

LAC DU FLAMBEAU TRIBAL ENERGY PROGRAM CONSERVATION AND RENEWABLE ENERGY PLANNING



Bryan Hoover
**Lac du Flambeau Band of Lake Superior
Chippewa Indians**
November 20, 2008

Brief Summary of Tribe

- Located in North Central Wisconsin.
- The reservation is 144 square miles or 86,000 acres.
- Population 3,400 Tribal Members.
- Checkerboard Reservation



Tribal Natural Resources

- Area- 86,630 acres or 144 square miles
- Land Ownership- 66.8%-Tribal land
33.2%-Fee land
- 260 Lakes
- 71 Miles of Streams
- 24,000 Acres of Wetlands
- 41,733 Acres of Forests

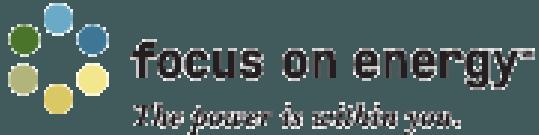
Lac du Flambeau Reservation



Project Objectives

- Develop and evaluate baseline data on energy consumption, costs, trends and future impacts.
- Assess Potential for Renewable Energy:
 - Wind , Solar, Geothermal, Biomass, Hydro
- Identify options for energy conservation and retrofitting existing building with renewable energy systems.
- Develop a Strategic Energy Plan.

Project Partners



Kaurich Energy Services, LLC



TRIBAL ENERGY LOADS

- Historical Records Release from Utility
- Match Accounts with Tribal Facilities
- Compile Data Into a Report Identifying:
 - Tribal Energy Consumption and Cost
 - Trends
 - Future Impacts

TRIBAL ENERGY LOADS

	Electricity (kWh)	Electricity Expenses (dollars)	Propane (gallons)	Propane Expenses (dollars)
2003	10,758,223	\$564,603	274,292	\$216,948
2004	11,050,869	\$638,091	388,589	\$380,383
2005	10,297,054	\$640,596	292,825	\$365,961
2006	11,634,594	\$733,593	397,817	\$551,449
2007	11,870,059	\$826,026	407,476	\$594,014

