Oneida Tribe of Indians of Wisconsin

ENERGY OPTIMIZATION MODEL

December, 2014

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Thanks to the Oneida Business Committee, Oneida Energy Team, and many staff for their assistance and support for this project.

Executive Summary

Oneida Nation is located in Northeast Wisconsin. The reservation is approximately 96 square miles (8 miles x 12 miles), or 65,000 acres. The greater Green Bay area is east and adjacent to the reservation. A county line roughly splits the reservation in half; the west half is in Outagamie County and the east half is in Brown County. Land use is predominantly agriculture on the west 2/3 and suburban on the east 1/3 of the reservation. Nearly 5,000 tribally enrolled members live in the reservation with a total population of about 21,000. Tribal ownership is scattered across the reservation and is about 23,000 acres.

Currently, the Oneida Tribe of Indians of Wisconsin (OTIW) community members and facilities receive the vast majority of electrical and natural gas services from two of the largest investor-owned utilities in the state, WE Energies and Wisconsin Public Service. All urban and suburban buildings have access to natural gas. About 15% of the population and five Tribal facilities are in rural locations and therefore use propane as a primary heating fuel. Wood and oil are also used as primary or supplemental heat sources for a small percent of the population. Very few renewable energy systems, used to generate electricity and heat, have been installed on the Oneida Reservation. This project was an effort to develop a reasonable renewable energy portfolio that will help Oneida to provide a leadership role in developing a clean energy economy. The Energy Optimization Model (EOM) is an exploration of energy opportunities available to the Tribe and it is intended to provide a decision framework to allow the Tribe to make the wisest choices in energy investment with an organizational desire to establish a renewable portfolio standard (RPS).

Project Overview

Renewable energy resources available to Oneida can be estimated using U.S. Energy Information Administration (EIA) data. The Oneida Nation reservation is located entirely within Wisconsin, therefore most fossil resources available to Oneida will be based on imports brought into the state. Likewise, renewable resources found within the state will also be available to Oneida. Wisconsin is not a state known for its energy reserves. According to EIA in 2009, Wisconsin has no oil rigs, wells, or mines to gain access to fossil fuel resources like oil, natural gas, or coal. That means all fossil fuel energy resources must be imported. *Figure 1, 2008 Total Energy Production, fossil & renewable sources (Wisconsin ranks #37*), shows that Wisconsin is ranked very low compared to states such as Texas where abundant fossil and renewable energy resources are available.

Wisconsin, and Oneida, will have to be creative with their energy development as well as maintain a commitment to sustainable, clean energy for the coming decades. Ignoring upfront costs, energy efficiency and renewable energy at this point in time have shown to be the most prudent ways to meet these challenges. Bioenergy, wind, solar, and ground-source heating & cooling are renewable sources providing the best opportunity for Wisconsin and Oneida to attempt some level of energy independence away from imported fossil resources.

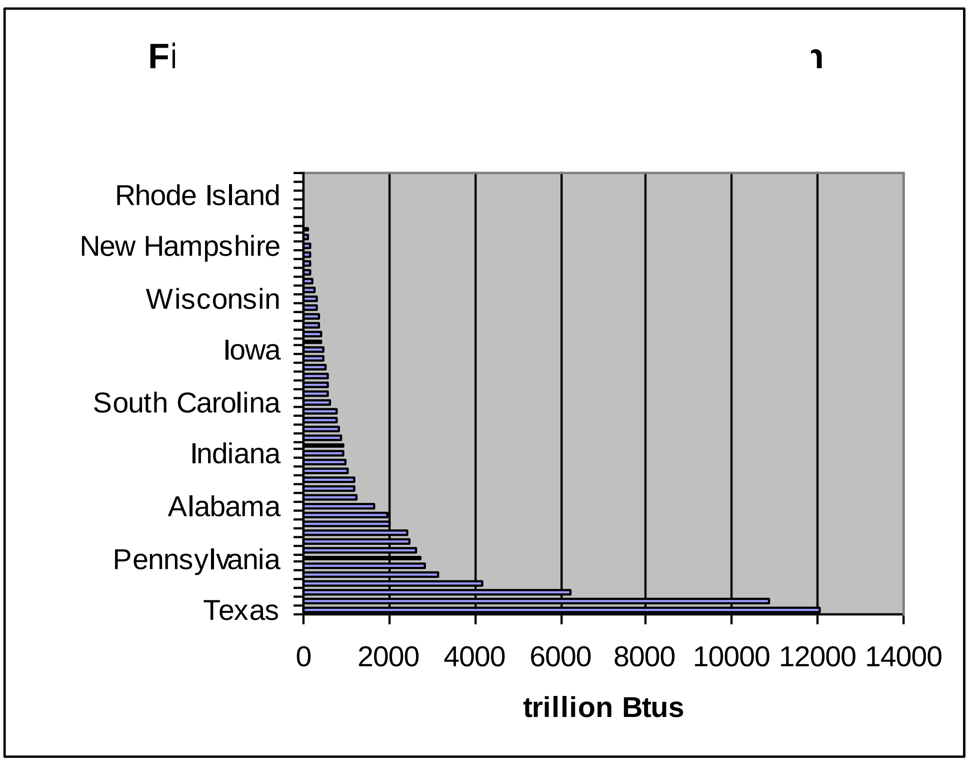


Figure 1, 2008 Total Energy Production, fossil & renewable sources (Wisconsin ranks #37)

OTIW has built a database of energy consumption for all of its buildings. This data was evaluated during the recent renewable energy assessment of several Tribal facilities. *Figure 2, Oneida electricity consumption distribution* is a pie-chart of facility energy consumption. Of the 90+ buildings that the Tribe operates, 15 buildings use 81% of total Tribal energy consumption. The largest loads belong to the gaming and retail operations at 59% in 8 facilities. Government services facilities rank second at 23% of load requirements in 7 facilities.

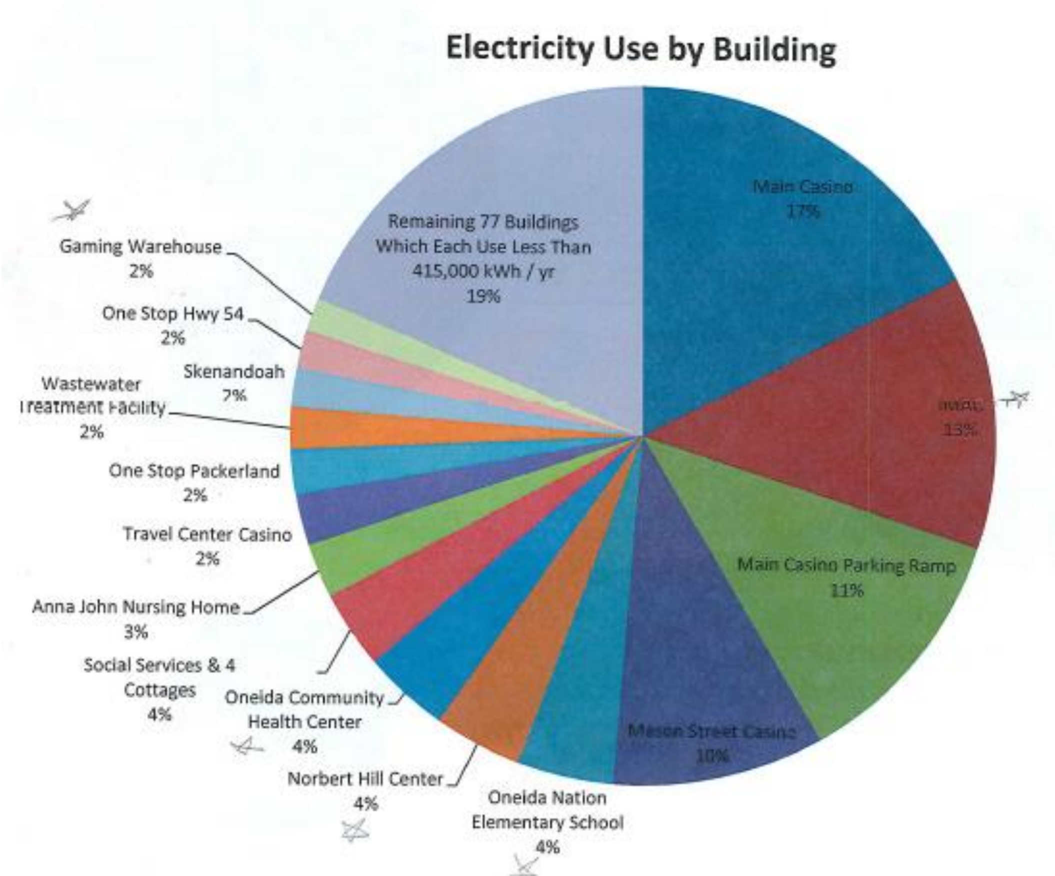


Figure 2, Oneida electricity consumption distribution

Figure 3, Electrical generation sources supplying Oneida shows the distribution of energy from the two utilities, Wisconsin Public Service Corporation and WE Energies. The combined utility-based renewable fraction is 6%; 3% from wind and 3% from hydropower. Theoretically, Oneida already uses 6% from renewable sources in their portfolio. However these are distant sources, primarily from Canadian hydro power plants; local renewable production is the goal here.

