Project Earth Lover

PONCA TRIBE OF NEBRASKA

Environmental Protection

Executive Summary

The Ponca Tribe of Nebraska was awarded a grant through Department of Energy in September 2011 for our Project Earth Lover grant which was to run from September 1, 2011 thru December 31, 2012. The purpose of the grant was to continue with our Project Earth Lover branding which would have the following objectives:

1. Develop a scope of work and identify a contractor to perform an Energy Options Analysis (EOA) of all tribally owned office facilities and present the findings to Tribal Council for consideration and determination of future projects for the energy program to pursue.
2. Develop community workshops that educate tribal members on energy efficiency and renewable energy utilizing up-to-date information from resources such as the Department of Energy website. Conduct weatherization workshops including providing energy efficiency kits.
3. Tribal public awareness events to display information and products to increase awareness and education of our "Earth Lover" focus.

In September 2012 our Energy Planner transferred positions within the Tribe and the Environmental Specialist took over the Project Earth Lover grant. In addition we asked for a no cost extension be awarded based on our project turnover. An extension was granted to run through June 30, 2013. All milestones were completed in January 2013 so we are submitting the final technical report several months earlier than previously anticipated.

Project Overview

In order for tribal leadership to have a clear understanding for future energy projects we had the objective of having an energy options analysis (EOA) completed at all tribally owned office facilities. This analysis was to identify in-depth energy reduction and renewable energy options at our locations.

To promote an earth lover understanding for our tribal members and employees we conducted weatherization workshops which helped in promoting energy efficiency on an individual scale to increase awareness and promote individual energy efficiency and change.

The public awareness component was achieved by having departmental booths at all tribally sponsored events where large numbers of tribal members were estimated to

attend. These included; our three annual pow-wows, health fair, back to school fair and newsletter and webpage updates. Our booth contained brochures and marketing products that branded an earth lover approach (reusable bottles and reusable shopping bags). In addition staff was present to educate and discuss small steps individuals could take to make changes in the larger society.

Objectives

The main objective of the project earth lover grant were to have an energy options analysis (EOA) completed and to share findings with tribal leadership to allow them to effectively screen energy options that will further develop the Tribe's long-term strategic plan and energy vision.

The second key objective was to enhance tribal members' capabilities, skills, and awareness of energy efficiency and conservation technology and practices through workshops.

Description of Activities Performed

Energy Options Analysis: We developed a scope of work for the energy options analysis (EOA) in order to obtain cost quotes in accordance with the procurement policy of the Ponca Tribe of Nebraska and worked with Department of Energy to ensure our chosen contractor met federal contracting guidelines. The EOA was performed at (3) of our facilities in Niobrara (community, health, headquarters), Lincoln, Omaha and Norfolk facilities The intended purpose was to have an energy assessment to analyze electrical energy consumption in order to make recommendations for reducing energy usage and identify possibilities for renewable energy integration into various buildings owned and operated by the Ponca Tribe of Nebraska. The second part of the EOA was to take the recommendations and develop a detailed cost analysis and estimated return on investment to assist Tribal leadership in prioritizing projects. Our contractor (Nebraska Renewable Energy Systems) then presented all findings to our Tribal Council in December of 2012.

Workshop Development: In the 10th month of the funding period we began advertising the workshops in the newsletter, webpage and Niobrara pow-wow. In the 12th month we began conducting weatherization workshops at all our office locations. The Assistant Environmental Specialist developed the curriculum based on energy conservation tips and detailed instruction on how to use products in the

weatherization kits as well as what outcomes would be achieved by the products use. We had such a large interest from tribal members that we conducted an additional workshop for all of our staff during our annual Employee Appreciation event. Based on these efforts we were able to educate and supply 230 weatherization kits and energy conservation measures during this funding period.

Community Education Events: Based on the period of performance extension we were able to attend our Restoration pow-wow in November 2011 and 2012, Annual pow-wow in August 2012, Walk-Run pow-wow in April 2012, Health Fair in June 2012 and the Lincoln Back to School Fair in August 2012. We developed the brochures for disbursement, procured marketing materials to promote our earth lover brand and attended all the above mentioned events.

Training

Mike Boggs the former Energy Planner attended the November 2011 and Stephanie Prichard-Slobotski attended the November 2012 Tribal Energy Review deliverable where the each presented updates on our Department of Energy grants. In addition, Mr. Boggs attended the Renewable Energy PPA Conference held September 16-18, 2012 in Las Vegas, Nevada.

Conclusions and Recommendations

Conclusions

In conclusion the Ponca Tribe of Nebraska was able to meet all of our grant milestones within the extended period of performance for grant DE-EE0005058. The information gathered from our Energy Options Analysis (EOA) gives us a needed roadmap in reducing our electrical outputs thus reducing our carbon footprint. We had the opportunity to educate 107 tribal members and 123 Ponca Tribe of Nebraska employees on energy conservation and small measures they could take individually to make a difference in the world they live. In addition we were able to speak with tribal members and members of the communities in which we live to educate and answer questions regarding energy conservation and how by conserving they were also spending less money. Our hope was that by showing them something tangible it would have a greater impact on their conservation efforts.

Recommendations

Below is a detailed listing of the Energy Options Analysis recommendations. We are leaving our Lincoln, NE facility off as it was not a viable option for solar or wind. These recommendations are what will help guide the tribal governing body as we move forward in our conservation quest.

Renewable Energy Assessment and Proposal

Prepared By:

Nebraska Renewable Energy Systems

Location:

Fred LeRoy Health and Wellness Clinic

2602 “J” Street

Omaha, NE 68107

Purpose

The purpose of this energy assessment was to analyze the energy consumption of the selected building in order to make recommendations for reducing energy usage and identify possibilities for renewable energy integration into various buildings owned and operated by the Ponca Tribe.

Overview

Energy data was examined and a site survey was conducted based on our experienced eye and extensive work with numerous Midwest Tribal entities. Our observations and recommendations were prepared and summarized in this report.

The sites examined have significant electrical consumption which was the focus of this initial survey. Significant increases in energy costs are occurring now and are expected to continue in the near and long term o and identification of the most beneficial opportunities to replace power now will provide energy saving to the tribe for decades to come.

Our site survey indicated there were very good opportunities for accessing solar resources for renewable energy production onsite.

NRES is very experienced with grants designed to assist with project development funding, although some project economics may justify investment without these additional sources. We are adept at identifying the lowest hanging fruit for maximum economic return and benefit as well as identifying secondary benefits to clean energy inclusion in your infrastructural portfolio. These opportunities are described in this report.

Solar energy has come of age and represents an excellent investment. NRES talks the talk as well, operating an Energy Farm Research Center that has operated off-grid over 8 years. We appreciate the opportunity to support and work with the Ponca tribe to identify areas that may be developed to improve self-reliance and efficiency. It is our hope that these surveys would identify the best technologies and systems for the tribe to consider.

Past Energy Consumption

We reviewed the electric bills for the Fred Leroy Health and Wellness Clinic and drew a comparison chart for energy consumption for the preceding three years as well as the projected energy production of a 25 kilowatt (kW) Photovoltaic (PV) system. As illustrated in the chart, the energy usage has been consistent through the years with the peak usage occurring during the summer months. A conclusion will be drawn based on the energy consumption history and the field survey as to the areas of greatest energy usage and potential energy use reduction.

It can also be noted from the chart that a photovoltaic system alone cannot meet the electrical energy demands of the building, given the available roof space. It is estimated about 2000 square feet are available on the roof with good solar access that could provide a cost effective platform for solar panels.

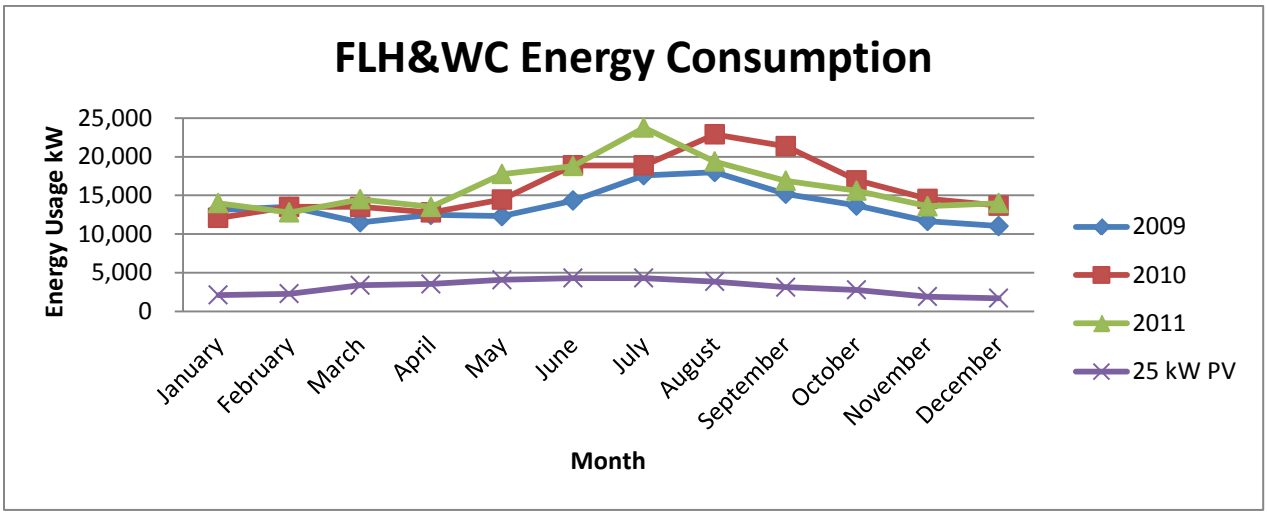

Figure 1: Energy consumption profile of the Omaha facility

	2009	2010	2011	25 kW PV
January	13,120	12,080	14,000	2125
February	13,520	13,520	12,800	2287
March	11,520	13,520	14,480	3388
April	12,480	12,800	13,520	3548
May	12,320	14,460	17,760	4094
June	14,320	18,880	18,800	4318
July	17,600	18,880	23,760	4317
August	18,000	22,880	19,360	3864
September	15,200	21,360	16,880	3140
October	13,680	16,960	15,600	2777
November	11,680	14,560	13,600	1919
December	11,040	13,680	14,000	1702
Average	13707	16132	16213	3123

Current Electricity Break Down

Kilowatt hour energy consumption observations from the field surveys are shown below. They have been sorted into categories that create a visual assessment of where energy usage can be reduced.