Table 1. Annual Electricity and Propane Consumption and Cost, 2003 to 2007

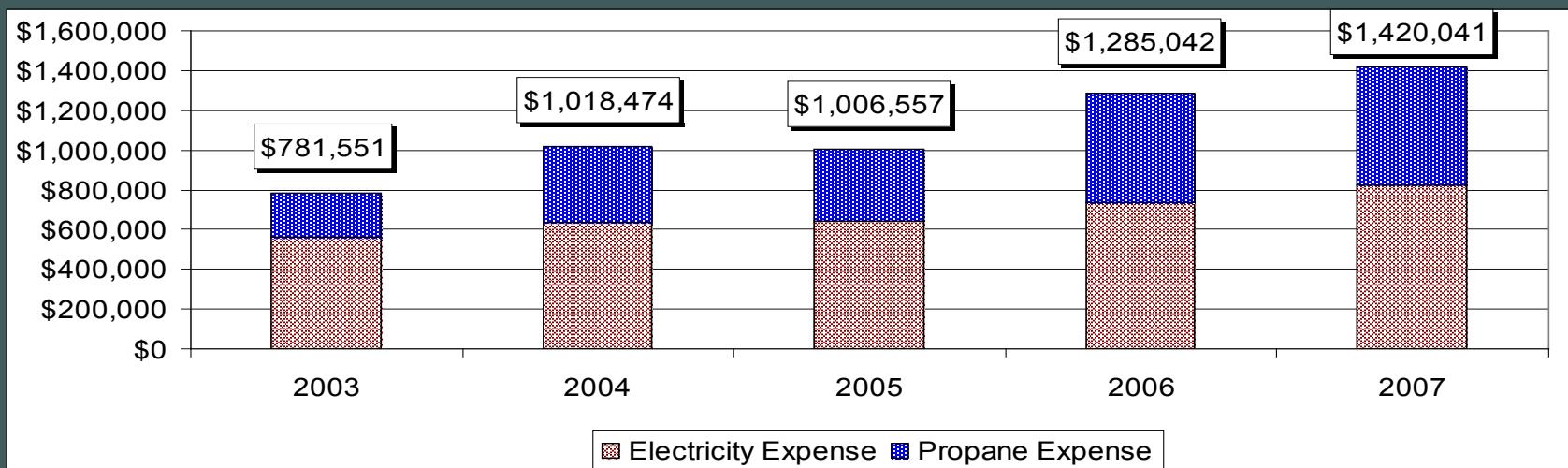


Figure 1. Annual Energy Expense, 2003 to 2007

TRIBAL ENERGY LOADS

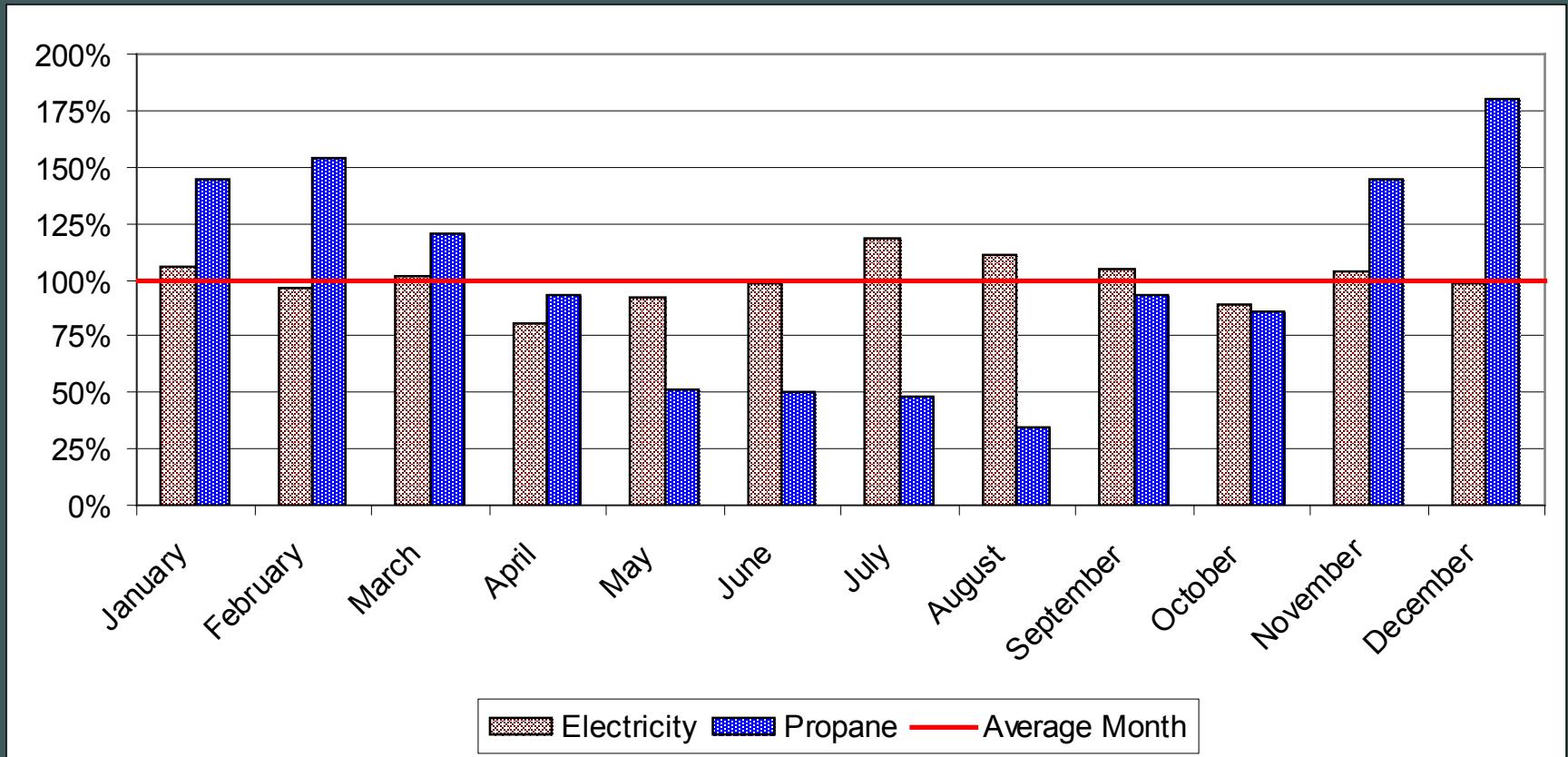
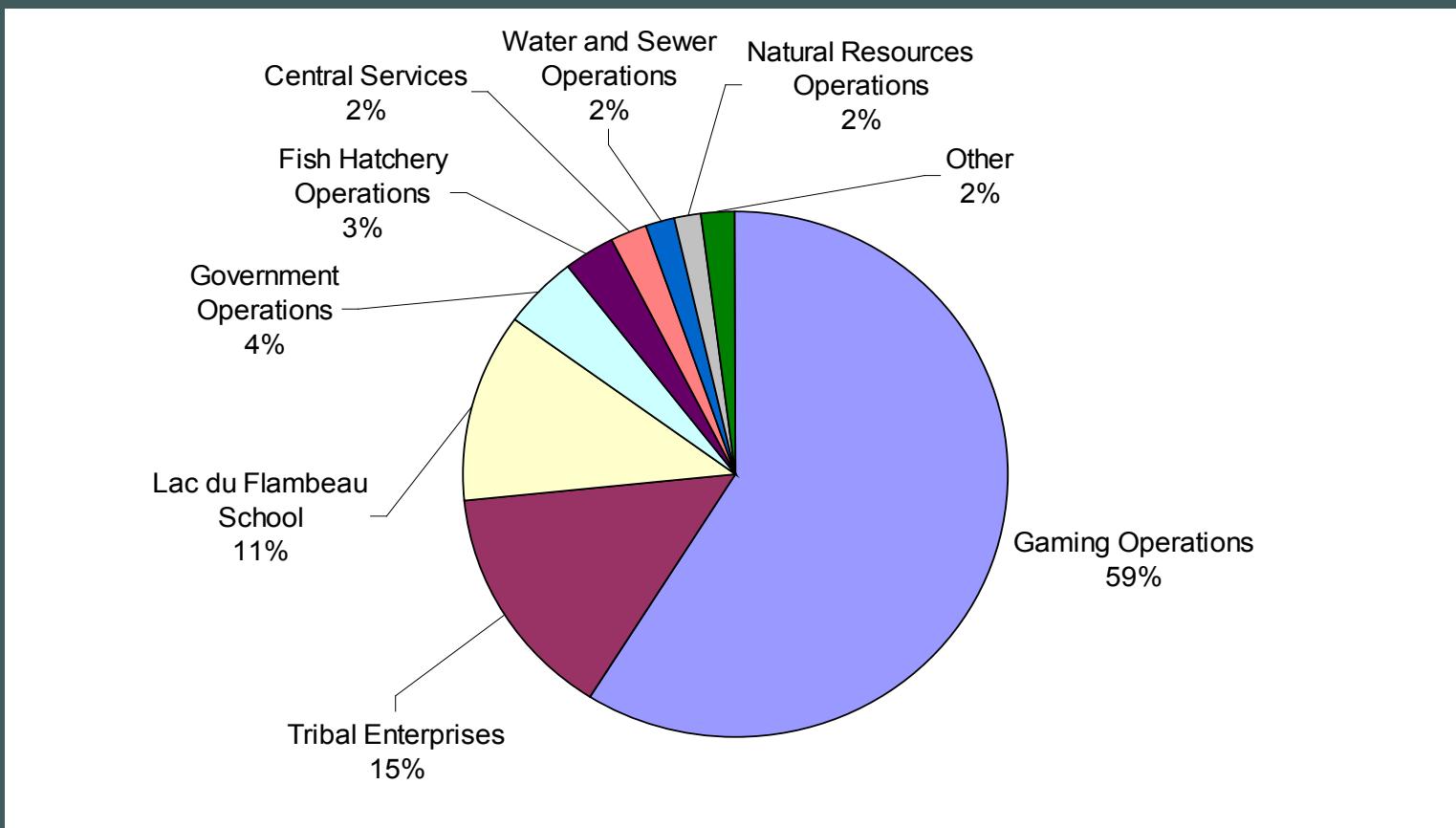