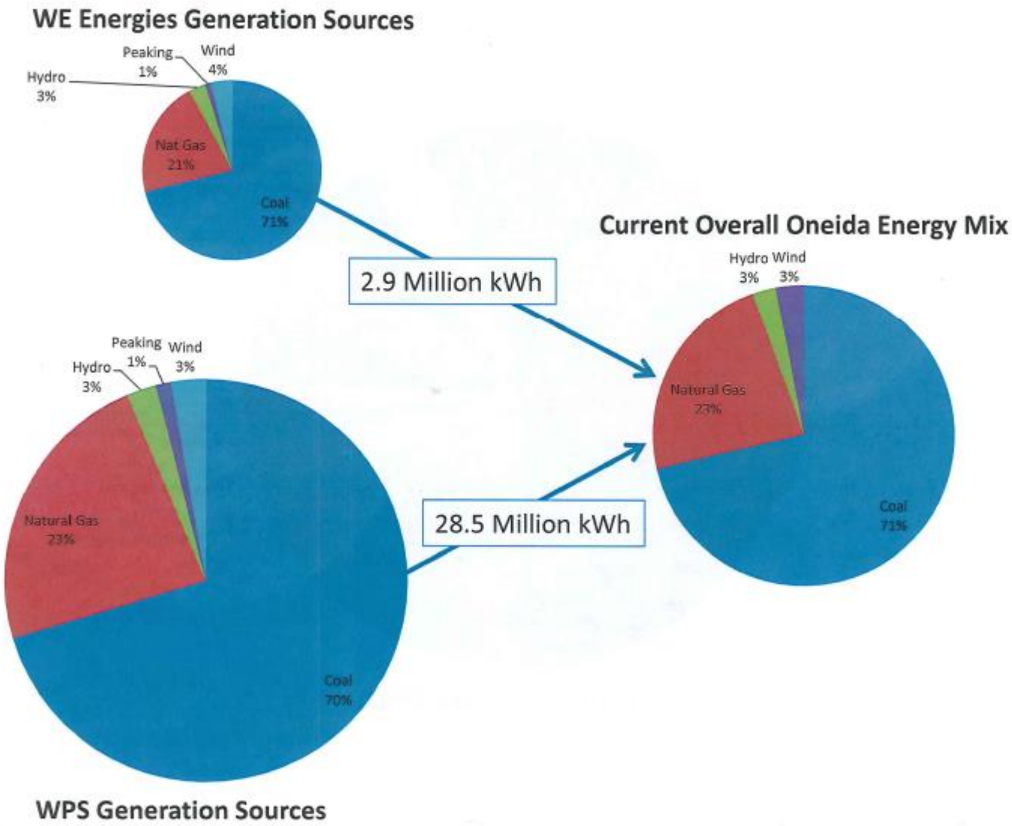


Figure 3, Electrical generation sources supplying Oneida

Energy distribution by sector:

- **Current Tribal community energy usage as of 2011 = 412,000 MMBtu.** Existing energy data for individual buildings will be made available upon contract approval.

a.	Institutional electricity:	31,000,000 kilowatt-hours	=	105,000 MMBtu
b.	Institutional natural gas:	540,000 therms	=	54,000 MMBtu
c.	Institutional transportation fuel:	145,000 gallons	=	5,000 MMBtu
d.	Housing electricity:	16,000,000 kilowatt-hours	=	48,000 MMBtu
e.	Housing natural gas:	2,000,000 therms	=	200,000 MMBtu

- **Initial Renewable Portfolio Standards –** for each standard, evaluate the appropriate Tribal buildings or properties using **<u>Section II.C</u>**. The cumulative production from the combination of technologies should add up to the RPS goal. **Three different RPS goals include**:
    a. 5% RPS = 20,600 MMBtu
    b. 10% RPS = 41,200 MMBtu
    c. 20% RPS = 82,400 MMBtu

The initial objectives developed for this project were to:

1) Quantify each energy resource in their available forms in the region surrounding the Oneida Reservation. This list will include wind, solar, biomass, ground-source, hydro, bio-fuels, bio-power, coal (utility generated electricity), natural gas, propane, gasoline,

and others that are available to the Oneida Tribe. Describe for each their geographical distribution and availability, usage costs, existing transmission, and processing with associated challenges.

2) Describe the latest energy conversion technologies for the appropriate energy resource.
3) Describe the planning, development, funding, and maintenance considerations of tribally controlled renewable energy facilities.
4) With assistance from Tribal staff, develop a forecast of Tribal energy needs 5, 10, 25, and 50 years into the future.
5) Develop a prioritized list of energy portfolio options that recommend the ideal combination of energy efficiency, renewable energy, and conventional energy technologies based on availability, maturity of technology, $/Btu, internal rate of return, net present value, and carbon emissions.
6) Provide discussion about municipalization, power purchase agreements, and 3rd party agreements.

The EOM was intended to:

- evaluate renewable resources in the reservation,
- investigate available technologies,
- provide pre-feasibility work on Tribal facilities to determine their capability to support these technologies, and
- devise an investment strategy that can be used to support and recommend a renewable portfolio standard to the governing body.

Model Findings and Preliminary Results

Early in the development process, it was recognized that the initial renewable portfolio standards would be very difficult to achieve given that the total energy picture that includes electricity, heat, and fuel for residential and Tribal facilities was large. We adjusted RPS calculations to be based on a percentage of institutional electricity consumption. Table 1, Oneida RPS process, provides a look at one strategy for achieving a renewable portfolio standard (RPS) using targets of 5%, 10%, and 20%. Complete solar and wind build-out for the potential projects listed could give OTIW as much as a 40% RPS. *Figure 4, Renewable Portfolio at maximum solar and wind build-out*, shows combined RPS of 45% solar, wind, and hydropower from utility renewables. There were many assumptions used in this scenario. More information is in the section Financial and Legal Realities. Information for each technology is described in the following pages.

Table 1, Oneida RPS process

Current Oneida Electricity Sources

Fuel Type	kWh	% of Total
Coal	22,103,096	70%
Natural Gas	7,233,816	23%
Hydro	773,080	2%
Wind	375,270	1%
Peaking	919,595	3%
TOTAL	31,404,857	100%

RPS Targets

RPS Target	% of Total	kWh	Additional kWh Needed
Low	5%	1,038,248	-98,268
Medium	10%	2,076,496	939,980
High	20%	4,152,991	3,016,475

Top-Ranked Potential Oneida Solar PV Projects

Facility	PV System Size (kW)	kWh Produced
Main Casino	255	312,068
Main Casino Parking	457	558,900
Turtle Elementary	550	673,064
Oneida Community Health Center	320	390,886
Norbert Hill Center	90	115,475
Travel Center Casino	150	211,389
Gaming Warehouse	265	324,310
Elder Services	200	244,020
Conservation	40	49,000
Land Management	20	24,320
Farm Outbuildings	15	17,560
Site II Community Center	15	17,973
TOTAL	2,377	2,938,964

Potential Oneida Large Wind Projects

	Wind Turbine Size (kW)	Estimated Output (kWh)
Wind Turbine #1	1700	5,361,120
Wind Turbine #2	1700	5,361,120
TOTAL	3,400	10,722,240

Table 2, Solar opportunities at top 15 facilities

Solar Electric Site Summaries

The following table summarizes the maximum potential solar electric systems that can be installed on each of the following facilities. Due to current utility policy and levels of peak demand by facility, the recommended system size is often smaller than the maximum potential size. One of the major advantages of solar electric is that it is highly scalable, and smaller systems will have similar (though slightly worse) economics than the full potential sizes shown below.