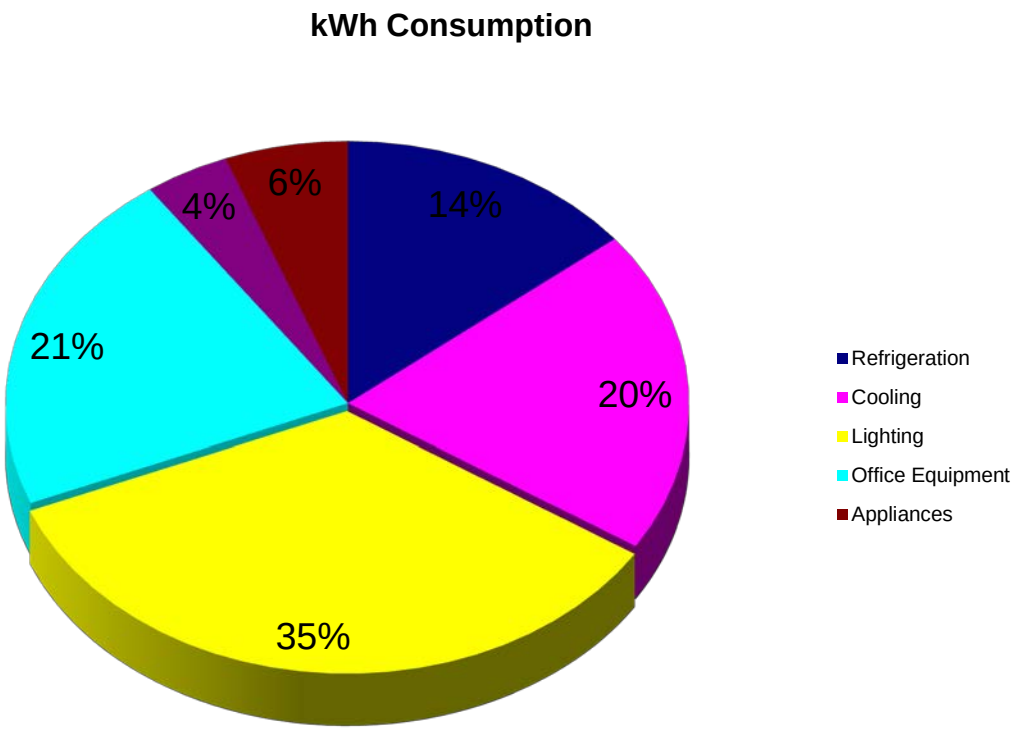

Figure 2: Electrical consumption breakdown chart based on field survey findings

The chart above shows a fairly typical commercial power consumption breakout with the exception that the fairly high ratio of refrigeration energy is due to the needs of the hospital for medical purposes. Our 'office equipment' category also ended up including numerous medical devices that expanded consumption above typical levels we have seen in other commercial space applications. The lighting component also stood out as relatively large share of the pie likely due to the higher watt/ft2 desired for a medical facility and the older style lighting we saw in place throughout the building. We also understand there are currently plans to increase lighting efficiency at the facility.

Assessment Summary

The property has very good overall efficiency. However, improvements are possible in order to further reduce energy consumption. The following is a list of energy conservation steps and renewable energy technology opportunities that could serve to reduce retail power purchases.

Energy Conservation Strategies

Lighting is a very large energy consumer in this facility. Our survey team was told that lighting and other upgrades are in the planning stage for the site. This would be a tremendously valuable effort and we would recommend going to T-5 or LED lighting to obtain maximum value over the long term.

Window films would provide improved energy conservation properties to reduce both thermal solar gain and retain cool air. There are several installers of these materials in Omaha and their cost reduction to installed cost ratio is exceptional. Window films would be an outstanding conservation investment at your facility and local suppliers would be glad to provide a facility survey and quote.

Water heaters could be insulated to reduce energy usage, though they were natural gas fired.

Since refrigeration was such a big part of the facility electrical usage, ensuring that these units are running efficiently with proper maintenance is important. Cleaning dust and debris away from compressors and using Energy Star rated units will aid in maintaining the highest possible efficiencies.

Potential for Renewable Energy Implementation

Wind Turbine

Because of zoning restrictions and the wind limitations created by surrounding buildings and trees, a wind turbine would not be a good choice for an alternative energy source at this location. Your consumption profile shows maximum electrical use in the summer and wind power generates the majority of its annual power in winter and spring, replacing energy at the lower value winter rates.

Solar Thermal

This location gets the most sun during the summer months and the least sun during the winter months and the vertical south face most suited to thermal solar air heating is blocked by the trees. The rooftop would have great solar access in summer, but this would not be beneficial for heating purposes. This location would not be a productive one for a thermal solar air heating system.

Biomass heating

A backdoor leading directly to the HVAC room would help make a biomass heating system more practical and there is a potential for installing a biomass heating unit in the basement. Since we were only looking to reduce electricity consumption and space heating is currently powered by

natural gas, this option is outside of our scope. However, more research may be done to outline biomass heating opportunities at the facility should natural gas costs warrant such a review. The nature of the facility may not be conducive to an inside biomass furnace, in which case an outside unit might be more appropriate.

PV Solar

There is excellent potential for using solar cells on the property to reduce yearly electricity consumption. Solar energy is harnessed from the light of the sun and can be converted into heat and electricity. Sunlight is captured using either concentrating photovoltaic (PV) collectors or flat plate PV collectors. The location at the FLH&WC provides monthly solar access averages ranging from 86% and up. PV solar would be a regular source of renewable energy with a majority of the production taking place during the higher value summer months.

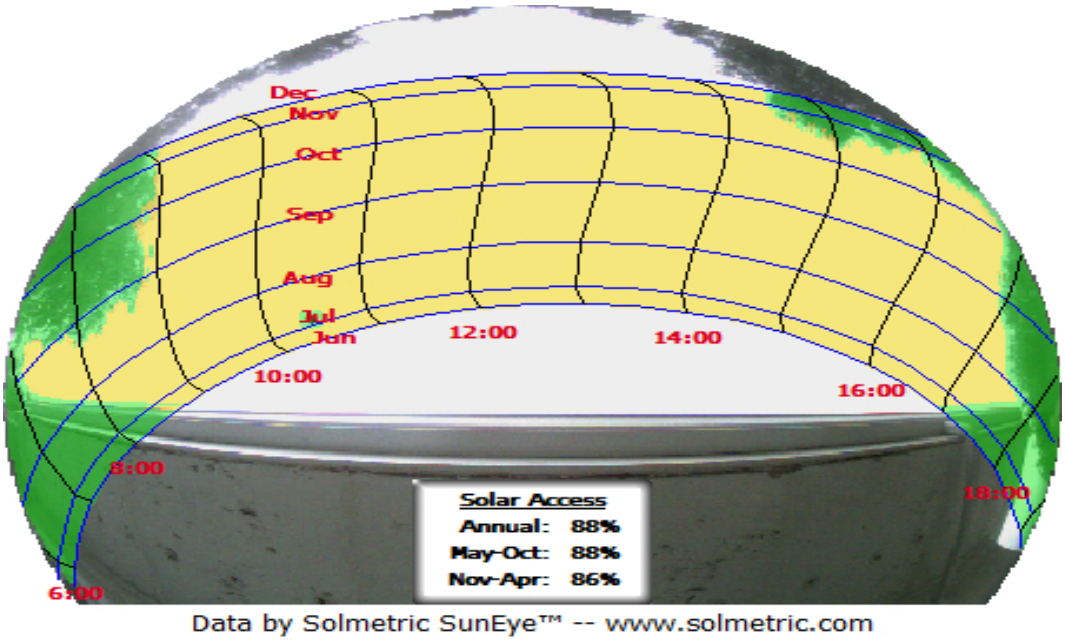

Figure 3: Solar access photo taken from second story window on south side.

The solar photo above shows very good solar access from the window as access to the roof could not be obtained while out survey team was onsite. It is clear that the taller roof above would have improved access than that shown in the photo above.

The upper roof has sufficient space for 25kW of PV panels, but a more detailed survey would be needed to ensure that available roof space is sufficient for the desired output. Nebraska limits these systems to 25kW for a net metering interconnection at each service meter.

Solar Hot Water

Using a solar hot water system is possible for this site to reduce energy costs associated with operating the water heater. Solar water heating systems include storage tanks and solar collectors,

with most solar water heaters requiring a well-insulated storage tank. Solar storage tanks have an additional outlet and inlet connected to and from the collector. In two-tank systems, the solar water heater preheats water before it enters the conventional eater heater. In one-tank systems, the back-up heater is combined with the solar storage in one tank.

This location would be considered marginal for a thermal solar hot water system although there is considerably more hot water used here than in typical commercial spaces. Access to the utility room from the roof becomes a very important factor when considering such retrofit applications as costs may rapidly escalate if easy access from the basement to the roof is not available. If such access for supply and return piping (3/4") can be found, this technology could be used to offset natural gas usage.

Next Steps:

- Implement desired conservation strategies outlined.
- Make sure there are no zoning regulations, which will limit your potential to install renewable energy technologies.
- Determine which renewable energy technologies you are interested in.

Location:

Niobrara Health Modular

249 Spruce Ave

Niobrara, NE 68760

Purpose

The purpose of this energy assessment was to analyze electrical energy consumption in order to make recommendations for reducing energy usage and identify possibilities for renewable energy integration into various buildings owned and operated by the Ponca Tribe in order to offset electrical consumption and improve self-sufficiency.

Overview

Three years of electrical energy consumption data was provided by Michael Boggs, Energy Planner of the Ponca Tribe. This data was examined and a site survey was conducted. Based on our experienced eye and extensive work with numerous Midwest Tribes, appropriate observations and recommendations were prepared and summarized here.

The sites examined have significant electrical consumption which was the focus of this initial survey. Significant electrical energy cost increases are anticipated in the near and long term, and identification of the most beneficial opportunities to reduce and/or replace power now will provide energy saving to the tribe for decades to come.

Our site survey indicated there was an excellent opportunity for accessing solar resources for renewable electricity production at the Ponca Health Facility.

NRES is very experienced with grant and support source identification to assist with project development funding, although some economics may justify investment without these additional sources. We are adept at identifying the lowest hanging fruit for maximum economic return and benefit as well as identifying secondary benefits to clean energy inclusion in your infrastructural portfolio.