Figure 4. Normalized Energy Use by Month, 2003 to 2007

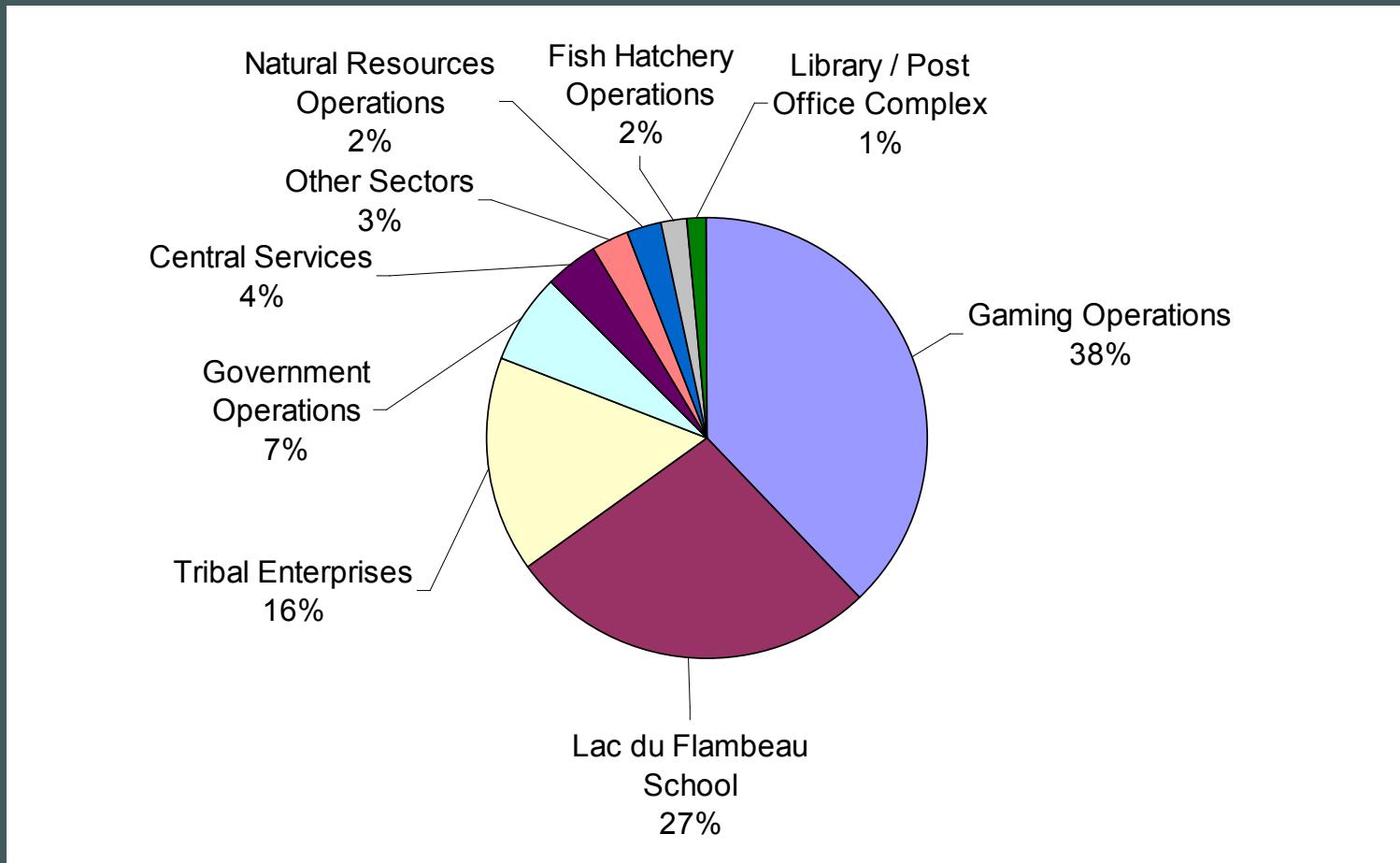
TRIBAL ENERGY LOADS

Figure 9. Electricity Consumption by Sector



TRIBAL ENERGY LOADS

Figure 10. Propane Consumption by Sector



TRIBAL ENERGY LOADS

Table 2. Aggregate Electricity Rate

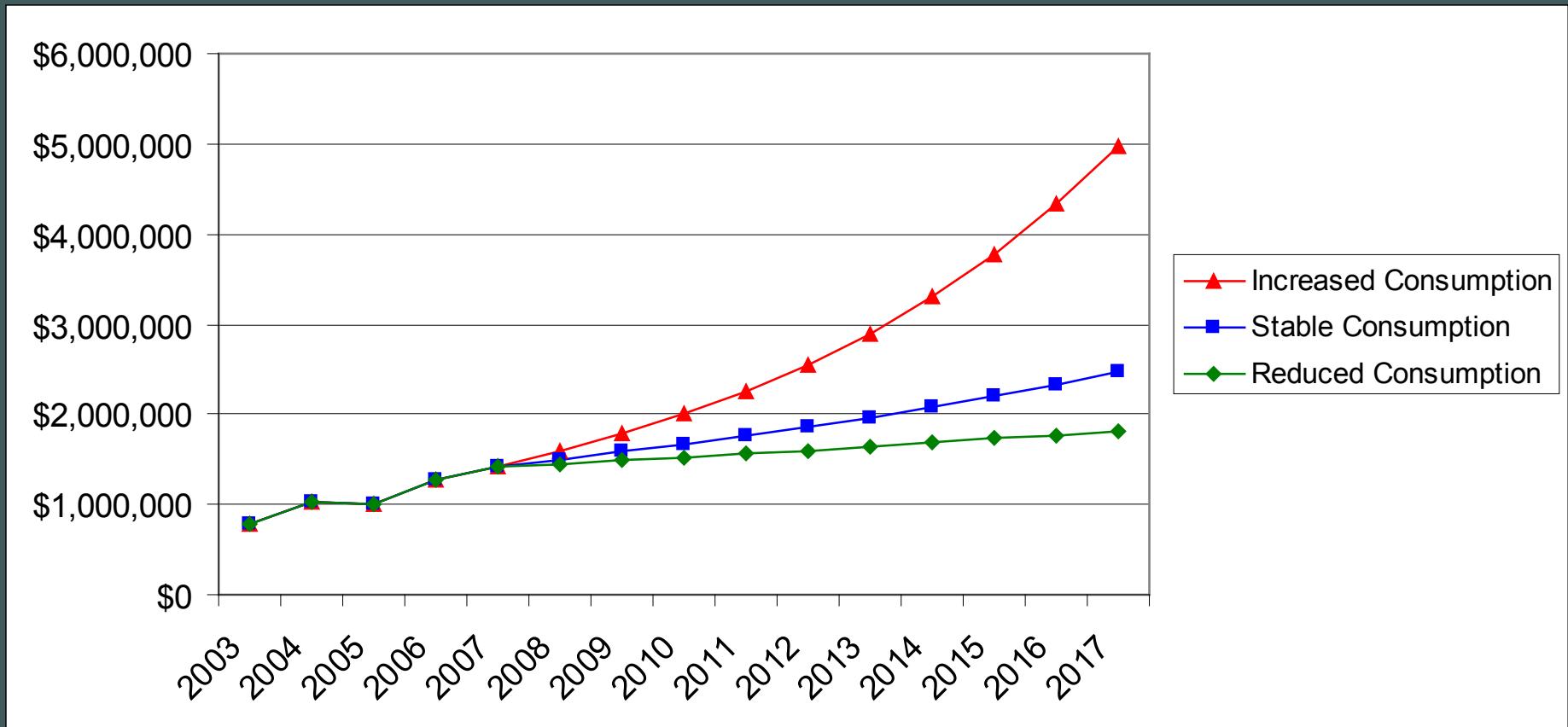
Year	Price per kWh
2003	\$0.05248
2004	\$0.05774
2005	\$0.06221
2006	\$0.06305
2007	\$0.06959
Percent annual increase	7.3%