Facility	Annual Usage (kWh)	Max PV system (kW)	Installed Cost	% facility usage
Main casino	5,572,638	255	$830,000	6%
Main casino Parking	3,726,000	457	$1.3M	15%
Turtle Elem.	1,373,600	660	$1.65M	49%
Oneida Community Health Center	1,221,520	320	$950,000	32%
Norbert Hill Center	1,154,748	90	$325,000	10%
Travel Center Casino (Hwy 29)	754,960	20 + parking (150)	$750,000	28%
Gaming Warehouse	348,720	265	$820,000	93%
Elder Services	348,600	200	$620,000	70%
Conservation	50,000	40	$150,000	98%
Land Management	121,600	20	$65,000	20%
Farm Office	17,560	15	$60,000	100%
Site II Community Center (County H)	17,973	15	$60,000	100%
IMAC & Bingo Hall	1,373,600	170	$595,000	15%
Food Dist. Center	123,000	20	$67,700	20%
Oneida Police Department	275,520	25	$80,300	11%
Total	**16,480,039**	**2.612 MW**	**$8,323,000**	**44%**

Solar

Overall findings tend to favor solar as an immediate opportunity and as other renewable resources develop. There are many reasons why solar has been identified as a preferred technology, largely because of the direct impact is has with individual buildings, the scalability of photovoltaics, significantly lower maintenance costs, and the ability to take advantage of unused roof space. *Table 2, Solar opportunities at top 15 facilities*, shows a maximum solar buildout scenario for the large facilities. *Figure 4, Renewable Portfolio at maximum solar and wind build-out*, shows the impact that solar and wind can have on the RPS. Other benefits and a comparison between photovoltaics and large-scale wind can be found in

Figure 11, Energy optimization model; preliminary results fact sheet.

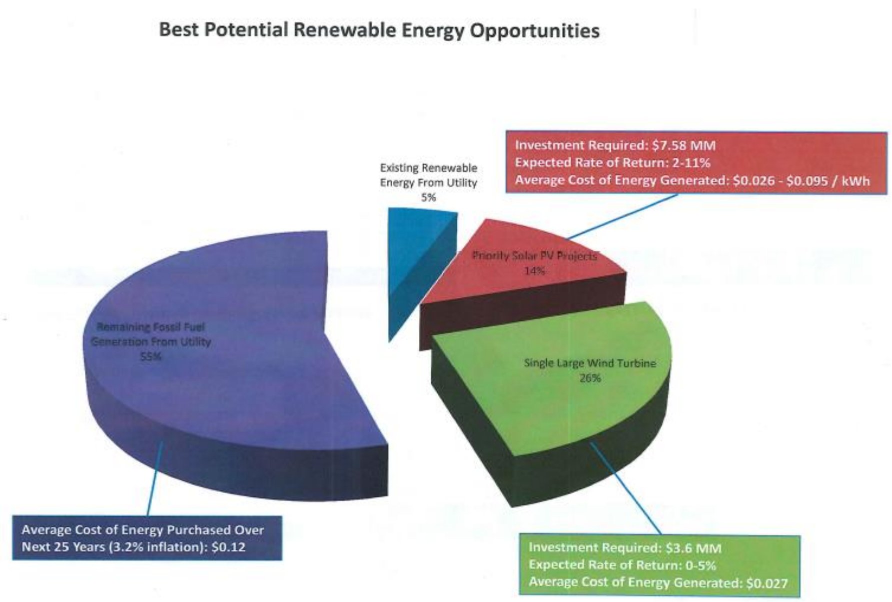


Figure 4, Renewable Portfolio at maximum solar and wind build-out

Wind

Regarding wind energy, a met-tower study performed in 2009-11 did show some opportunities for large wind Refer to *Figure 7, Oneida Reservation potential wind turbine sites*, and *Table 7, Oneida met-tower results*. Based on this data and the assumptions in *Table 3*, a 1.5 megawatt wind turbine could pay for itself in about 12 years. Refer to *Table 4, Oneida large wind project results* and *Figure 5, Oneida large wind cash flow*. Since the Tribe is a non-taxable entity, these results also assume that the only incentive available will be a 50% grant. More discussion is in the section Financial and Legal Realities. Siting concerns, local and regional opposition, operations and maintenance costs, and poor utility power purchase rates are primary reasons explaining why wind will not be an immediate opportunity in the near future. Although these issues are significant, local development and off-site investment remain as options and the Tribe will continue to investigate.

Table 3, Oneida large wind pre-feasibility assumptions

ASSUMPTIONS	
Operational	
Commercial Operations Date	12/31/2014
Project Size (kilowatts)	1,600
Project Life (Years)	25
Net Capacity Factor	37.5%
Production Degradation / Year	0%
Power Purchase Agreement ($/kWh)	$0.04
PPA Escalation	3.0%
Maintenance Cost / Yr	$50,000
Maintenance Cost Escalation	2.0%
Maintenance Cost Start Year	3
Monitoring Cost/yr	$0
System Down Time (Years 1-10)	0%
System Down Time (Years 11-20)	0%
Insurance Cost / Yr	$5,550
Capital, Tax & Financing	
Installed Cost	$3,700,000
DOE Grant	0%
Other Grant (i.e. FoE)	0%
Investment Tax Credit	30%
Tax Basis	$3,145,000
Federal Tax Rate	0%
State Tax Rate	0%
Capital Gains Tax Rate	0%
Oneida Share of Installed Cost	$3,700,000
% of Total - Grant funded by Debt	50%
Total Debt Amount	$1,850,000
Interest Rate on Debt	5.0%
Debt Term	25
Buyout Year	25
Buyout Amount	$0
Land Lease Payment Years 1-10	$0
Land Lease Payment Years 11-25	$0

Table 4, Oneida large wind project results

RESULTS	
System Size (kW)	1,600
Project Lifespan	25 years
Estimated Annual Electricity Production (kWh)	5,256,000
Installed Cost	$3,700,000
DOE Grant Value	$0
Other Grant (i.e. FoE)	$0
Cost After Incentives	$3,700,000
Estimated Payback Period (years)	12
25 Year Value of Energy Production	$7,665,196
Average Cost/kWh Generated	$0.028
Average Projected Sale Price / kWh	$0.058
Internal Rate of Return (IRR)	10.0%
Net Present Value (at 3% Discount Rate)	$994,480
Sum of Net Revenues	$7,665,196

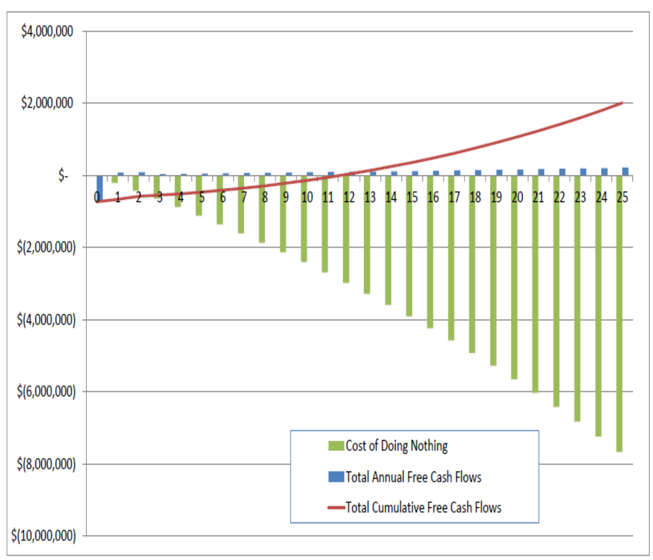


Figure 5, Oneida large wind cash flow

Biomass

Biomass as a heating source in facilities or homes is competitive with propane. Due to the extreme variability of propane prices from season to season, building owners may benefit from cordwood sources or from a regionally expanding wood pellet supply. Appliances, stoves and furnaces, designed to use these kinds of fuels are generally available and affordable with respectable efficiency ratings (80 to 90+%). Large-scale projects have greater limitations. These are heavy on infrastructure costs and require a consistent source of fuel to maintain heat and efficiency. The supply of feedstock options such as wood chips or waste materials from tree harvesting activities are not significant in northeast Wisconsin, compared to northern Wisconsin. Tree stand acres are limited primarily due to a strong commodity crop agriculture and dairy industry in this part of the state, where more than 80% of the land is in corn, soybeans, or hay. The nearest large-scale tree management program is Menominee Tribal Enterprises, owned and operated by the Menominee Tribe, located about 40 miles away. Transportation costs significantly limit the opportunities to use these feedstocks. *Table 5, Biomass energy system proposals based on pre-feasibility analysis for select Oneida Tribal facilities* summarizes the costs and payback for select buildings that may support biomass.