In recent months solar energy has seemingly come of age and represents an excellent investment. Costs involved with installing solar energy systems has reduced significantly in the past year and NRES has been a long term partner with Ho Chunk in Winnebago who will soon be the second member of the 100kW+ club in Nebraska.

Past Energy Consumption

We reviewed the electric bills for the Health Modular (HM) facility and created comparison for energy consumption for the preceding three years as well as the projected energy production of a 10 kW solar system in comparison.

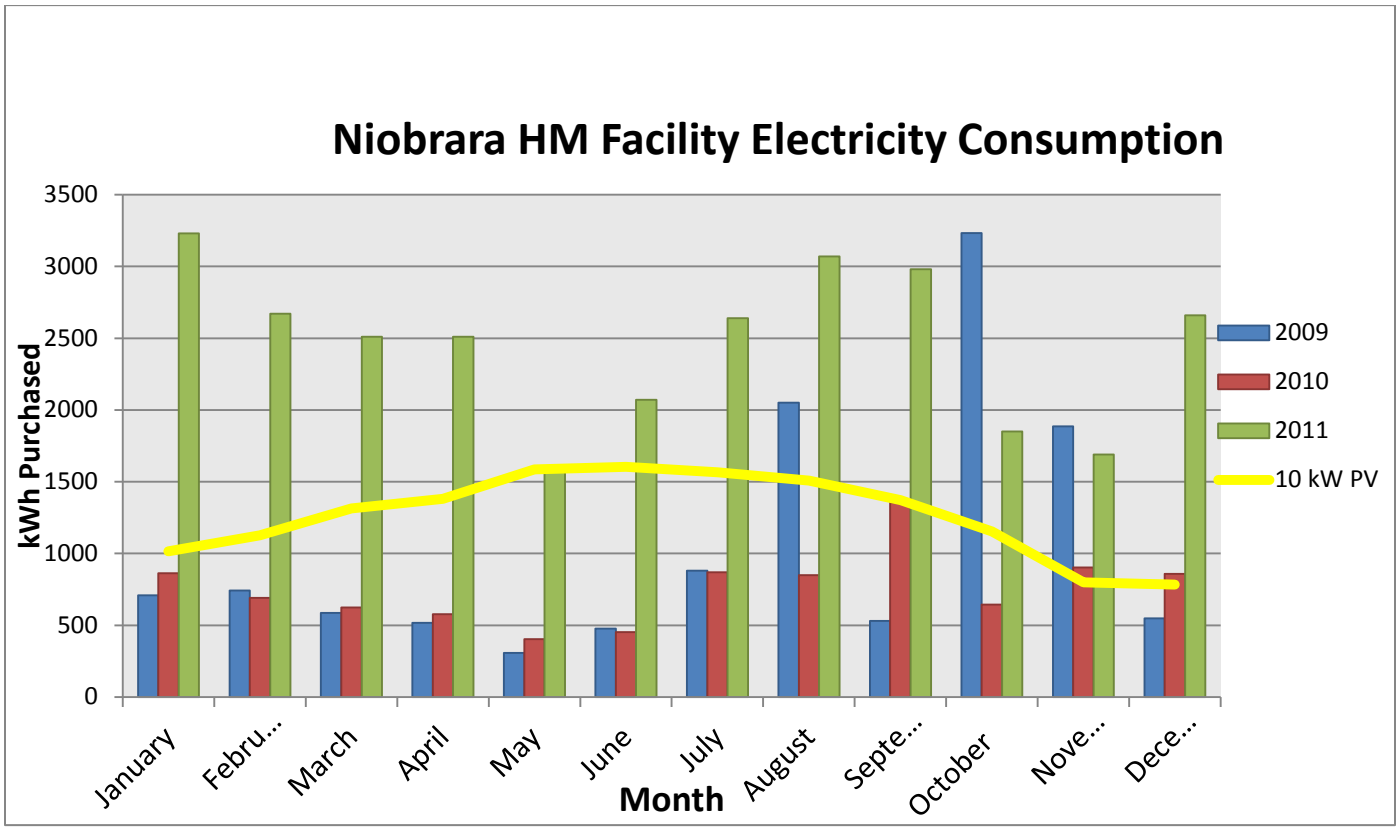

Figure 1: Consumption chart from 2008-2011 with a 10kW PV solar system production curve.

Several things can be noted from the graph above, primarily the greatly increased utilization of the facility in 2011 over previous years. This increased consumption was seen throughout the year, not just in months where HVAC loads would be noted during the summer months.

We believe that a significant portion of the increased consumption is also due to a very low efficiency HVAC system that would drive increased electrical use involved in both heating and cooling systems. Specific recommendations are presented in the conservation opportunity section.

It also seems apparent that the consumption trend is more impacted by usage than by seasonal conditions. A relatively high ratio of refrigeration seen in the pie chart also creates a significant baseline load that is not significantly affected by outside conditions.

Current Electricity Break Down

NRES would like to thank the Health Facility secretary for the time she took to show us around and explain the details of the power system there.

Kilowatt hour energy consumption trends are shown below based on the supplied consumption records and our field energy survey.

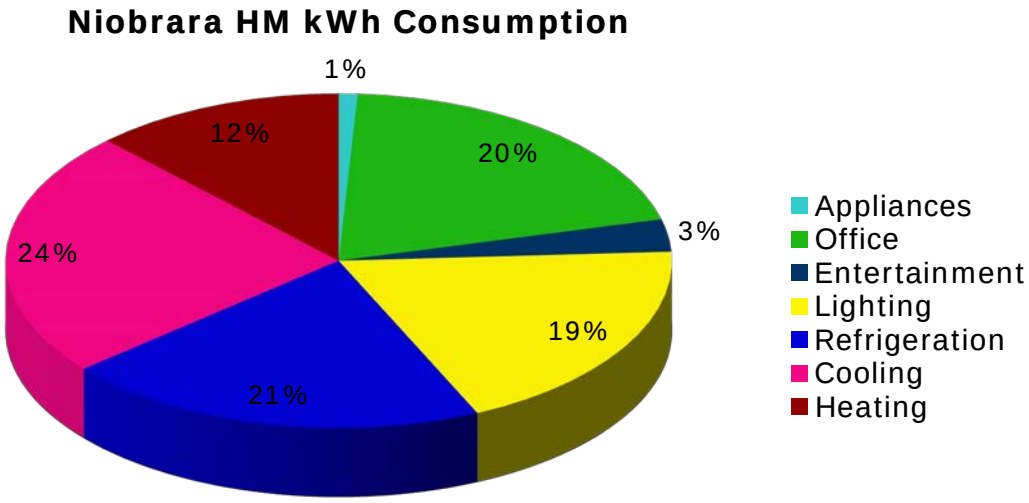

Figure 2: kWh consumption of various appliances and cooling units at the Niobrara Health Modular Building.

The pie chart above shows a fairly typical distribution for a commercial office space with an enlarged refrigeration share that would be typical for a health/ medical facility. Cooling energy consumption also exhibits a typical proportion of the pie chart for that use, but could be significantly reduced for this facility with an updated HVAC system.

Assumptions:

- Gym use was 3 hours/day with 1 hour of AV use per week
- Freezer and refrigerator were rated at 300 watts with 30% on cycling
- Microwave was 1200 watts at 0.5hrs/wk
- Electric range was rated 1200 watts at one hour per month

Assessment Summary

The property has moderate to low overall efficiency. The modular structure was constructed with very marginal quality materials and is being to show its age. However, numerous improvements are possible in order to further improve efficiency of this structure to enable more efficient operation in the years to come. The following is a list of energy conservation steps that can significantly reduce your energy usage.

Potential Energy Conservation Opportunities

Lighting is a large component of the overall energy consumption on the site. T-8 lighting is installed throughout the building and many fixtures have only 2 of the possible 4 bulbs installed, a good energy reducing strategy. Only 5 incandescent bulbs were found, which can be easily replaced with screw in LED bulbs, drastically reducing wattage while increasing its service life compared to incandescent. A complete bulb upgrade to LED should be considered for this facility.

The water heater and hot water piping around the hot water heater needs to be insulated to reduce electrical consumption and thermal energy loss. This original water heater is still in service and should also be considered for replacement.

Although not in our scope, the natural gas furnace was noted as a low efficiency unit with metal exhaust piping, this entire unit could be upgraded to reduce gas usage and associated electrical use. Although not inspected, but it is likely the blown in insulation of the attic has settled since its construction and an additional layer of blown in insulation should be applied to the attic crawl space. This is a very inexpensive thing to do and results in significant year round savings. A new roof laid over the existing roof would also provide some additional insulation.

The facility has shown three-fold increase in electrical usage in 2011 verse previous years. A significant portion of this increase is related to decreasing efficiency of the condensing unit outside. The unit is original to the building and was made in 1997 with a 10 SEER (Standard Energy Efficiency Rating) which is low compared to units that are currently available. Replacement of the HVAC system would be an excellent investment at this facility. The outside AC unit was also not shaded on the south side of the building and the insulation on the cold return piping needed to be improved near the unit to reduce thermal loss.

Window Films now possess outstanding energy conservation properties to reduce both thermal solar gain and retain cool air. There are several installers of these materials in Omaha and their cost reduction to installed cost ratio is exceptional. Window films would be an outstanding conservation investment at your facility and local suppliers would be glad to provide a facility survey and quote.

Potential for Renewable Energy Implementation

The Health Modular facility has a very specific opportunity with regard to renewable electricity production. The structure and property are on the northern down\slope of a hill and is located in the center of the town so PV solar stands out as an excellent option. The average cost of power at $0.11/kWh would allow a good return on investment for any efficiently installed system.

Wind Turbine

The Health Modular facility is not a good location for a wind turbine because of the local terrain. A turbine placed at this facility would have to be very tall to overcome the various objects around the area, which is set down lower from the hill crest and surrounded by trees.

Solar Thermal Air Heating

Solar thermal collectors on the vertical south faces would have poor performance because of the building location on the north side down slope of a hill.

Biomass Heating

The Health facility is prefabricated with a natural gas stove installed. An efficient conversion to a biomass unit would be possible but would be complicated because the current unit acts as both a cooling and heating unit. If a biomass unit was installed, a separate cooling system would be required, but since both the existing heating and cooling units are outdated and would be best replaced, this opportunity should be considered before such an upgrade is made. The realities of moving biomass into the hopper would also need to be carefully considered and a system selected that would meet the facility needs in terms of maintenance.