Table 4. Advertised Propane Rates

Year	Advertised rate (price per gallon)
2003	\$0.85
2004	\$0.99
2005	\$1.30
2006	\$1.37
2007	\$1.46
Percent annual increase	14.5%

TRIBAL ENERGY LOADS

Table 11. Projected Tribal Energy Expenses with Mid-range Price Increases

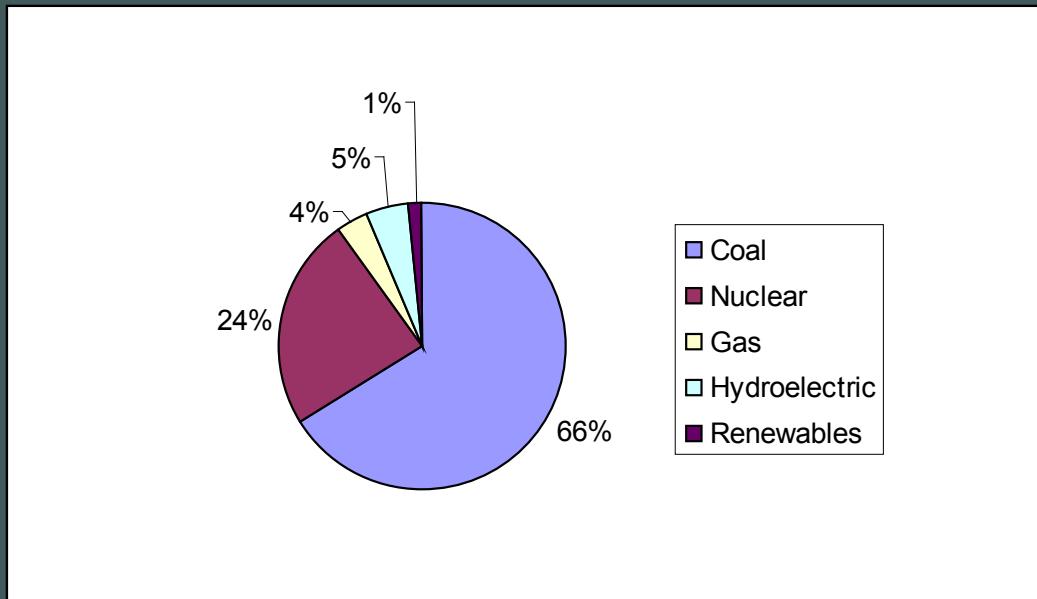


TRIBAL ENERGY LOADS

FACILITY	sqft	Energy Intensity (kBtu / sqft)	Energy Cost Intensity (\$ / sqft)
Gas Station	768	476	\$14.20
Casino	75340	426	\$6.67
Fish Hatchery	4680	293	\$6.27
Simpson's Plastics Plant	14780	264	\$5.40
Bath House #1	660	243	\$7.98
Store (Ojibwe mall)	11305	231	\$4.14
Deer Registration Station	300	173	\$3.50
Round House	1200	157	\$3.20
Casino Engineering Building	5151	146	\$2.83
Bath House #2	784	135	\$4.52
Bingo Hall	13741	126	\$2.73
Lac du Flambeau School	100000	125	\$2.22
Simpson's Main Plant	27280	105	\$2.23
Community Center/Clinic	35000	102	\$1.85
Smoke Shop	8000	97	\$2.73
Multipurpose Building	2560	97	\$2.07
Judicial building	5000	92	\$2.34
Casino Human Resources / Education Building (LOTC)	14853	88	\$1.83
Roads Garage (Tribal garage)	9800	88	\$1.83
Indian Bowl	5250	81	\$1.72
Home Rehab Office / WOLF (REHAB/HIP PROGRAM)	1296	79	\$1.55
Planning / Bank Building	5620	71	\$1.73
Family Resource Center	5988	70	\$1.60
Food Distribution Building	3800	66	\$1.52
Land Management Office	2030	64	\$1.57
Museum	9000	64	\$1.48
Casino Hotel	74400	63	\$1.02
Post Office	8176	58	\$1.10
Wellness Center	20000	58	\$1.29
Youth Center (Abinoojiiyag Center)	7568	52	\$1.32
Domestic Abuse Shelter	6800	48	\$1.12
Water & Sewer Office	5000	47	\$0.86

