended Measure	Electric Savings (kWh)	Propane Savings (Gal)	Installed Cost	Energy Cost Savings	Payback (years)
Tasting Room	Replace incandescent bulbs with LEDs	3,403		$650	$851	0.8
Lab	Replace T-12 fluorescent fixtures with T-8 fixtures	197		$200	$70	2.9
Winery	Insulate Walls	2,069	828	$13,600	$3,748	3.6
Winery	Replace T-12 fluorescent fixtures with T-8 fixtures	548		$500	$137	3.7
Small Office	Replace refrigerator	404		$800	$101	7.9
Winery	Replace chiller	8,176		$20,000	$2,044	9.8
Lab	Replace hot water heater with 90% efficient heater		52	$2,500	$204	12.3

Current vs. Proposed Propane Use



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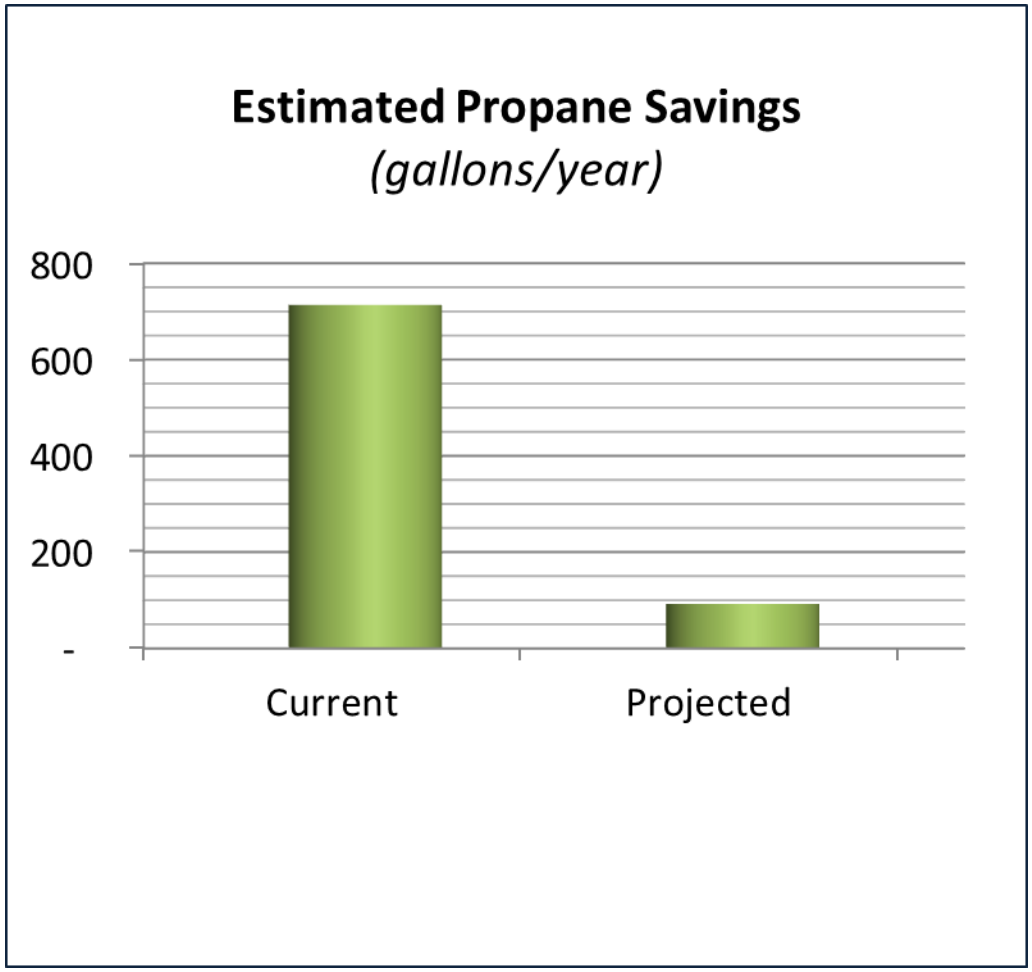

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Questions?