A Biomass heating system, like a wood or corn stove installed in the basement could be vented directly outside through foundation walls or windows and provide both supplemental and back up heating capability. In any case, if there was an electrical outage, the building will be cold and dark. An uninterruptible energy capability could be integrated into the recommended PV solar system to ensure the building has power in an outage if desired. The facility also has a three way switch at the meter outside that would allow easy hook up to a standby generator to run the facility if needed.

PV Solar

There is excellent potential for using solar on the roof of this facility; the roof has an exceptional pitch with unobstructed solar access.

Figure 3: The Health Modular building looking from the South.

The available roof space on the southern exposure is about 750 ft² which would provide space for about 10kW of roof mounted solar panels. The projected production of a solar system that size is included on the consumption trend chart. A smaller system (8kW) could be considered if the building HVAC and lighting systems were upgraded and window films installed. The roof provides excellent solar access shown below.

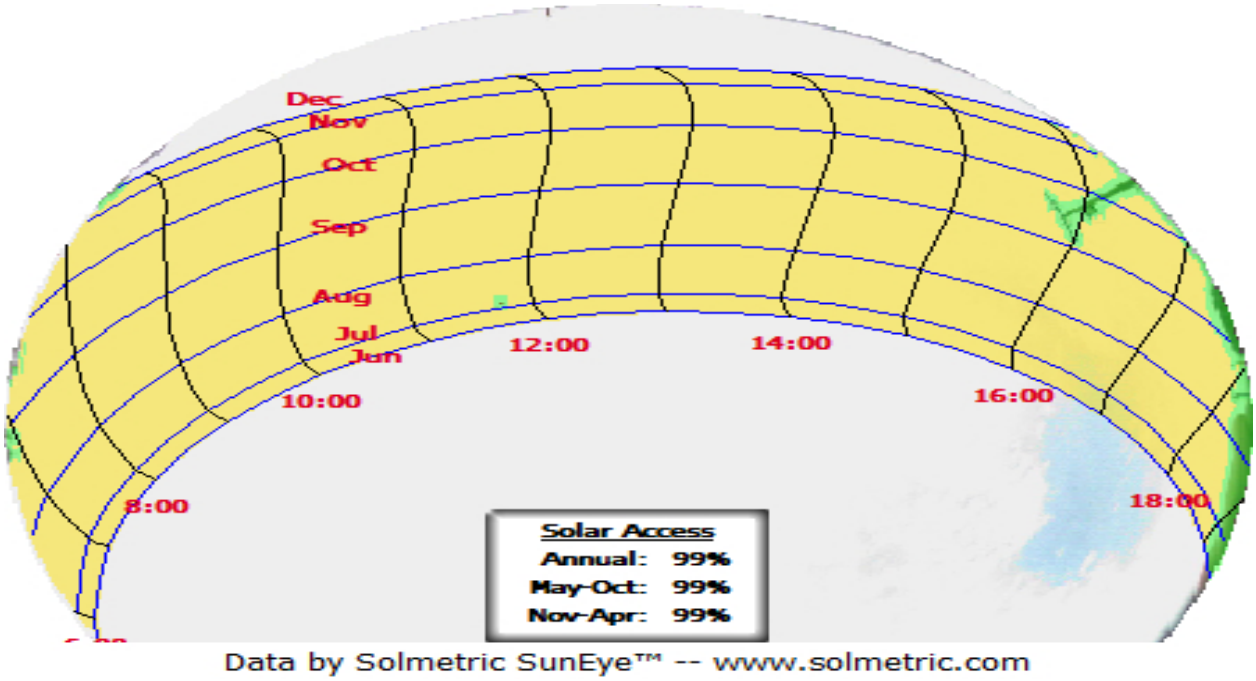

Figure 4: Solar access of HM Building on the roof showing excellent access

Solar systems provide power offset ptimarily during high cost Summer months and silently create energy for decades and without any maintenance. A solar system installed at the current pricing for a rooftop mount with good access is $4/watt. Such a grid tied system shows a 12% IRR and a 10 year simple payback given current rates and 10% annual inflation/increases.

The composite shingles on the roof will need to be replaced or another layer added before any solar system can be considered for this roof.

Thermal Solar Hot Water

Solar hot water would have a very limited application for this site because the facility does not have significant hot water usage, making return on investment very long term.

Next Steps:

- Implement desired conservation strategies outlines.
- Make sure there are no zoning regulations, which will limit your potential to install renewable energy technologies.
- Determine which renewable energy technologies you are interested in.
- Consult with industry contacts for bids and scope development
- Identify support sources that could assist with product economics
- Pursue project development steps
- Commission and certify system operation
- Maintain and record system operation

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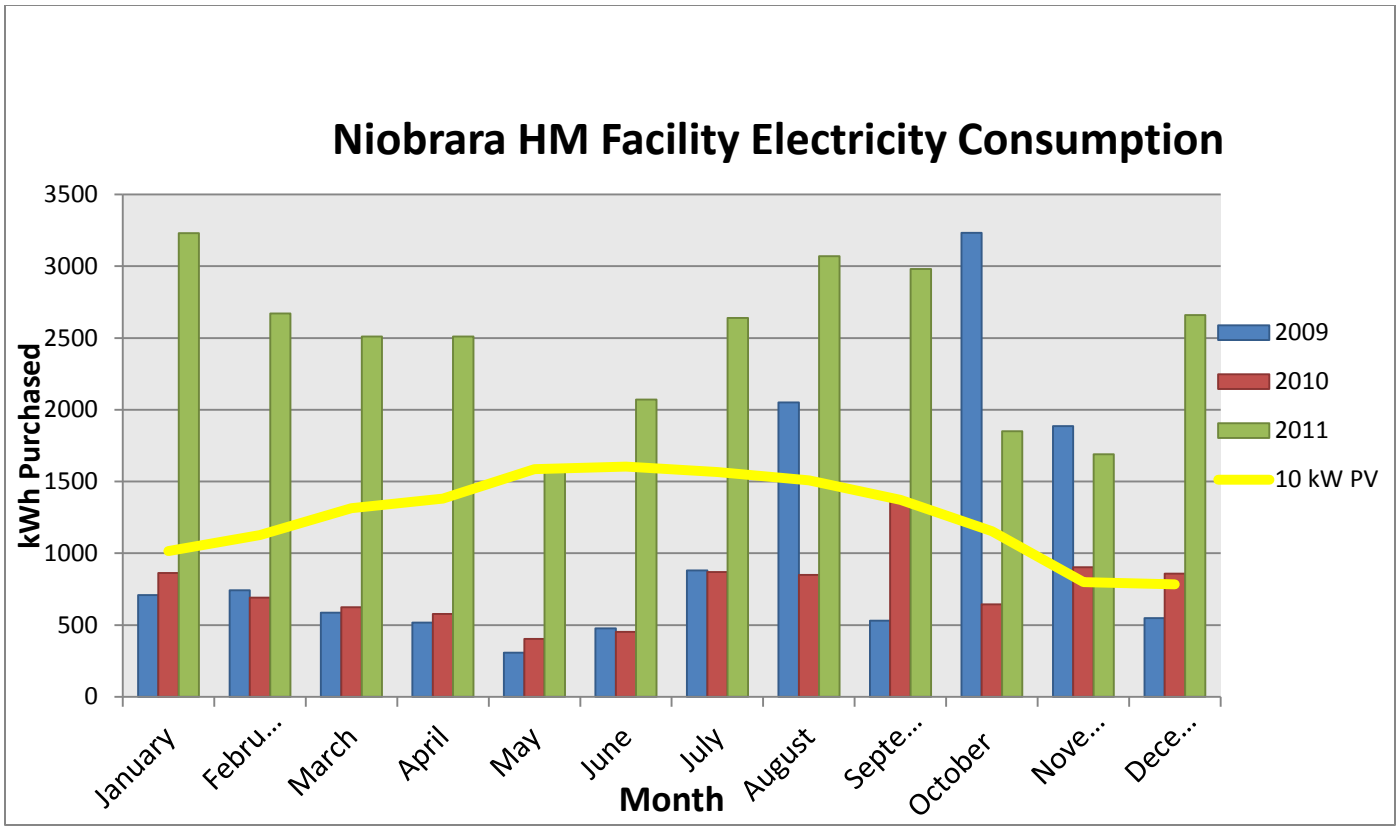

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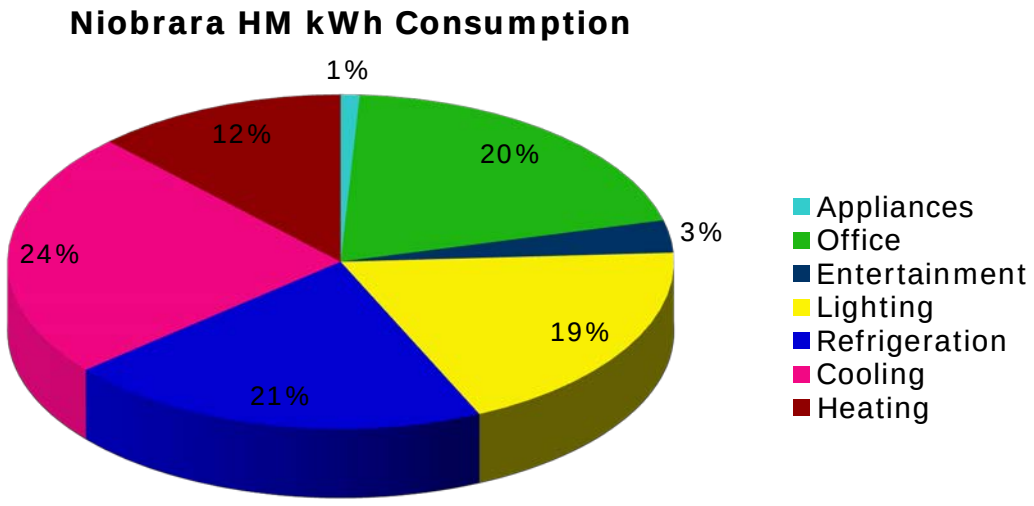

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Solar thermal collectors on the vertical south faces would have poor performance because of the building location on the north side down slope of a hill.