TRIBAL ENERGY LOADS

Figure 8. WPS power supply mix

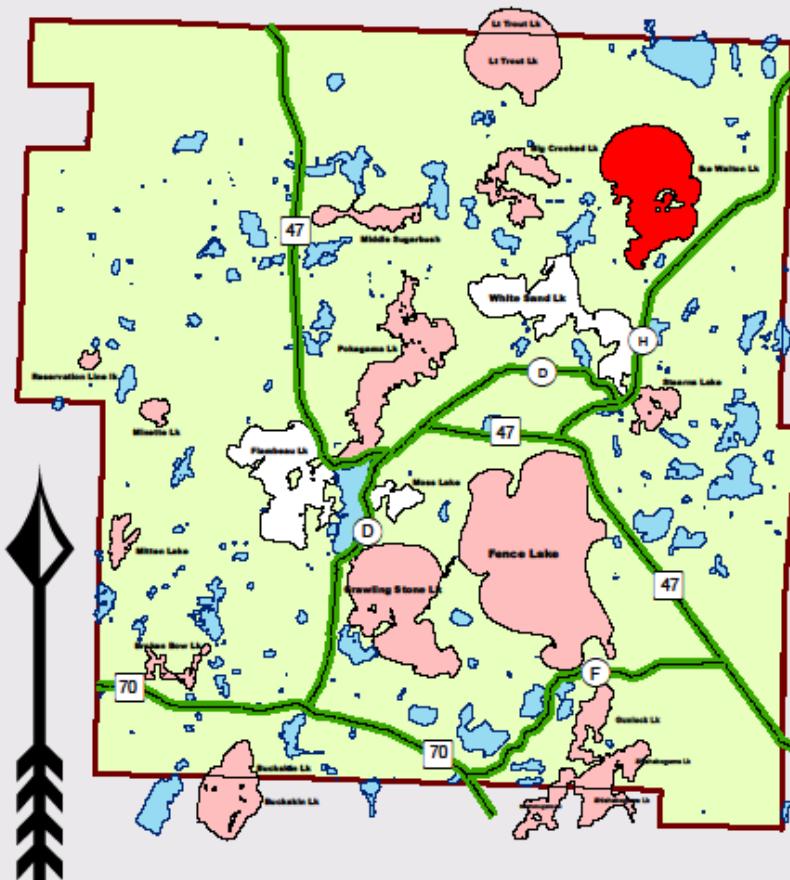


Total equivalent Metric Produce	Equivalent metric description	2007 electricity (kWh)	2007 propane (gallons)
31,331,860	Pounds of CO ₂	are released from 11,870,059	and the 407,476
73,364	Pounds of NO _x	are released from 11,870,059	and the 407,476
144,831	Pounds of SO _x	are released from 11,870,059	and the 407,476
1	Pounds of mercury (HG)	are released from 11,870,059	and the 407,476

Table 5. Emissions associated with average Tribal energy consumption per year

TRIBAL ENERGY LOADS

Lac du Flambeau Mercury Advisory



Safe Eating Guidelines (Mercury) –

for most of Lac du Flambeau Walleye Lakes

All fish contain some mercury. Large fish, especially walleye contain more mercury than small fish, like perch. In some lakes and rivers, mercury bioaccumulates to higher levels in fish.

This map contains special advice for fish that have been found to contain mercury at higher levels. Women of childbearing age who intend on becoming pregnant and children under 15 should be especially careful to follow the guidance.

Women of Childbearing Years, Nursing Mothers, and all Children under 15 Should Follow this Map for Walleye over 18 Inches Long:

- | | |
|-------------------------------------------------------------|--|
| Do Not Eat Walleye from Lakes Labeled – Red | |
| Do Not Eat More Than One Walleye a Month from Lakes Labeled | |
| Do Not Eat More Than One Walleye a Week from Lakes Labeled | |
| Lakes have not been analyzed for mercury content | |

Men and Women beyond their childbearing years should eat no more than one Walleye over 18 inches long per week.

For more detailed fish consumption advice please review the information on the back of this map







Practical Energy Management Training



Renewable Energy Resources

- Wind
- Solar
- Hydro
- Biomass
- Geothermal

Wind

Height Meters (Feet)	MAX WIND speed on reservation (mph)	AVERAGE wind speed expected across the majority of the reservation (mph)
30 m (98 ft)	10.1 – 11.2	>10.1
40 m (131 ft)	11.2 – 12.3	10.1 – 11.2
60 m (197 ft)	12.3 – 13.4	> 12.3
70 m (230 ft)	13.4 – 14.5	12.3 – 13.4
100 m (328 ft)	14.5 – 15.7	12.3 – 13.4

Table 2. Wind speeds on the Lac du Flambeau Reservation

Focus on Energy, Wisconsin State Wind Map: www.focusonenergy.com.