Table 5, Biomass energy system proposals based on pre-feasibility analysis for select Oneida Tribal facilities

		Biomass System		
Rank	**Building**	**Cost**	**Payback**	**Comments**
1	Grain Dryer	$130,000	9 years	Under a ten year payback; eligible for Focus Grant
2	Social Services	$650,000	21 years	Infrastructure for chips already resides; payback could fall to sub-15 years
3	Tsyunhehkwa	$22,000	18 years	Between 12-18 years figures to be the most reasonable range of payback
4	Skenandoah	$270,384	25 years	Potential to gain positive earnings, but significant variations in prices would need to happen
5	Civic Center	$300,000	28 years	85% thermal offset has the best payback potential; could fall to 20 years
6	Turtle School	$787,000	15 years	Great potential payback, but relatively new boilers and a brand new chiller
7	Land Management	$53,000	30+ years	Potential to fall under 20 years, but would require significant price variation
8	Elder Services	$710,000	30+ years	Aside from concrete poles blocking access, the payback would struggle to fall under 30 years
9	Norbert Hill	$1,458,245	30+ years	For the hefty investment, does not offset enough natural gas to make it affordable
10	Community Health Center	$432,120	N/A	Potential to gain positive earnings, but significant variations in prices would need to happen
11	Police Department	$300,000	N/A	No reasonable economic variations to create a favorable payback

Ground-Source Thermal

Ground-source energy technology is an expanding industry in northeast Wisconsin. Cost effectiveness depends in part on buildings that require heating and cooling; building for one or the other is not wise. The costs for balance of system infrastructure, such as heat pumps, are relatively comparable to conventional appliances. The excavation work for these systems, however, is significant whether it is for horizontal, vertical, or pond loops. The attention to detail in the geotechnical reports cannot be overemphasized. So long as these systems are designed, engineered, and constructed for newly constructed, large facilities or campus-style developments by credible firms, this technology will provide some benefit to energy portfolio development.

Financial and Legal Realities

Available funding from internal sources remains to be the supreme challenge for OTIW as it is for other large or small communities throughout the nation. Most projects, especially large-scale projects, that will strictly depend on Tribal funding will likely not move forward. These projects are dependent in large part on incentives, grants, and tax benefits forcing project planners and designers to includes these funding sources as an important part of the project funding strategy. Since grants are becoming increasingly scarce, and OTIW is not in a position to use tax benefits, other creative funding mechanisms will need to emerge to take up the slack. Business structures, such as partnership flip models *Figure 6, Partnership flip model*, may provide the means to allow renewable portfolio standards at the local level to become reality.

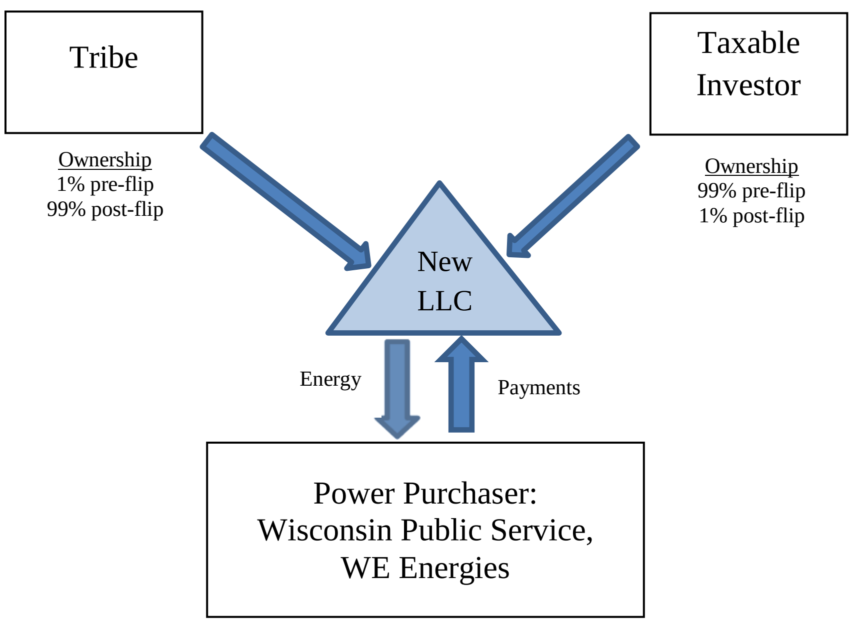


Figure 6, Partnership flip model

As an example of funding challenges, recent financial calculations for a proposed large-scale solar electric installation strongly suggest that without incentives, tax benefits, or investor support, projects of significant magnitude remain to be elusive and rare. For this particular project, the combination of a significant grant award and a partnership with an equity investor can provide nearly 75% of the required capital in a $2 million project. The National Renewable Energy Laboratory System Advisor Model was used to calculate the financial metrics listed in *Table 6, Preliminary comparison of financial metrics***Error! Reference source not found.**. Net present value and internal rate of return are summarized. Four scenarios are outlined, a Grant + Power Purchase Agreement (PPA), a Grant alone, a PPA alone, and no incentive. In this situation, the power purchase agreement represents the equity investor's contribution to the project. Clearly, the combination of grants and other capital support to a long way in making energy projects reality.

Table 6, Preliminary comparison of financial metrics of a large-scale solar proposal

Options	NPV	IRR
Grant + PPA	442,100	25.5%
Grant, No PPA	(190,300)	3.24%
PPA, No Grant	(400,000)	1.2%
No Grant, No PPA	(1,162,200)	(207.19%)

Another example demonstrates the challenges with wind turbine construction. *Figure 8, Financial analysis #1 for wind proposal*, shows that without financial incentives, a wind turbine with a 25-year life has a payback of 23 years. On the other hand, *Figure 9, Financial analysis #2 for wind proposal*, demonstrates a 13 year payback for the same turbine, only with a 50% grant to help with construction costs. In today's economic climate, very few communities are in a position to amass this kind of outside revenue with little or no obligation. This further does little to encourage renewable portfolio development at the local level.