Biomass Heating

The Health facility is prefabricated with a natural gas stove installed. An efficient conversion to a biomass unit would be possible but would be complicated because the current unit acts as both a cooling and heating unit. If a biomass unit was installed, a separate cooling system would be required, but since both the existing heating and cooling units are outdated and would be best replaced, this opportunity should be considered before such an upgrade is made. The realities of moving biomass into the hopper would also need to be carefully considered and a system selected that would meet the facility needs in terms of maintenance.

A Biomass heating system, like a wood or corn stove installed in the basement could be vented directly outside through foundation walls or windows and provide both supplemental and back up heating capability. In any case, if there was an electrical outage, the building will be cold and dark. An uninterruptible energy capability could be integrated into the recommended PV solar system to ensure the building has power in an outage if desired. The facility also has a three way switch at the meter outside that would allow easy hook up to a standby generator to run the facility if needed.

PV Solar

There is excellent potential for using solar on the roof of this facility; the roof has an exceptional pitch with unobstructed solar access.

Figure 3: The Health Modular building looking from the South.

The available roof space on the southern exposure is about 750 ft² which would provide space for about 10kW of roof mounted solar panels. The projected production of a solar system that size is included on the consumption trend chart. A smaller system (8kW) could be considered if the building HVAC and lighting systems were upgraded and window films installed. The roof provides excellent solar access shown below.

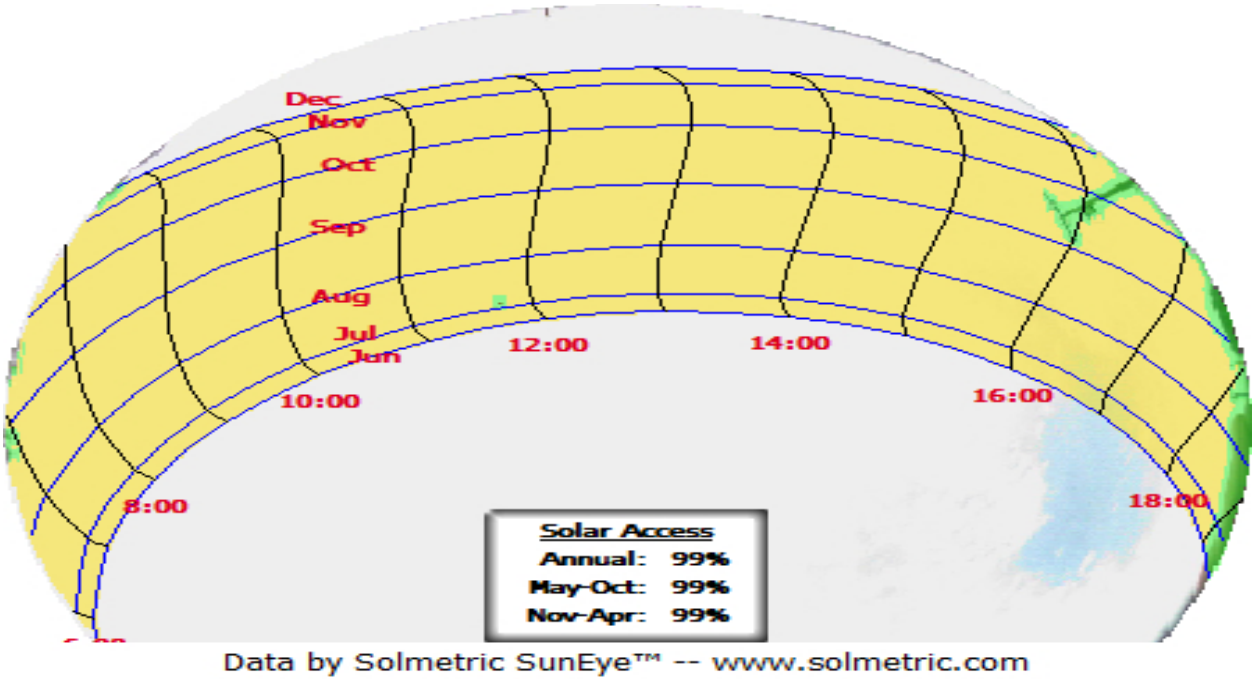

Figure 4: Solar access of HM Building on the roof showing excellent access

Solar systems provide power offset ptimarily during high cost Summer months and silently create energy for decades and without any maintenance. A solar system installed at the current pricing for a rooftop mount with good access is $4/watt. Such a grid tied system shows a 12% IRR and a 10 year simple payback given current rates and 10% annual inflation/increases.

The composite shingles on the roof will need to be replaced or another layer added before any solar system can be considered for this roof.

Thermal Solar Hot Water

Solar hot water would have a very limited application for this site because the facility does not have significant hot water usage, making return on investment very long term.

Next Steps:

- Implement desired conservation strategies outlines.
- Make sure there are no zoning regulations, which will limit your potential to install renewable energy technologies.
- Determine which renewable energy technologies you are interested in.
- Consult with industry contacts for bids and scope development
- Identify support sources that could assist with product economics
- Pursue project development steps
- Commission and certify system operation
- Maintain and record system operation

Location:

Niobrara Headquarters Facility

252 Spruce Ave

Niobrara, NE 68760

Purpose

The purpose of this energy assessment was to analyze electrical energy consumption in order to make recommendations for reducing energy usage and identify possibilities for renewable energy integration into various buildings owned and operated by the Ponca Tribe.

Overview

Three years of electrical energy consumption data was provided by Michael Boggs, Energy Planner of the Ponca Tribe. This data was examined and a site survey was conducted. Based on our experienced eye and extensive work with numerous Midwest Tribes, appropriate observations and recommendations were prepared and summarized here.

The sites examined have significant electrical consumption which was the focus of this initial survey. Significant electrical energy cost increases are anticipated in the near and long term, and identification of the most beneficial opportunities to reduce and/or replace power now will provide energy saving to the tribe for decades to come.

Our site survey indicated there was an excellent opportunity for accessing solar resources for renewable electricity production at the Ponca Health Facility.

NRES is very experienced with grant and support source identification to assist with project development funding, although some economics may justify investment without these additional sources. We are adept at identifying the lowest hanging fruit for maximum economic return and benefit as well as identifying secondary benefits to clean energy inclusion in your infrastructural portfolio.

In recent months solar energy has seemingly come of age and represents an excellent investment. Costs involved with installing solar energy systems has reduced significantly in the past year and represents an excellent investment opportunity. NRES has been a long term partner with Ho Chunk in Winnebago in this area who will soon be the second member of the 100kW+ club in Nebraska.

Past Energy Consumption

We reviewed the electric bills for the Niobrara Headquarters (HQ) facility and created a comparison for energy consumption over the preceding three years as well as the projected energy production of a 10 kW and 25Kw solar systems.

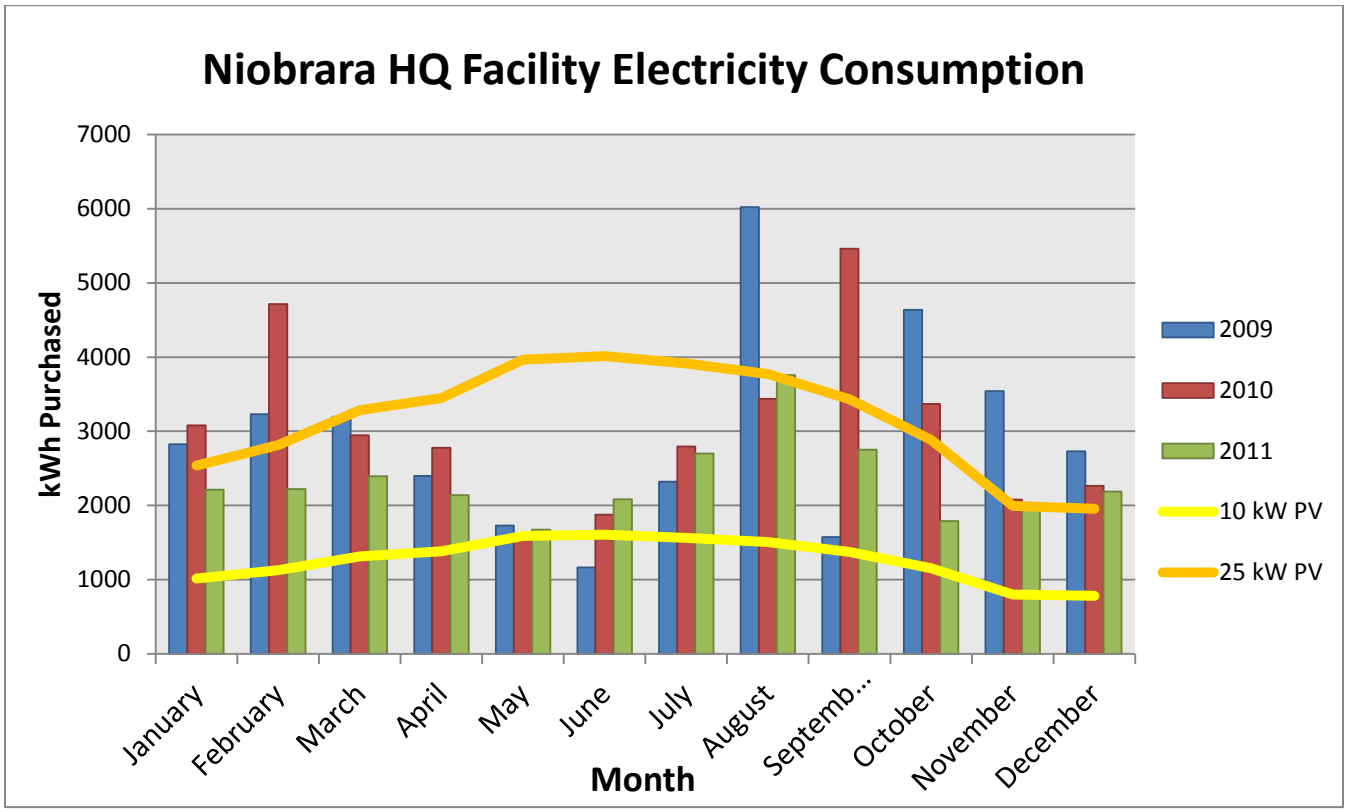

Figure 1: Consumption chart for the Niobrara HQ facility from 2008-2011 overlaid with the projected outputs of 10kW and 25 kW PV solar systems.