Wind

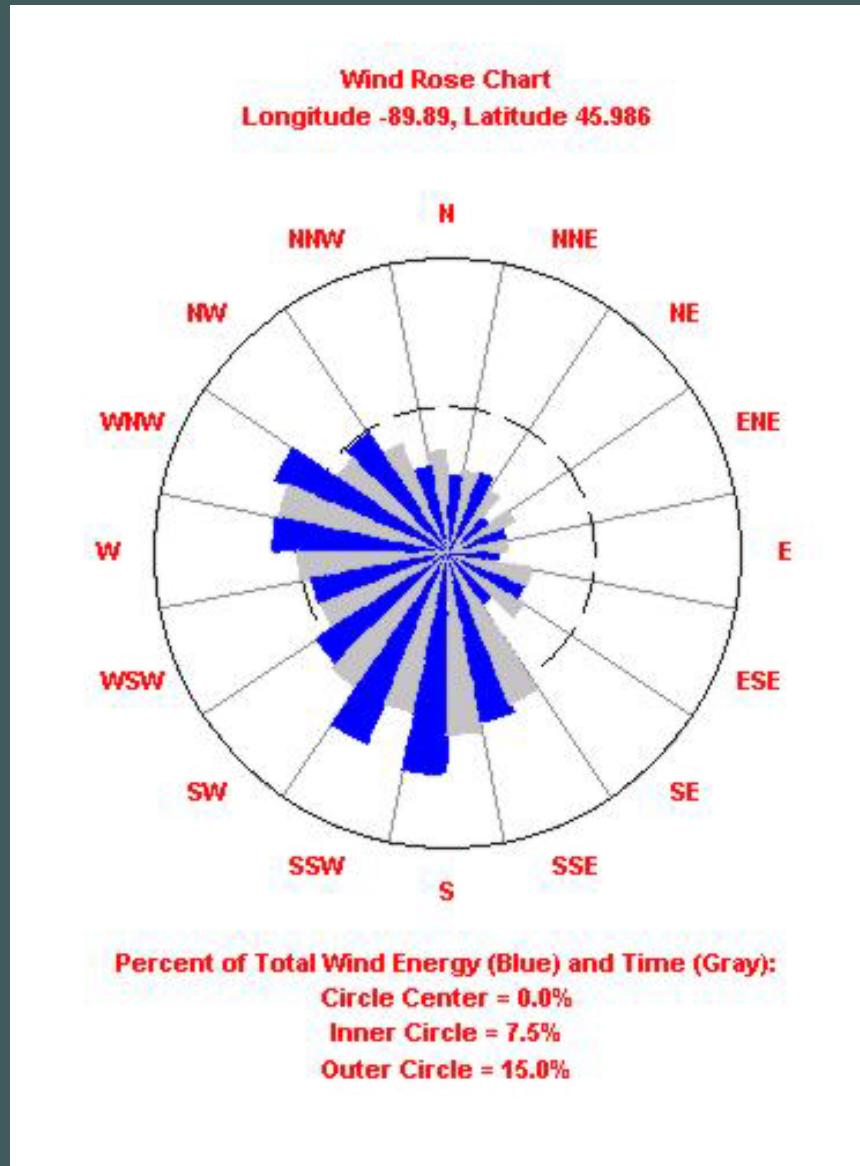


Figure 7. Wind rose for Lac du Flambeau





08/08/2008



08/08/2008



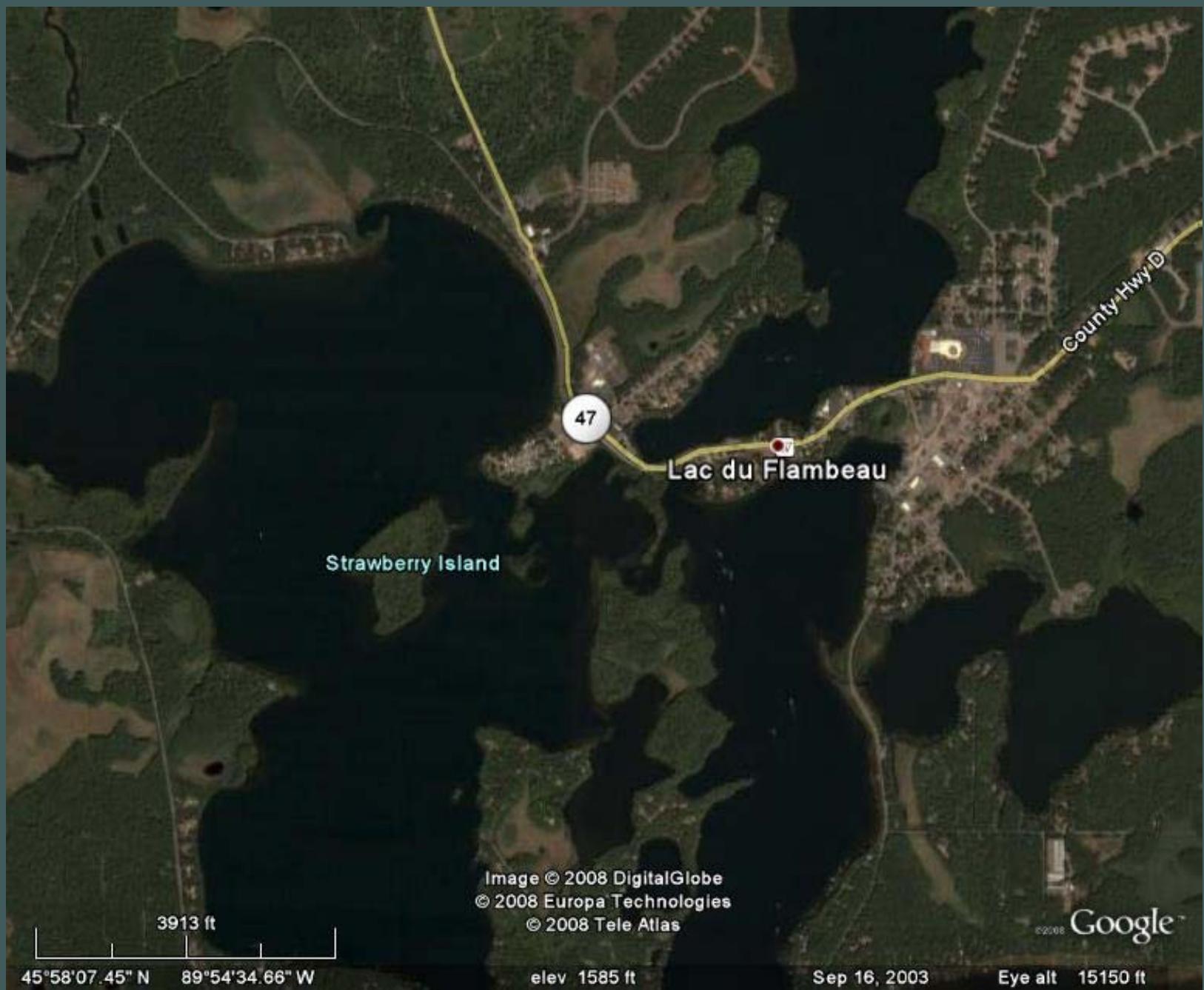


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3913 ft

45°58'07.45" N

89°54'34.66" W

elev 1585 ft

Sep 16, 2003

Eye alt 15150 ft

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Location	Appropriate Size (kW)	2007 Electricity consumption	Estimate 60 m wind speed (mph)	Amount of energy offset
1) Casino	35 - 50 kW	5,043,793	12.1	1.1 - 1.8 %
2) Hotel	35 - 100 kW	1,380,360	12.1	4 - 6.5%
3) *GLITC building	10 - 20 kW	40,000*	11.9	10 - 40 %
4) Tribal Housing; Apartments, *	35 kW	120,000*	12.3	40 - 70%
5) Tribal Housing; Elder Housing*	35 kW	240,000	12.6	20 - 40%
6) Tribal House, *	1 - 10 kW	8,000*	12.5	45 - 150%
7) Tribal House, *	1 - 10 kW	10,000*	12.5	40 - 140%
8) Hwy 47 and Cemetery	10 - 35 kW	n/a	12.4	n/a
9) Planned DNR Facilities*	5 - 35 kW	25,000	12.4	20 - 290%

Table 3. Summary of Possible Wind Turbine Locations

*Estimated electricity use

Solar

PVWatts estimates a solar radiation of 4.4 kWh/m²/day
for Lac du Flambeau

Site characteristics include:

- South-facing or flat roof space, or open ground space with minimal shading.
- Significant amount of space (each one kW requires 100 square feet of space)
- Access to the sun all year round during peak solar times of 9AM to 3PM.
- No future shading issues caused by future roof penetrations, trees, etc.
- A roof that can be repaired in conjunction with the solar installation
- The return on investment is improved if:
 - the solar system off-sets peak or high energy and demand charges
 - the utility offers a solar buy back rate

Table 1. Facilities Suitable for Solar Electric (PV) , Solar Hot Water (SHW), Solar Space Heating (SSH)

Facility	PV	SHW	SSH
Community Center/Clinic	X	X	X
Casino	X	X	X
Hotel	X	X	
Lac du Flambeau School	X		
Simpson's Plastic Plant			
Simpson's Main Plant			X
Smoke Shop	X		X
Bingo Hall	X		X
Gas Station	X		
Judicial Building	X		X
Museum	X		X
Water Resources Office	X		
Store (Ojibwe Mall)		X	X
Roads Garage			X
Tribal Housing; Apartments,	X	X	
Tribal Housing; Elks Point Elder Housing	X	X	
Tribal Housing,	X	X	
Tribal Housing,	X	X	
Hwy 47 and			
Planned DNR Facilities	X	X	X