Figure 7, Oneida Reservation potential wind turbine sites

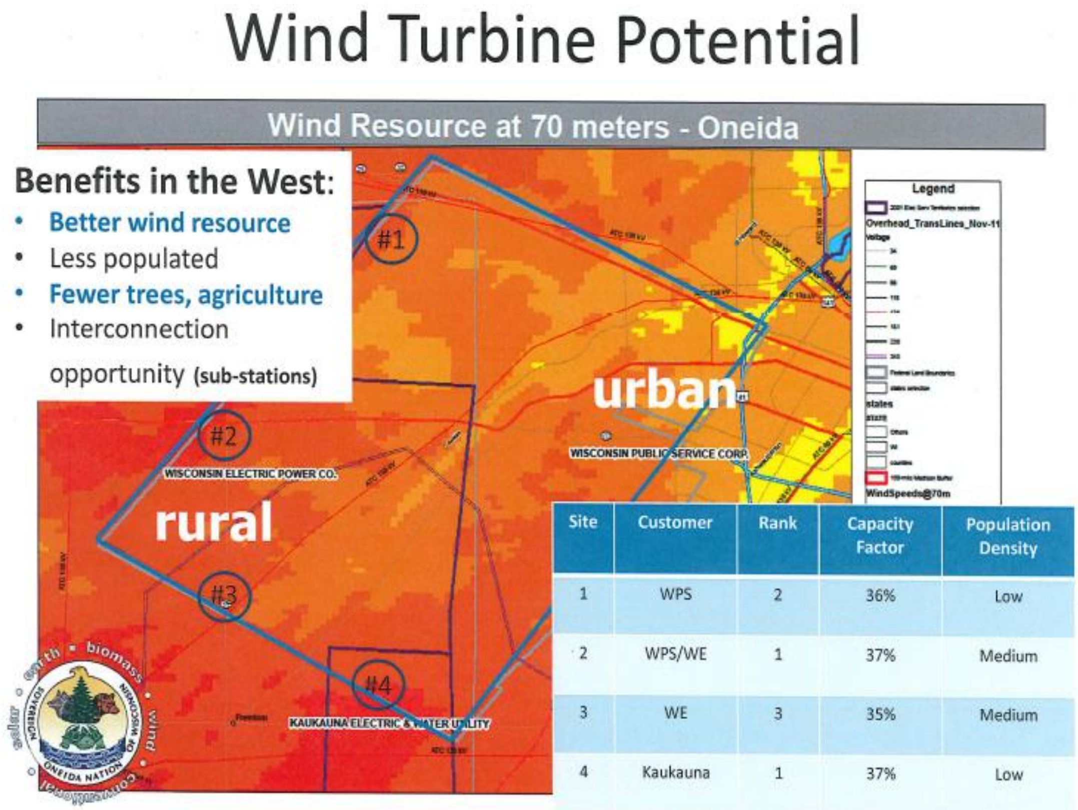


Table 7, Oneida met-tower results

Met Tower Monitoring Summary

Data Indicator	Monitoring Height (m)	(ft)	Jan 2010	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG 2010
P Windspeed (m/s)	57	187	6.3	5.2	4.9	6.4	6.4	4.6	4.7	4.9	5.7	5.9	6.2	6.0	5.6
R Windspeed (m/s)	57	187	6.2	5.1	4.8	6.4	6.4	4.5	4.7	4.9	5.6	5.9	6.2	6.0	5.6
P Windspeed (m/s)	47	154	6.0	4.8	4.5	6.1	6.1	4.3	4.4	4.5	5.3	5.5	5.9	5.7	5.2
R Windspeed (m/s)	47	154	5.9	4.9	4.6	6.1	6.1	4.3	4.4	4.6	5.3	5.5	5.9	5.7	5.3
P Windspeed (m/s)	32	105	5.4	4.3	4.0	5.5	5.5	3.8	3.8	3.9	4.6	4.8	5.3	5.1	4.6
R Windspeed (m/s)	32	105	5.3	4.2	3.9	5.4	5.4	3.8	3.8	3.9	4.6	4.8	5.4	5.1	4.6
Status / Issues	--	--	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	--
Data Availability (%)	--	--	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Data Indicator	Monitoring Height (m)	(ft)	Jan 2011	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG 2011
P Windspeed (m/s)	57	187	5.1	6.4	5.2	6.0	6.0	5.3	4.6	4.5					5.4
R Windspeed (m/s)	57	187	5.1	6.4	5.2	6.0	5.9	5.3	4.6	4.5					5.4
P Windspeed (m/s)	47	154	4.8	6.1	5.0	5.8	5.7	5.0	4.2	4.1					5.1
R Windspeed (m/s)	47	154	4.8	6.2	5.0	5.7	5.7	5.0	4.2	4.2					5.1
P Windspeed (m/s)	32	105	4.2	5.5	4.4	5.2	5.1	4.4	3.7	3.5					4.5
R Windspeed (m/s)	32	105	4.3	5.5	4.5	5.3	5.1	4.5	3.7	3.5					4.5
Status / Issues	--	--	ok	ok	ok	ok	ok	ok	ok	ok					--
Data Availability (%)	--	--	100%	100%	100%	100%	100%	93.5%	100%	100%					99.2%

Figure 8, Financial analysis #1 for wind proposal

SITE #2 – ONEIDA SUBSTATION – Near intersection of 54 and 55

- 6.5 – 6.8 meters / second at 70 meters above ground level
- 37.2% Net Capacity Factor
- Interconnection costs: $75,000 (Estimated)
- New transmission costs: $25,000 (0.5 mile)

No Grants or Incentives

ASSUMPTIONS	
Operational	
Commercial Operations Date	12/31/2014
Project Size (kilowatts)	1,700
Project Life (Years)	25
Net Capacity Factor	37.2%
Production Degradation / Year	0%
Power Purchase Agreement ($/kWh)	$0.04
PPA Escalation	2.0%
Maintenance Cost / Yr	$50,000
Maintenance Cost Escalation	3.0%
Maintenance Cost Start Year	3
Monitoring Cost/yr	$0
System Down Time (Years 1-10)	0%
System Down Time (Years 11-20)	0%
Insurance Cost / Yr	$5,400
Capital, Tax & Financing	
Turbine Installation Cost	$3,500,000
Distance to Transmission Line (Miles)	0.5
Cost per mile of new Transmission	$50,000
Cost of new interconnection equipment	$75,000
Total Cost of new Transmission & IC	$100,000
Total Turbine Installation Cost	$3,600,000
DOE Grant	0%
Other Grant (i.e. FoE)	0%
Investment Tax Credit	0%
Tax Basis	$3,600,000
Federal Tax Rate	0%
State Tax Rate	0%
Capital Gains Tax Rate	0%
Oneida Share of Installed Cost	$3,600,000
% of Total - Grant funded by Debt	50%
Total Debt Amount	$1,800,000
Interest Rate on Debt	5.0%
Debt Term	25

RESULTS	
System Size (kW)	1,700
Project Lifespan	25 years
Estimated Annual Electricity Production (kWh)	5,539,824
Total Turbine Installation Cost	$3,600,000
DOE Grant Value	$0
Other Grant (i.e. FoE)	$0
Cost After Incentives	$3,600,000
Estimated Payback Period (years)	23
25 Year Value of Energy Production	$7,097,689
Average Cost/kWh Generated	$0.026
Average Projected Sale Price / kWh	$0.051
Internal Rate of Return (IRR)	0.9%
Net Present Value (at 3% Discount Rate)	-$438,586
Sum of Net Revenues	$7,097,689

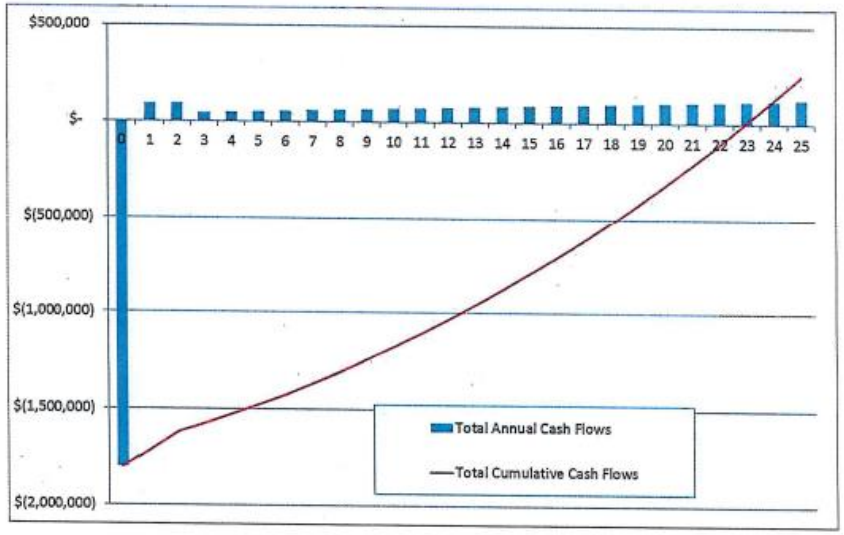
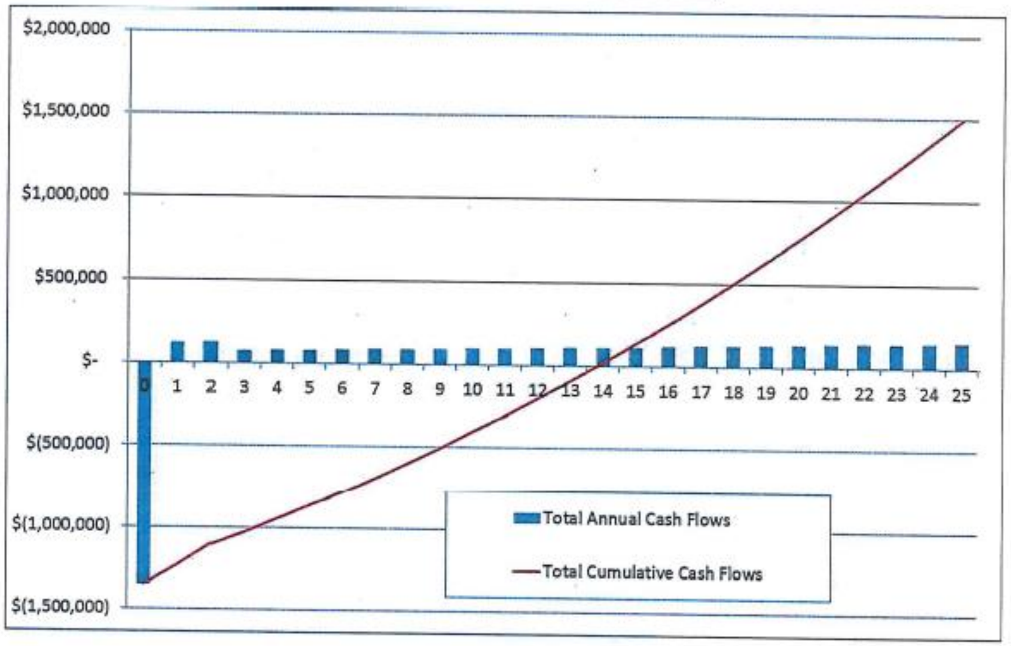


Figure 9, Financial analysis #2 for wind proposal

ASSUMPTIONS	
Operational	
Commercial Operations Date	12/31/2014
Project Size (kilowatts)	1,700
Project Life (Years)	25
Net Capacity Factor	37.2%
Production Degradation / Year	0%
Power Purchase Agreement ($/kWh)	$0.04
PPA Escalation	2.0%
Maintenance Cost / Yr	$50,000
Maintenance Cost Escalation	3.0%
Maintenance Cost Start Year	3
Monitoring Cost/yr	$0
System Down Time (Years 1-10)	0%
System Down Time (Years 11-20)	0%
Insurance Cost / Yr	$5,400
Capital, Tax & Financing	
Turbine Installation Cost	$3,500,000
Distance to Transmission Line (Miles)	0.5
Cost per mile of new Transmission	$50,000
Cost of new interconnection equipment	$75,000
Total Cost of new Transmission & IC	$100,000
Total Turbine Installation Cost	$3,600,000
DOE Grant	25%
Other Grant (i.e. FoE)	0%
Investment Tax Credit	0%
Tax Basis	$3,600,000
Federal Tax Rate	0%
State Tax Rate	0%
Capital Gains Tax Rate	0%
Oneida Share of Installed Cost	$2,700,000
% of Total - Grant funded by Debt	50%
Total Debt Amount	$1,350,000
Interest Rate on Debt	5.0%
Debt Term	25