Despite the relatively consistent use of the facility significant consumption variations are seen in the consumption trending. The trending shows that 2011 had significantly lower energy use compared to previous years. This positive trend is clearly due to the new HVAC/cooling unit and new windows.

The consumption trend for the building shows a typical profile for an office space with non-electric heating with greatest usage in the summer related to space cooling. Increased efficiencies are also noted in the conservation section.

The HQ meter also serves the large maintenance garage with the associated lighting and cooling going on there. These loads were included in the consumption profiles above and the use distribution pie chart below.

Current Electricity Break Down

NRES would like to thank HQ Facility staff for the time they took to describe the facility for our survey.

Kilowatt hour energy consumption trends are shown below based on the supplied records and attention to detail of the systems that are used.

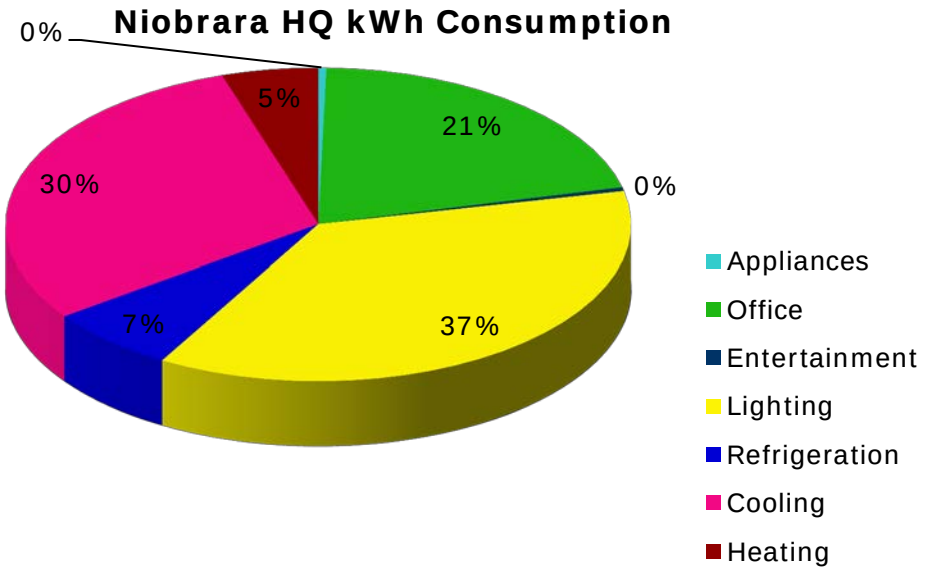

Figure 2: kWh consumption of various appliances and cooling units at the Niobrara Headquarters (HQ) Building.

The consumption profile above reflects the consumption onsite at the HQ facility. This breakdown includes the maintenance building usage as well, which is minor. Two security lights placed on a timer were reset and were not included in recent consumption totals.

The pie chart shows a slightly higher than average cooling system energy use as well as lighting. Conservation options for these areas will be specifically discussed in the conservation sections.

Assumptions:

- Lights on and regular building use was an 8hrs/day, 5 day/week schedule
- All lighting in the HQ building itself was T-12; the maintenance building had large CFL bulbs installed.

- The very large Pitney Bowes machine had a standby load of 125watts, 8hrs/day
- The central printer stayed essentially active all day at 56watts
- Microwave was 1200 watts was incidental

Assessment Summary

The property has moderate overall efficiency. However, numerous improvements are possible in order to further improve efficiency. The following is a list of consumption reduction improvements which can greatly reduce your overall energy use.

Potential Energy Conservation Opportunities

Lighting is a large component of the overall energy consumption on the site. Older, T-12 lighting is installed throughout the building which presents an excellent opportunity to jump to high efficiency LED lighting. A conversion to LED would reduce lighting energy consumption by 2/3 and these long life bulbs would provide a rapid energy payback and savings. Many fixtures have reduced bulb numbers, a good energy reducing strategy, given the bulbs in use. Only 5 incandescent bulbs were found, which can be easily replaced with screw in LED bulbs, drastically reducing wattage while increasing its operating life cycle to 20- 25 years at the current 2,000 hours per year usage rate.

The water heater and hot water piping around the hot water heater needs to be insulated to reduce electrical consumption and thermal energy loss.

The outside air handling units were not shaded and were installed on the south side of the building making heat rejection from the building less efficient. Insulation on the cold return piping near the unit itself needs to be replaced/installed to reduce thermal loss. The units were noted as having very poor air flow through them due to the coils being choked with dust and debris. Allowing maximum airflow over the coils will greatly improve unit efficiency and reduce energy consumption. Installing a privacy fence around the units would not only shade them but also protect them from dust and debris.

All of the Niobrara facilities had at least one outside air handling unit that was choked with debris. It is strongly recommended that these units are regularly checked and carefully cleaned out to maintain airflow without damaging the coil as needed. Monthly checks during the cooling season should be considered minimum. Local HVAC companies can perform this service if internal staffing is inadequate to perform this important function.

Window Films now possess outstanding energy conservation properties to reduce both thermal solar gain and retain cool air. There are several installers of these materials in Omaha and their cost reduction to installed cost ratio is exceptional. Window films would be an outstanding conservation investment at your facility and local suppliers would be glad to provide a facility survey and quote.

Potential for Renewable Energy Implementation

The HQ facility has some good opportunities for onsite renewable electricity production. The structure and property are on the crest of a hill in the center of the town and both wind and PV solar stand out as good options. Cost of power at $0.11/kWh would allow a good return on investment for an efficiently installed system.

Wind Turbine

The HQ facility is a possible location for a wind turbine because of the absence of large trees and the elevation of the site. A small wind turbine placed at this facility would need to be at least 60’ tall to provide good power production so local zoning requirements would need to be reviewed to see if such a structure would be permitted. The area near the unused outbuilding would provide a good location for a wind turbine because it would provide about 250’ setbacks from the road and property lines.

If rooftop solar was not an option, a 10Kw wind turbine would be a good second option for this facility. A wind turbine of this size would cost between $5-6/watt compared to rooftop solar at $4/watt. There would be some noise generated by the turbine which should be considered, but would not be a nuisance top anyone around based on setback, distance from Main Street and surrounding land use.

Solar Thermal Air Heating

Solar thermal collectors on the vertical south face of the HQ or maintenance building would be well suited to reduce the heating requirements for these buildings. Thermal solar air heating units would be able to greatly reduce the amount natural gas used for heating and provide for an excellent application of the most cost effective renewable energy technology available. If the maintenance building was considered for refurbishment, a thermal solar air heating system and thermal mass storage system could be easily designed and built into the garage space and the building then remodeled around it. Such a ‘total solar’ solution boasting PV solar on the roof couple with thermal solar air heating would provide savings for decades to come with essentially no maintenance and upkeep required.

NRES would be glad to assist in further development of solar air heating options that can range from locally built units to commercial units that utilize advanced materials.

Biomass Heating

The HQ facility itself is not a good candidate for biomass heating, but a biomass heating system could be integrated into a remodeled garage or new HQ facility. In the future, consideration of an outside boiler to heat a new or remodeled facility that would burn large logs and other low cost biomass materials to heat hydronic tubing in the floor. Traditional energy

sources like natural gas, propane or alternatives like vegetable oil, pellets, corn or wood chips could also be used to fire the boiler to allow best cost selection of various fuels. With a renewable heating fuel, the balance of the system (fan and pump) could be easily operated by a PV system. Thermal solar water heating could also be integrated into a central, outside boiler system that could also produce the hot water for the facility, though that need is very small in an office environment.

PV Solar

There is excellent potential for using solar at this facility; however the best solar roof is the maintenance garage, not the HQ building. The HQ building itself is an older metal roof that has been over sprayed with a sealing material; it is best to keep un-disturbed. The metal roof sheets also sit atop metal rafters and purlins, making it difficult to properly secure solar panel mounting stanchions to resist strong Nebraska winds. The service main panel in this building was also filled, making interconnection more complex as the service meter was some distance away at the Health Modular Building.

Although the HQ Building itself was not well suited as a solar platform, the maintenance garage is. The garage is tied into the HQ service line through an underground feeder to a 100 amp subpanel that is currently seeing very little use. Installation of panels atop the maintenance garage roof would have numerous advantages and is well suited for renewable energy production.

- The roof is exceptionally strong and well-built with wood rafters making racking installation easy and secure
- Available slots in the existing subpanel will make interconnection very efficient and low cost
- Available southern roof square footage would allow up to 25kW in PV solar, the current state limit per meter
- Solar access and incident angle provided by the garage roof are exceptional
- Roof mount will reduce thermal heat gain of the building

It was noted by the survey team that consideration was being given to eliminating the garage structure and building a new HQ Building. Given the sturdiness of the building, size and exceptional solar roof, NRES would recommend that the garage be considered for a complete remodeling that would create a new HQ Building within its current footprint. Such a path would certainly appear to be the most sustainable and cost effective. If a new building is ultimately selected, it is highly recommended that the structure integrate PV solar into it’s’ design to

capitalize on the exceptional solar access at this site.

Figure 3: The HQ Building looking from the South, note outside condenser location.

Figure 4: Maintenance garage building from the south, note exceptional solar roof.