Hydro















Fish Hatchery



Image © 2008 DigitalGlobe

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45°58'17.87" N 89°54'37.22" W

Sep 16, 2003

Eye alt 516 m

Fish Hatchery



Fish Hatchery



Hatchery Pumps



**1 x 15 HP Deep Well Pump
in Water Resources Office**



3 x 15 HP Lake Pump in New Hatchery

Hatchery Flows

No. of Pumps Running Annually	Flow Rate (gal/min)	Percent of Time in Use	Effective Flow Rate (gal/min)
1	1000	20%	200
2	2000	40%	800
3	3000	20%	600
4	4000	10%	400
5	5000	0%	0
Total			2000 (annual average)

Reservation Biomass

	Total from Indian land		Total from non-Indian land		Totals	
	dry tons available	MMBtu (available)	dry tons available	MMBtu (available)	dry tons available	MMBtu (available)
Residuals	71	1,100	1,574	24,400	1,645	25,500
Cordwood	431	7,410	9,544	164,200	9,975	171,610
sawlog	13	229	295	5,100	309	5,329
Total	515	8,739	11,414	193,700	11,929	202,439

Biomass within Radii of Reservation

Radius	Logging Residue @ 70% removal (green tons)
25	158,540
50	686,270
75	1,419,019

Feller Buncher



Geothermal

Lac du Flambeau Resources:

- Groundwater Temperature – 51 °F
- Thermal Conductivity – 1.45 Btu/h-ft-°F
- Thermal Diffusivity – 0.96 ft²/day

Geothermal

Evaluation of Buildings

Introduction

The following criteria were used to evaluate the buildings for appropriateness for a geothermal retrofit:

Size of Building – Buildings less than 5,000 ft² were given a lower priority due to economies of scale.

Year of Construction – Buildings recently constructed were given a lower priority. Likewise, buildings due for renovation, planned for construction and buildings with older HVAC equipment due for retrofit were given a high priority

Heated/Cooled – Buildings that were not cooled were given a lower priority.

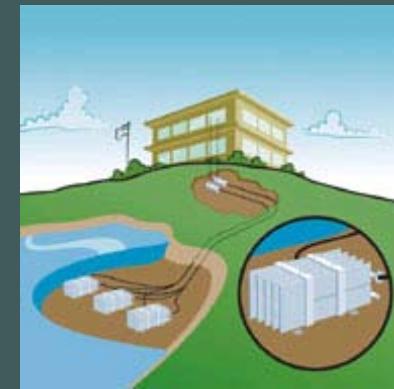
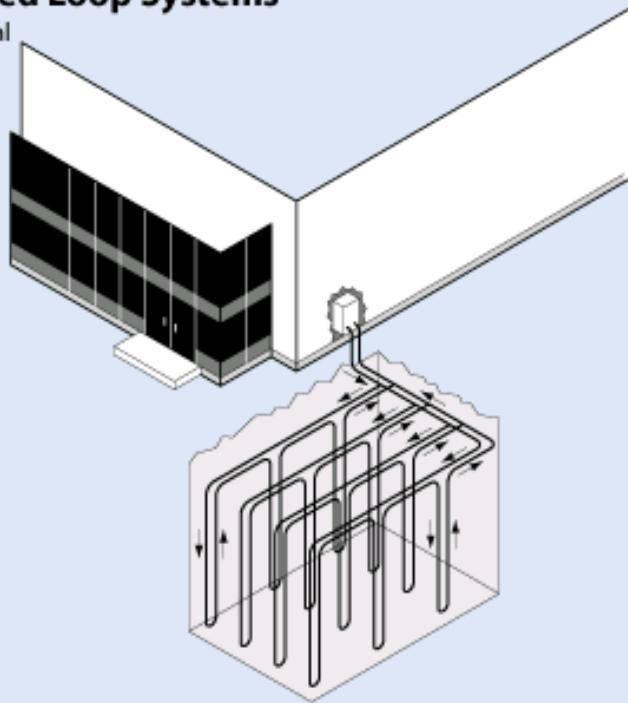
Occupancy – Buildings with sporadic or low occupancy rates were given a lower priority.

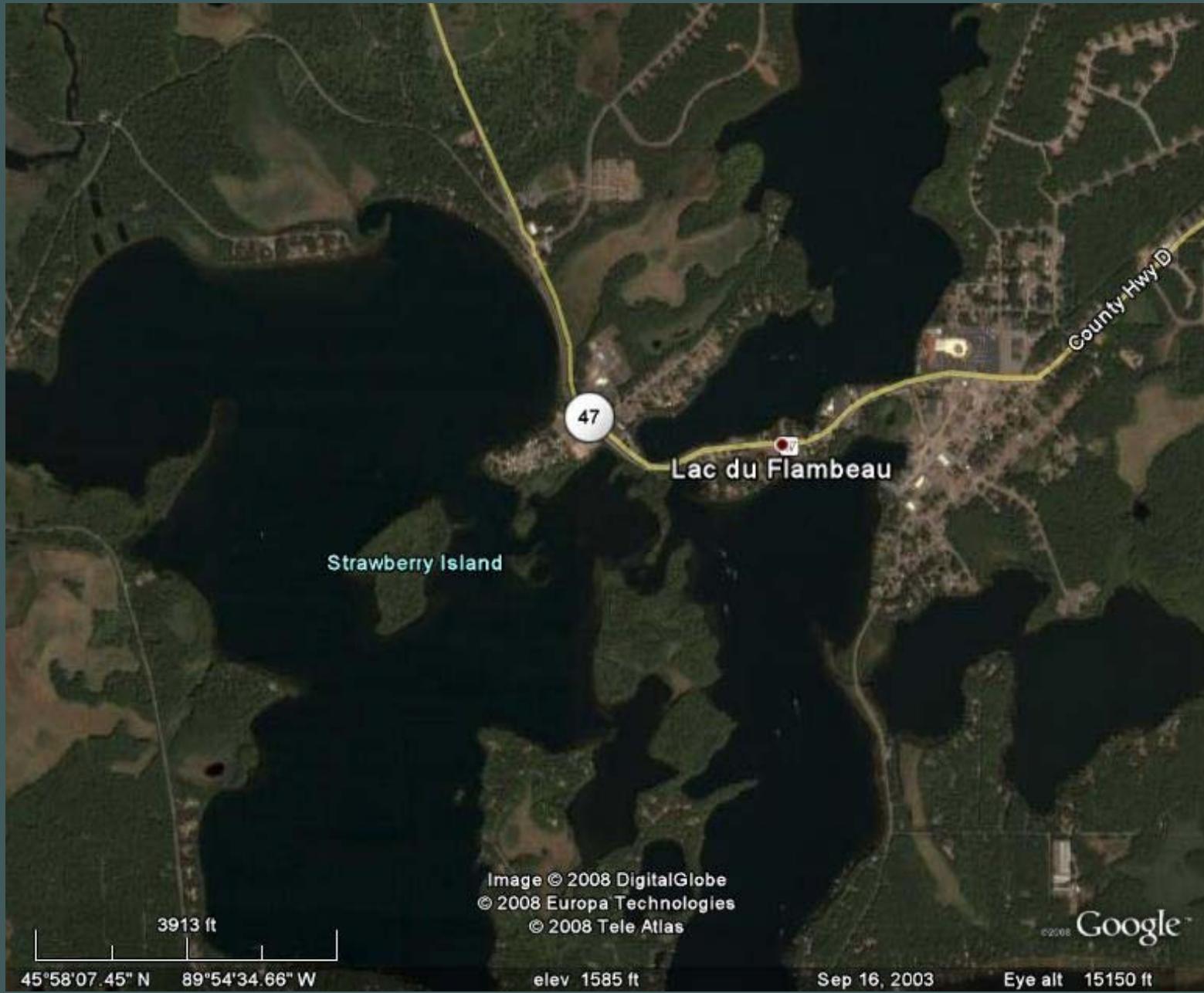
Site Appropriateness – Buildings located near one of the lakes or with open land (parking lots, grassy areas, etc) were given a higher priority.