RESULTS	
System Size (kW)	1,700
Project Lifespan	25 years
Estimated Annual Electricity Production (kWh)	5,539,824
Total Turbine Installation Cost	$3,600,000
DOE Grant Value	$900,000
Other Grant (i.e. FoE)	$0
Cost After Incentives	$2,700,000
Estimated Payback Period (years)	14
25 Year Value of Energy Production	$7,097,689
Average Cost/kWh Generated	$0.019
Average Projected Sale Price / kWh	$0.051
Internal Rate of Return (IRR)	6.1%
Net Present Value (at 3% Discount Rate)	$566,999
Sum of Net Revenues	$7,097,689



Energy Crop Component

OTIW is currently exploring local opportunities to grow and harvest its own energy crops for heating purposes initially, but eventually expanding to include liquid fuel production. (There are a few examples where a biomass energy crop has been used for electricity generation, however this typically is supported where large-scale energy production facilities {e.g. coal-fired power plants} will purchase a bioenergy crop material from local farming operations to supplement their primary resource, coal; significant volumes are required to meet demand.) If local supply and a robust technology can motivate and support a local demand for this energy crop, then the local market for such a product may be able to support a self-sustaining energy production operation.

We are working with the University of Wisconsin Green Bay on this energy crop test plot. Refer to *Figure 10, Oneida energy crop project*. Oneida's interest in the project has to do with local production, processing, and use of a bioenergy crop. This can potentially be a local and sustainable source of energy that minimizes fuel import and transport costs and it optimizes local production and use. UWGB's interest in the project has to do with feasibility of converting marginal agricultural row-crop land (poorly drained soils) into perennial grasslands used for biofuel production. Marginal land is the significant piece of this project; competition for land between food and energy interests is being discouraged, in large part due to the impending demand for prime farm land to support food production for a growing population. This also suggests that carbon capture and carbon neutral bioenergy production systems will support climate change mitigation policies and begin the transition away from carbon-rich fossil fuels and associated emissions. Native grass species do serve a multi-functional purpose by providing other local benefits beyond energy, including decreased water runoff, increased infiltration, decreased contamination of local water ways from nonpoint waste, improved habitat, and increased plant and animal diversity.

The Oneida Reservation does contain a significant amount of agricultural land. Refer to *Table 8, Oneida Reservation land use*. The Energy Team has initiated this energy crop study, that includes switchgrass, to investigate the Tribe's ability to use their acres to grow a local energy source for fuel or heat. See *Figure 12, Energy crop fact sheet for additional information*. The literature shows that a typical yield is four to five harvested tons per acre per year. Based on Tribal land use and acres of existing grasslands or a combination of marginal and prime agricultural lands (*Table 9, Oneida Reservation soil drainage classes and area*), UWGB forecasts 5,000 tons to 15,000 tons of available prairie grass material for harvest. It's apparent, however, that field results and market forces will be slow to develop. This activity requires a level of patience and commitment until such benefits can show themselves. It's up to decision makers to commit to a vision.

Figure 10, Oneida energy crop project

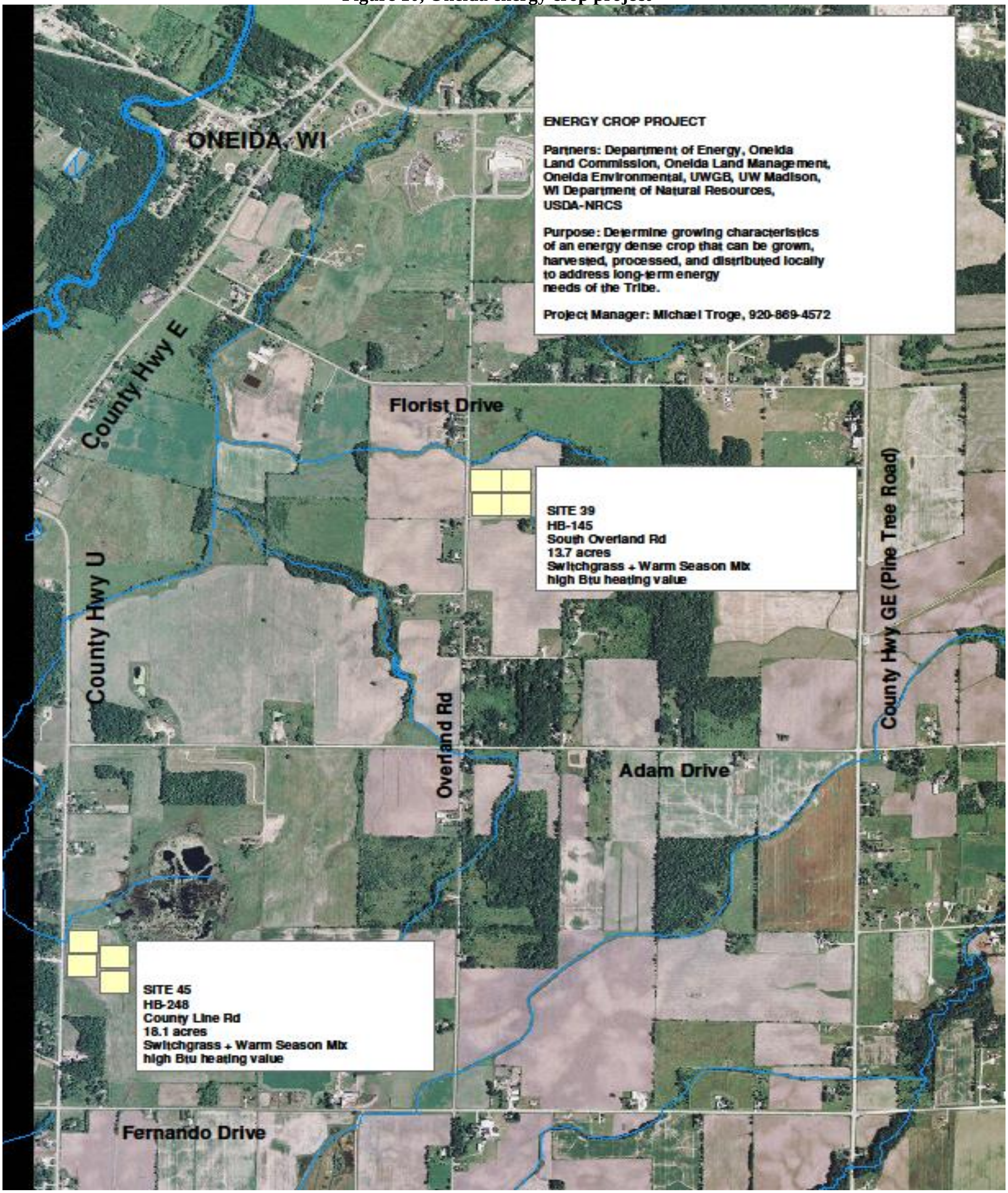


Table 8, Oneida Reservation land use

Table 4: Oneida Reservation land use. Miscellaneous land use includes quarries, borrow pits, rock outcrops, and landfills. Bold land uses were compatible with conversion to perennial biofuel grasslands or herbaceous biofuel biomass harvesting.

Land Use	Area (ha)	Area (acres)	Relative Abundance (%)
Agriculture	**15,769.0**	**38,949.4**	**59.4**
Grassland/Pasture	**920.4**	**2,273.4**	**3.5**
Woody vegetation	5,860.2	14,474.7	22.1
Developed	3,743.0	9,245.2	14.1
Miscellaneous	164.5	406.4	0.6
Open Water	82.0	202.5	0.3
Total	*26,539.1*	*65,551.6*	*100.0*

Table 9, Oneida Reservation soil drainage classes and area

Table 5: Abundance of USDA Dominant Soil Drainage Classes for the Oneida Reservation. Miscellaneous land use includes quarries, borrow pits, rock outcrops, and landfills. Bold drainage classes were considered available for conversion to perennial biofuel grasslands or biofuel biomass harvesting.

Soil Drainage Class	Area (ha)	Area (acres)	Relative Abundance (%)
Excessively, Well, or Moderately Well Drained soils	14,957.7	36,945.6	56.4
Agriculture	*9,385.6*	*23,182.5*	*62.7*
Grassland/Pasture	*402.7*	*994.6*	*2.7*
Woody vegetation	*2,442.0*	*6,031.6*	*16.3*
Developed	*2,705.5*	*6,682.6*	*18.1*
Open Water	*22.0*	*543.*	*0.1*
Somewhat Poorly, Poorly, or Very Poorly Drained soils	**11,417.7**	**28,201.6**	**43.0**
Agriculture	***6,666.1***	***16,465.3***	***58.4***
Grassland/Pasture	***516.3***	***1,275.2***	***4.5***
Woody vegetation	*3,235.3*	*7,991.1*	*28.3*
Developed	*955.6*	*2,360.2*	*8.4*
Open Water	*44.5*	*109.8*	*0.4*
Miscellaneous	163.7	404.4	0.6
Total	*26,539.1*	*65,551.6*	*100.0*

Conclusions and Recommendations

The energy strategy for the Oneida Tribe of Indians of Wisconsin is a work in progress. Our analysis has provided the initial starting point to integrate a broader clean energy strategy into our current energy portfolio.