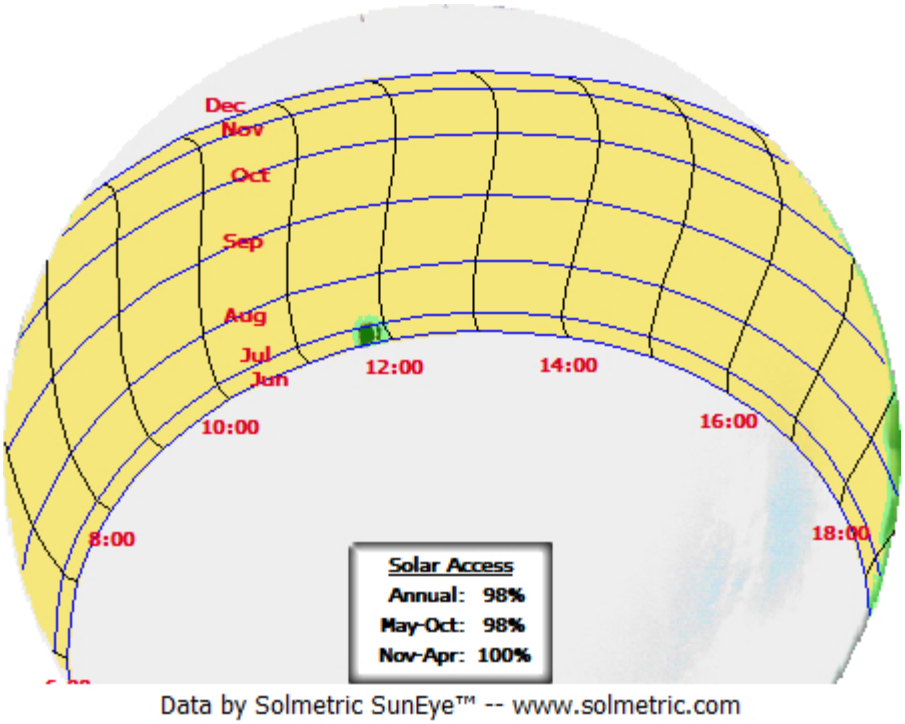

Figure 5: Solar access of maintenance garage roof showing full solar access

The solar access and the other advantages noted make the maintenance garage an excellent location for PV solar deployment. Note the shadow seen at solar photo center is likely from object on lens or overflying aircraft and should be ignored, only light shading from foliage tops are seen as very minor shading sources.

Thermal Solar Hot Water

Solar hot water would have a very limited application for this site currently because the facility does not have significant hot water usage, making return on investment very long term. However, if alternative heating systems are considered down the road, thermal solar hot water technology may be appropriate to consider at that time to provide additional space heating energy directly from the sun. Commercial offices rarely use enough hot water to justify changing their current system from an economic perspective alone.

Next Steps:

- Implement desired conservation strategies outlines.
- Make sure there are no zoning regulations, which will limit your potential to install renewable energy technologies.
- Determine which renewable energy technologies you are interested in.
- Consult with industry contacts for bids and scope development
- Identify support sources that could assist with product economics
- Pursue project development steps
- Commission and certify operation
- Maintain and record system operation

Location:

Ponca Niobrara Agency Property

PO Box 288

Niobrara, NE 68760

Purpose

The purpose of this energy assessment was to analyze electrical energy consumption in order to make recommendations for reducing energy usage and identify possibilities for renewable energy integration into various buildings owned and operated by the Ponca Tribe.

Overview

Three years of electrical energy consumption data was provided by Michael Boggs, Energy Planner of the Ponca Tribe. This data was examined and a site survey was conducted. Based on our experienced eye and extensive work with numerous Midwest Tribes, appropriate observations and recommendations were prepared and summarized here.

The sites examined have significant electrical consumption which was the focus of this initial survey. Significant rise in electrical energy costs are anticipated in the near and long term and identification of the most beneficial opportunities to reduce and/or replace power now will provide energy saving to the tribe for decades to come.

Our site survey indicated there were some significant conservation opportunities and some limited renewable energy production opportunities at the Museum location.

NRES is very experienced with grant and support source identification to assist with project development funding, although some economics may justify investment without these additional sources. We are adept at identifying the lowest hanging fruit for maximum economic return and benefit as well as identifying secondary benefits to clean energy inclusion in your infrastructural portfolio.

In recent months solar energy has seemingly come of age and represents an excellent investment. Costs involved with installing solar energy systems has reduced significantly in the past year and NRES has been a long term partner with Ho Chunk in Winnebago who will soon be the second member of the 100kW+ club in Nebraska.

Past Energy Consumption

We reviewed the electric bills for the Agency Property for the preceding three years as well as the projected energy production of a 10kW solar system in comparison.

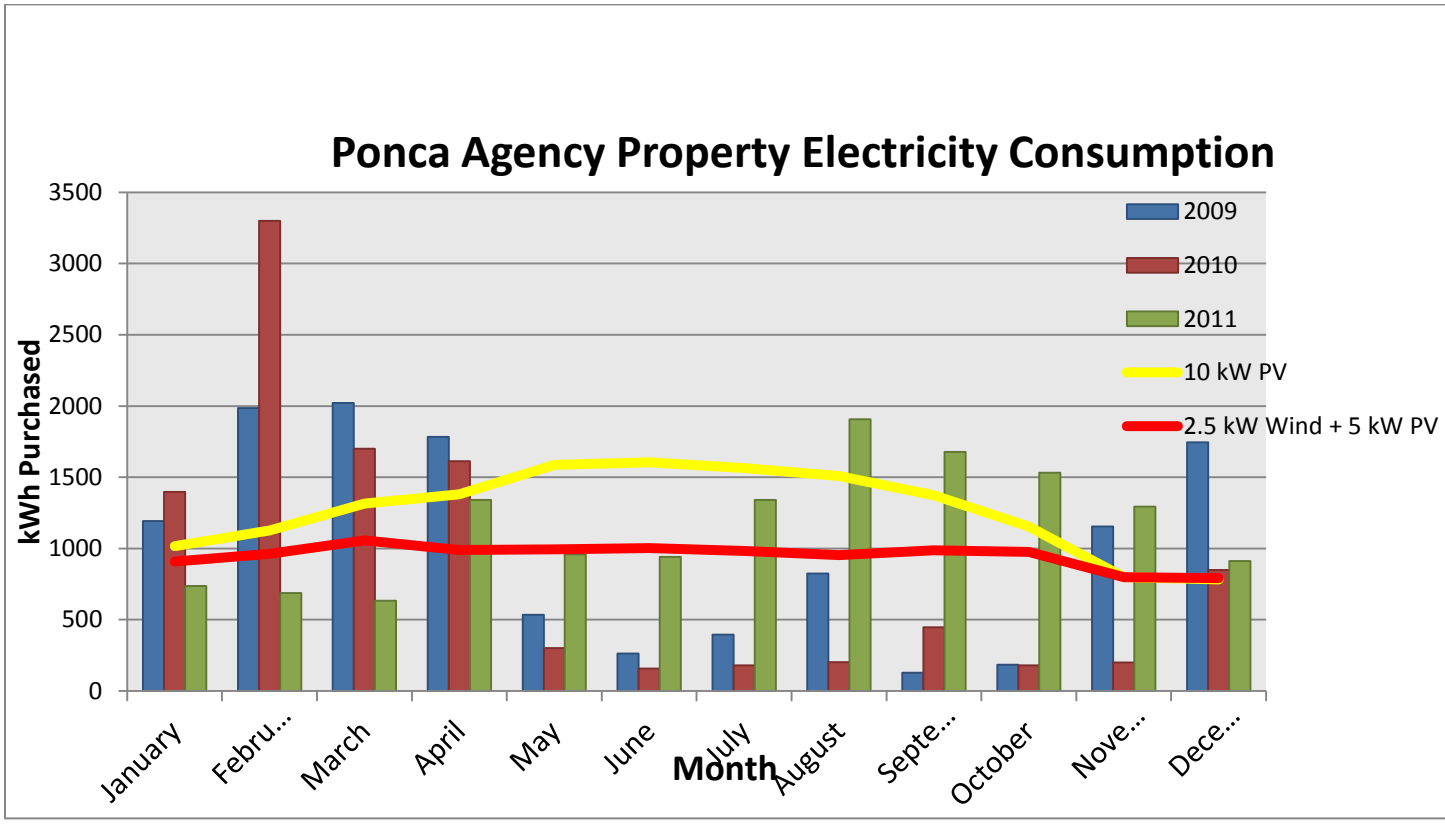

Figure 1: Consumption chart from 2008-2011overalyed with a 10kW PV solar system.

Examination of the consumption profile for this facility does not show any consistent or clear trending, but some observations may still be made. The Pow-Wow energy use at the facility was not significant despite increased building utilization during that period.

Winter heating energy use was down quite a bit over previous years. This is no doubt due to the very mild winter experienced in 2011 and the reduced energy requirement needed for pump house heating to prevent freezing.

On the other hand, summer use was up quite a bit. While this may indicate increased utilization, it can also indicate that the cooling system efficiencies are poor. More recently, the HVAC system has been replaced, so we would anticipate that summer usage in 2012 will be significantly less than previous years, though the 2012 summer will show up much hotter than previous years. Despite the new inside equipment, there are ways to further enhance the cooling system and these will be described in the conservation section.

Current Electricity Break Down

NRES would like to thank Gloria Hamilton for the time she took to show us around and explain the details of the systems at this location.

Kilowatt hour energy consumption trends are shown below based on the supplied records and attention to details of the systems in place.

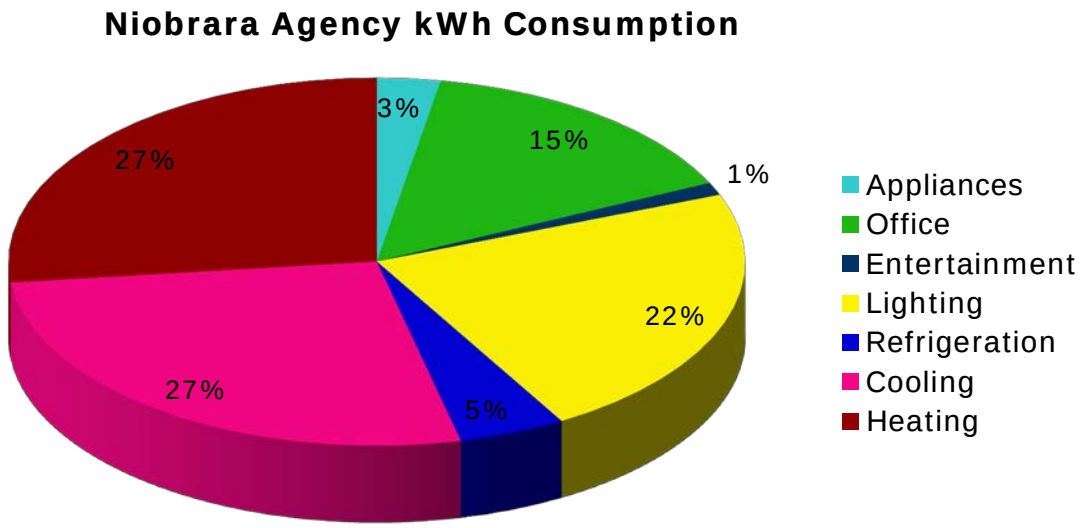

Figure 2: kWh consumption of various appliances and cooling units at the Niobrara Agency Building.