Geothermal

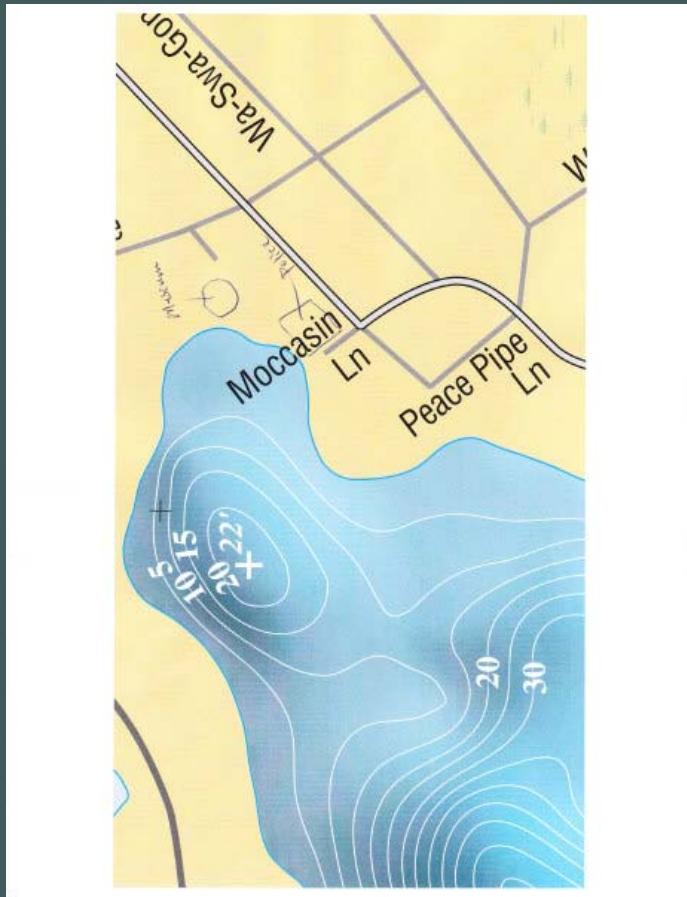
Closed Loop Systems

Vertical





Geothermal



Geothermal

	Conventional CAV	Geotherma l
Annual Gas Consumption (therms)	2,619	72
Annual Electric Consumption (kW-h)	60,260	54,310
Peak Demand August (kW)	30.5	25.1
Building Energy Use (kBtu/sq-ft/yr)	94	39
Energy Saved by Geothermal (%)		59%
Building Energy Cost (\$/sq-ft/yr)	\$2.37	\$1.23

	Conventional CAV	Geotherm al
Emissions from Electricity (lbs CO2)	112,006	100,947
Emissions from Gas (lbs CO2)	30,642	848
Total (lbs CO2)	142,648	101,795
CO2 Saved by Geothermal (lbs CO2)		40,853

Geothermal

	Conventional CAV	Geothermal
First Cost	\$80,000	\$110,000
Additional First Cost	Base	\$30,000
First Year Gas Cost	\$5,238	\$145
First Year Electric Consumption Cost	\$6,429	\$5,795
First Year Service Charges	\$204	\$204
First Year Electric Demand Cost	\$0	\$0
<i>Total First Year Energy Cost</i>	<i>\$11,871</i>	<i>\$6,144</i>
First Year Maintenance Cost	\$1,500	\$1,000
<i>Cost</i>	<i>\$13,371</i>	<i>\$7,144</i>
First Year Savings	Base	\$6,227
Simple Payback (Years)	Base	4.8
Life Cycle Cost Payback (Years)	Base	4.7
Cost Savings (25-Year basis)	Base	\$146,960

Geothermal



Geothermal

	Conventional CAV	Geothermal
First Cost	\$800,000	\$1,156,900
Additional First Cost	Base	\$356,900
First Year Gas Cost	\$80,682	\$2,490
First Year Electric Consumption Cost	\$70,674	\$56,378
First Year Service Charges	\$204	\$204
First Year Electric Demand Cost	\$0	\$0
<i>Total First Year Energy Cost</i>	<i>\$151,560</i>	<i>\$59,072</i>
First Year Maintenance Cost	\$15,090	\$10,060
<i>Cost</i>	<i>\$166,650</i>	<i>\$69,132</i>
First Year Savings	Base	\$97,518
Simple Payback (Years)	Base	3.7
Life Cycle Cost Payback (Years)	Base	3.6
Cost Savings (25-Year basis)	Base	\$2,426,425

Table 16: Cost comparison of a conventional CAV furnace system to a geothermal system.

Activities yet to be completed...

- Meet with Consultants to Comment on Renewable Resource Reports
- Receive Final Reports
- Communicate the Results to Community Stakeholders
- Create our Strategic Energy Plan

Future Plans

- Tribal Natural Resources Complex
- 20 – unit Green Housing Complex
- Seek funding
- Green Building Construction Codes

Thank You.