- First and foremost, the strategy will emphasize the integration of energy efficiency into buildings and infrastructure. This will require a working knowledge of technologies and products as they become available.

1) The data supports a strategy with short term goals that pursue end-use opportunities incorporating solar (electric and thermal) and bioenergy (wood pellets and cordwood) into facilities and homes that have a need. Thermal ground-sources (i.e. geothermal) in facilities and campus-style developments may also assist with energy portfolio goals.
2) Medium-term goals will analyze and identify large-scale community wind opportunities as the social and economic climates evolve. Large-scale bioenergy opportunities may also arise as markets become available.
3) Long-term goals will study bioenergy opportunities (for heat or fuel) that come from the Tribe's land management activities. Again, markets largely control if and when these kinds of entrepreneurial ideas will be recognized. But from a sustainable energy standpoint, the Tribe stands to gain from local production <u>and</u> consumption of a bioenergy product in its own backyard.

➢ In keeping with the presumption that an organization's total energy use contributes to the total national energy picture, all organizations will provide a collective good by implementing their own clean energy portfolio. The challenge for any community will be to keep energy usage at current levels with an ultimate goal to decrease energy usage levels. In today's belief that economic growth is essential, energy efficiency and renewable energy are the most effective means to achieve reduction goals.

Clean energy is a complex issue. There are a broad range of variables that influence the decision matrix that controls the smallest of projects to the largest of comprehensive strategies. Any breakdown in the availability of resources, procurement of funding, advances in technology, adaptability to infrastructure, acquiescence of recipients, or the migration of markets can render a clean energy project lifeless at any stage. The economic system is undeniably the controlling force by which *most* communities and nations solely base their decision points. Scientific findings and sustainable principles have yet to infiltrate the board rooms where these decisions are made. Political will remains to be the driving force that can overcome the restraints of project or strategic execution. Policies at the local, state, and federal levels can provide incentive to move in that direction. So far, however, those actions have not guaranteed any long-term shift away from business-as-usual. Transitioning from a conventional energy to a clean energy economy will take time, will require commitment, and it will not be easy.

Lessons Learned

What follows are the lessons learned while working on this project. They are not listed in any particular order:

- Technologies and infrastructure have emerged into highly specialized industries.
- Strategy development is highly influenced by markets and technology.
- Strategy development requires careful thought and analysis.
- Modeling energy investment scenarios in a dynamic economic and complex political environment is challenging.
- Buy-in and commitment are not automatic.
- It takes a team of people to execute an opportunity.
- A small number of large-scale energy projects are easier to manage and maintain compared to a large number of small-scale projects.
- The energy infrastructure is strictly driven by economic forces.
- Energy considerations and strategies need consensus by a critical mass.
- Energy portfolio development is plagued with immediate, single-project hesitations and delays.
- Payback does not account for a community's long-term commitment to geographic roots.
- Energy savings are not recognized as revenue in an organization's accounting procedures.
- The gradual erosion of policies, incentives, and tax benefits that support renewable energy development will have a direct and profound impact on a successful clean energy portfolio.

Appendix

List of documents:

1. Figure 11, Energy optimization model; preliminary results fact sheet
2. Figure 12, Energy crop fact sheet
3. Figure 13, Initial solar deployment proposal on Tribal facilities information sheet

Figure 11, Energy optimization model; preliminary results fact sheet

Project Update

Energy Optimization Model; Preliminary Results

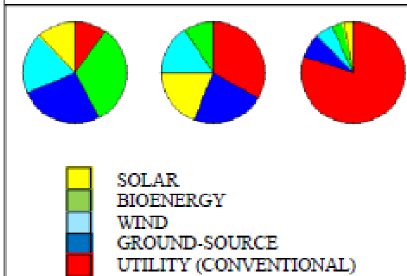
ONEIDA ENERGY TEAM

Emerging Issues

Purpose

This Project is designed to provide the Oneida Tribe of Indians of WI with a **comprehensive energy investment strategy** for renewable energy and conventional energy sources. It is called the ***Energy Optimization Model***. It is a component of the larger energy management plan that aims to capitalize on ***Tribal energy sovereignty***. Establishing a renewable portfolio standard (RPS) is a clear commitment to future generations.

Figure 1: Hypothetical Renewable Portfolio Options



Definitions

1 Megawatt = 1,000 kilowatts = 1,000 kw.
1 Megawatt-hour = 1,000 kilowatt-hours = 1,000 kWh.
The average home in Wisconsin uses 9,000 kWh/year.
RE = renewable energy, e.g. solar, wind, bioenergy, ground-source

Objectives

⇒ Assess local, RE resources;
⇒ Assess Tribal property to determine RE potential;
⇒ Provide a feasibility study for RE development;
⇒ Research funding strategies;
⇒ Develop a model that creates different RPS scenarios: 5%, 10%, 20%;
⇒ Create a plan that will maximize the Tribe's RE development potential.

Preliminary Results - Electricity

- **Total electrical use of Tribal facilities**: 31 million kWh;
- 15 buildings consume 81%; 50+ buildings consume 19%;
- *Utility policies for interconnecting solar or wind to their transmission lines are economically challenging;*
- **Large wind power: least expensive/kWh, but lowest value**
  - ◊ Requires considerable negotiation over wholesale pricing,
  - ◊ Permitting is very extensive (up to 3 years),
  - ◊ Wind resource is best at west and south boundaries,
  - ◊ Interconnection is limited to sub-stations,
  - ◊ Controversial reputation,
  - ◊ Utility RPS already fulfilled.

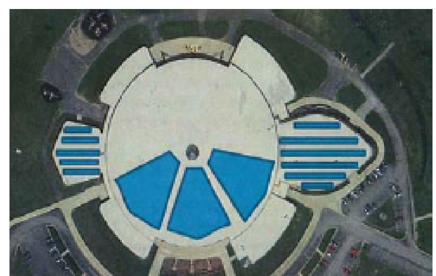
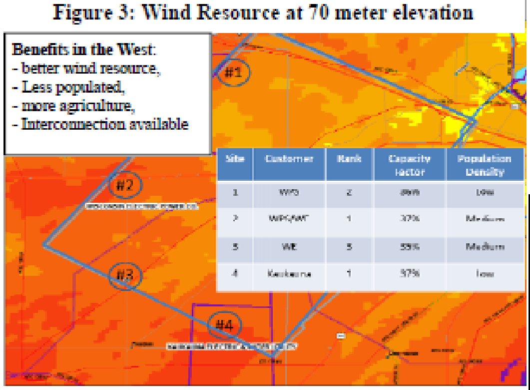


Figure 2: Turtle School Solar Design

Figure 3: Wind Resource at 70 meter elevation



- **Solar is preferred technology**
  - ◊ Easy to install, flexible, scalable,
  - ◊ Array on benign part of building (the roof),
  - ◊ Rest of equipment has small footprint,
  - ◊ Building is direct recipient of energy produced,
  - ◊ Maintenance can be performed by Tribal staff,
  - ◊ Can sell to utility at retail rate,
  - ◊ More funding opportunities.

	Solar	Wind
Project size	1.0 Megawatt	3.4 Megawatts
Production (kWh)	1.3 million	10.7 million
Location	13 buildings	1 of 3 sites (KU declined)
Cost	$3 million	$8 million
IRR	<2%	<2%
Revenue	$0.10/kWh	$0.04/kWh
Limitations	cost	Power purchase agreement

Oneida Environmental, Health & Safety Division

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June, 2014

Project Update

ONEIDA ENERGY TEAM

Emerging Issues

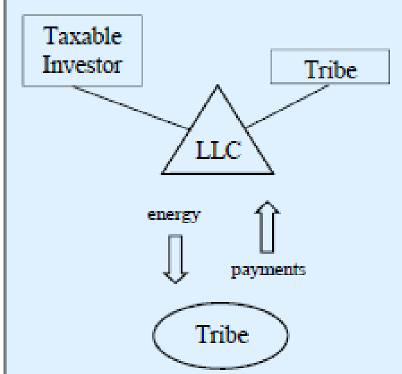
Renewable Portfolio Standard

- **Utilities serving the Tribe**: Wisconsin Public Service and WE Energies
- **Current utility energy generation by fuel**: Coal 70%; Natural Gas 23%; Hydropower 3%; Wind 3%.
- 1.3 million kWh from solar will give Oneida a 4% RPS;
- Future investment in other technologies will increase the Tribe's RPS and commitment to RE over time.

Funding Strategies

- Tax benefits are important for RE development: 30% Investment Tax Credit, depreciation;
- Oneida Tribe is a non-taxable entity;
- A taxable investor, as a partner, can get value from tax benefits;
- **Recommended financing flip model**:
  - ⇒ LLC partnership: front-end ownership by taxable investor with payments from the Tribe to the LLC.
- Other models: Sale-Leaseback approach, Allocation-by-Lease approach.

Figure 4: LLC partnership flip model



	Front-end	Back-end
Tribe	1%	99%
Investor	99%	1%

Other Funding Used for Cost-share

- Department of Energy Deployment Grants
- 3rd party energy provider - not fully defined by Public Service Commission
- Crowdfunding - Techniques to raise money from small investors
- Solar utility cooperative -

Figure 5: Tribal internships

Supplemental Results

- Tribal student involvement;
- Heating the Midwest conference, April 2014;
- Conservation Department Energy Reduction Project
- Collaboration with Wisconsin State Energy Office;
- Formation of Midwest Tribal Renewable Energy Association (MTERA);
- Policy monitoring at the state and federal levels;
- Oneida Tribe & Brown County energy work featured by UW-Extension;
- Oneida Energy Crop Study with UWGB (refer to Native Grasses Project Update);
- Investigating natural gas commodity markets for competitive, reliable pricing;
- Investigating the Tribal Utility Authority concept;
- Investigating hemp as a supplemental source for local production.

Partners

- U.S. Department of Energy,
- University of Wisconsin Green Bay,
- H&H Energy Management Services,
- Godfrey & Kahn,
- UW-Extension

Oneida Energy Team:

- Environmental Resources Board,
- Department of Public Works,
- Oneida Farm,
- Land Management,
- Engineering,
- Planning,
- Housing Authority,
- Land Commission,
- Oneida Sustainable Resource Advisory Council,
- Energy Development Program.

Contact Information

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Oneida Environmental, Health & Safety Division

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July, 2014

Figure 12, Energy crop fact sheet

Project Update

ONEIDA ENERGY TEAM
Emerging Issues

Biomass: Native Grasses in Tribal Agriculture Encourage Energy Sovereignty

Purpose

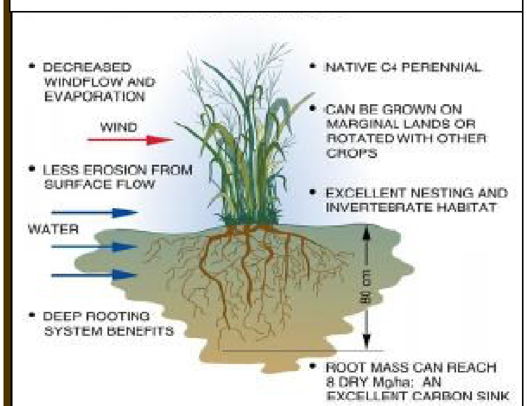
For thousands of years, native prairie was an important feature on the landscape. Along with forests, ***prairies are an essential ground cover protecting soil and water and providing habitat***. Humans have altered the landscape at a massive scale, destroying millions of acres of prairie. This resulted in erosion, habitat destruction, and water pollution. A well-known historical period, The Dust Bowl, was the result of prairies being replaced by agriculture. Locally, the agriculture industry contributes more than 250,000 pounds of phosphorus and 100,000 tons of sediment per year to the Bay of Green Bay, causing algae blooms, anoxic conditions, and fish kills. Reestablishment of prairies will bring back that important ground cover and keep the soil in place. In addition to preserving soil, grasses can provide another human need - energy! Native grasses and trees offer an opportunity for ***Tribal energy sovereignty***.

Switchgrass stand

Environmental Services

The thick root mass of grasses give stability to the soil while the stems aboveground protect the surface from driving rains and flooding. These traits have a tremendous impact, minimizing soil erosion and nutrient pollution. Prairies also minimize stormwater impacts by slowing the water down and encouraging infiltration. Habitat for wildlife and songbirds also provides for biodiversity and beautiful landscapes. Another valuable trait of an energy crop is a greater tolerance for wet soils where corn and soybeans tend to fail. The occasional mowing or controlled burn will help to keep prairies healthy and vibrant. Native grass species are perennial, which means the prairie renews itself every year, eliminating the need to plant year after year. Refer to Figure 1.

Figure 1



End-use Potential

In addition to the environmental services they provide, native grasses can also serve a purpose after they are harvested. Straw production can be used as bedding for cattle, as garden mulch, or in compost. Another overlooked opportunity is energy. The British thermal unit (Btu) is a measure of energy and is used to determine space heating needs. Table 1 shows a comparison of different biomass materials; grass has comparable energy content to these other wood materials. This energy crop can be easily adapted to an agricultural field that is managed with the same equipment that any farmer would use on a food crop.

Table 1

Fuel (oven-dried)	Energy content (Btu/pound)
wood (oak)	9,500
wood (maple)	8,400
Green wood	4,300
Native grass	8,200

Partners

Oneida Tribe Energy Team; Oneida Tribe Energy Development Program; University of Wisconsin Green Bay; U.S. Department of Energy; Oneida Land Commission; Land Office; Oneida Farm; Environmental Division; UWM, WDNR, USDA-NRCS

Oneida Environmental, Health & Safety Division

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June, 2014

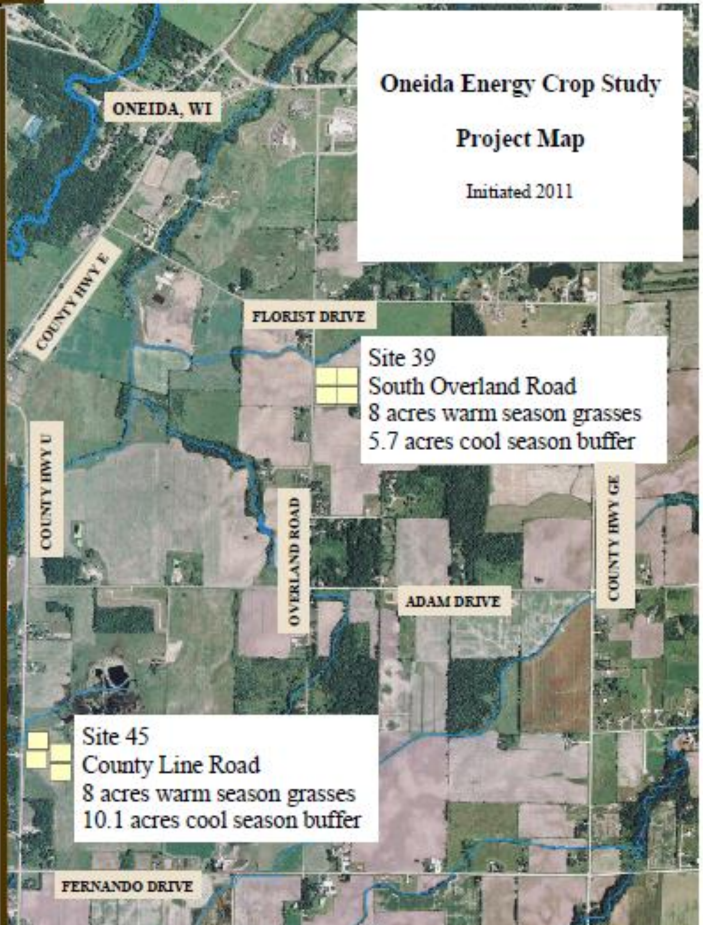
Project Update

ONEIDA ENERGY TEAM

Emerging Issues

Oneida's Energy Crop Study

In 2011, Oneida Tribe and UWGB partnered to initiate a ten-year energy crop study to make some determinations about growing characteristics, opportunities for bioenergy development, and environmental benefits. Working with the Oneida Land Commission, we established 16 acres on two different fields located on County Hwy U and on Overland Road. UWGB has been monitoring a variety of natural processes, including groundwater, soil chemistry, biodiversity, and carbon sequestration.



2014 marks our 4th growing season. Establishing the grass has been challenging, but nonetheless successful - 75% of the site contains a healthy population of native grasses with new growth coming each year. We expect to have our first harvest in fall, 2014. At that time we will document production to forecast energy availability. Other end-use research includes:

- moisture content,
- processing the material,
- appliances that can burn grasses,
- ash content.

Being a research and development project, we expected to be confronted by such questions. Native grasses are a local energy source that offer a wide variety of social, economic, and environmental benefits for the Tribe. We are investigating ways to harness this energy source.

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June, 2014

Figure 13, Initial solar deployment proposal on Tribal facilities