The chart shows typical proportions with heating being attributed to the pump house use, as the main fuel is propane. Office use included Museum consumption as well.

Assumptions:

- Pow-Wow grounds is on its' own meter
- Winter electric heating loads were associated with pump house heating
- The bathhouse was connected onto this meter
- Chest freezer in pantry is not used

Assessment Summary

The property has moderate overall efficiency. However, numerous improvements are possible in order to further improve efficiency. The following is a list of energy reduction strategies, which can greatly expand your overall efficiency.

Potential Energy Conservation Opportunities

Lighting in the Museum was 100% incandescent 100 watt bulbs. Conversion of these bulbs to LED lighting would reduce electrical consumption fivefold. Conversion to CFL would decrease lighting electrical use by a factor of three. A trial of bulbs may be necessary to ensure lighting quality is satisfactory. High temperature (4000-5000K) bulbs are recommended to most closely replace the clear bulb incandescent that are currently in use, though the white glass fixture covers tend to make all of the emitted light a softer white type. Changing the screw in bulbs would not impact the buildings historical registration restrictions. CFL bulbs also contain mercury and are more difficult to properly dispose of.

The HVAC systems at the Museum were brand new and highly efficient and the outside units were largely shaded from the sun. Insulation on outside cold return piping could be improved. One of the condenser units was packed with dirt and debris, reducing airflow and efficiency. We noted numerous outside units at the inspected buildings were totally packed with dust and debris and a regular maintenance and cleaning routine is strongly recommended to ensure these units are able to reject heat with the needed airflow. Choked air flow requires the units to run harder and longer, decreasing comfort on hot days and increasing energy use. Outside air units may be wrapped with an external screening to reduce this choking effect of dust and debris and south/west facing units would benefit by a privacy screen to shield the units from both dust and sun. The new gas fired water heater had excellent insulation on the hot water piping, but the water heater itself was not wrapped and should be.

The bath house building energy use was very significant and can be easily reduced with a maintenance procedure that allows the lines to be drained/blown out to prevent freeze in the winter. Antifreeze can be poured in toilet bowls and systems drained at low points, to prevent damage. There were two water heaters running that had uninsulated storage tanks and copper piping which were all hot. If these heaters were drained down, they could be turned on only for the week of the Pow-Wow and then turned off. Cold water service would remain during the season to allow lavatory use during the warm months, if required. A heat regulated ceiling fan was noted being on to reduce heat trapped within the building that otherwise had no ventilation. Installation of screen doors and increased roof venting would reduce or eliminate the need for this fan.

Also to be noted in the bath house building photo is a 100 amp subpanel with numerous empty slots for additional breakers. This would be an excellent location to interconnect a

renewable energy system that would offset site usage. Because of the historic registration (and accompanying limitations) of the Museum building, any renewable energy system needs to be totally separated from the structure and the electrical system there, the main panel in the Museum was also completely full, making interconnection more challenging. A wind or solar system deployed on the western portion of the Pow-Wow grounds would be an excellent location to access both the solar/wind resource and efficiently tie into the Museum meter without any impact or complication involved with the historic building status.

Figure 3: Bath house water heaters showing lack of insulation and the subpanel with expansion slots available for renewable energy system interconnection.

Window Films now possess outstanding energy conservation properties to reduce both thermal solar gain and retain cool air. Due to the historic registration, windows cannot be

changed without great difficulty, but films may be selected that are invisible to the eye or provide a very light tint. There are several installers of these materials in Omaha and their cost reduction to installed cost ratio is exceptional. These would be an outstanding conservation investment at your facility and local suppliers would be glad to provide a facility survey and quote.

An electrical space heater is used in the well pump house to prevent freezing in the winter and has significant energy consumption. Increasing insulation in this building will reduce these energy use requirements and improve freeze protection ability.

Potential for Renewable Energy Implementation

The Museum facility has relatively low electrical usage, but cost is high at $0.11/kWh average cost with continued increases expected. A small renewable energy system could go a long way in offsetting this use and create a sustainable environment in this important cultural center. A hybrid wind and solar system may be considered to offset the twin high use periods in winter and summer.

Wind Turbine

The location would be excellent for a small wind turbine. A wind turbine would provide offset in the winter months for the well space heater and HVAC indirect use. Solar energy would provide little power during these months.

A 2.5-5kW wind turbine would be recommended to hybridize with a 5kW solar system. Economics involved with a wind system are estimated at $6-8/watt installed cost depending on model, size and tower type selected. Wind economics will not be as favorable as solar, but the hybridized system at the Cultural Center would provide other, indirect benefits to the Tribe through education and awareness opportunities created by the presence of these demonstration systems at this location.

Solar Thermal Water or Air Heating

Based on limitations placed on the historical structure, seasonal usage and available south faces, thermal solar heating systems would not be efficient at this location. Although an outside gravity shower could be outfitted with a thermal heated solar water tank that then could be filled (with well or captured rainwater) and allowed to warm up for Pow Wow usage, eliminating the need for the electrical water heaters all together. NRES has operated a rain water feed, thermally heated, gravity driven, outside shower on the Energy Farm for many years and can assist in such a project.

Biomass heating

Although the structure was originally biomass heated, a new and efficient propane heating system has been installed. A wood fired stove in the basement could be tied into existing and available openings in the chimney base and could provide non-electric back up heat to the building if desired, the fireplace itself could also be used in an emergency, but its condition is unknown. Based on the HVAC investment just made in the building, existing heat units are high efficiency and cannot be improved upon further (except for cleaning of the outside air handling units) and a biomass heating system should only be considered for back up requirements in case of grid outage.

PV Solar

The Pow Wow grounds would provide an excellent area for wind/solar systems. As mentioned, an efficient interconnection point exists at the bath house subpanel, less than 100 feet away. While ground mount systems will run about $1-1.25/watt more than roof mounted systems, they will still demonstrate superior economics and long term performance compared to wind systems; however, solar systems will not provide much production in winter when heating needs are present. If a solar shower is used and the well pump house is insulated further, the winter electrical usage would drop significantly and largely obviate the need for a hybrid system.

The proposed physical location for the ground mount shows very good solar access for the selected site. This selected location is well to the rear of the historic structure and would not impact the looks of the building in any way. The trees along the western edge of the skyline could also be trimmed as needed, as they will grow and their impact on production will increase over time.

Figure 4: Proposed solar ground mount site on western edge of Pow wow grounds

An elevated structure at this location could also be used to provide shade for picnicking and camping underneath the solar canopy. This structure would be similar to solar mounts used as parking lot shade structures. Such an elevation would increase cost, but improve solar access and create a very popular spot underneath the panels! The location is excellent for interconnection to the system through the bathhouse panel.

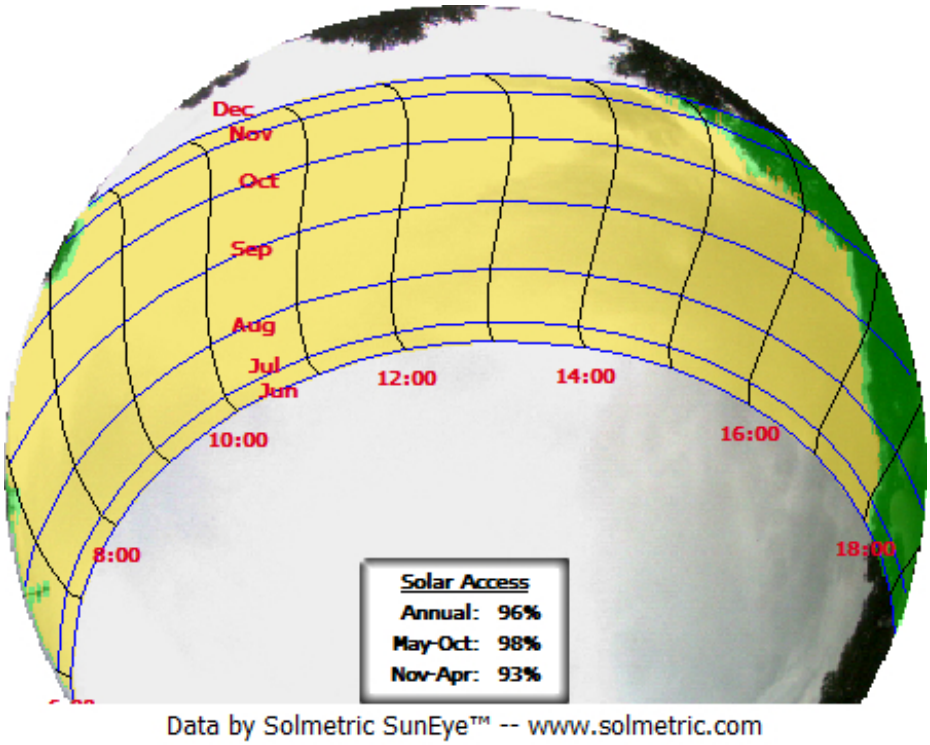

Figure 5: Solar access for a ground mount solar system on western edge of pow-wow grounds (within the circular driveway near newly planted trees).

Next Steps:

- Implement desired conservation strategies outlined above.
- Make sure there are no zoning regulations, which will limit your potential to install renewable energy technologies.
- Determine which renewable energy technologies you are interested in.
- Consult with industry contacts for bids and scope development
- Identify support sources that could assist with product economics
- Pursue project development steps
- Commission and certify operation
- Maintain and record system operation

Location:

Ponca Norfolk Complex

1800 Syracuse

Norfolk, NE

Purpose

The purpose of this energy assessment was to analyze electrical energy consumption in order to make recommendations for reducing energy usage and identify possibilities for renewable energy integration into various buildings owned and operated by the Ponca Tribe.

Overview

Three years of electrical energy consumption data was provided by Michael Boggs, Energy Planner of the Ponca Tribe. This data was examined and a site survey was conducted. Based on our experienced eye and extensive work with numerous Midwest Tribes, appropriate observations and recommendations were prepared and summarized here.

The sites examined have significant electrical consumption which was the focus of this initial survey. Significant electrical energy cost increases are anticipated in the near and long term and identification of the most beneficial opportunities to reduce and/or replace power now will provide energy saving to the tribe for decades to come.

Our site survey indicated there were several opportunities for accessing solar resources for renewable energy systems at the Norfolk location.

NRES is very experienced with grant and support source identification to assist with project development funding, although some economics may justify investment without these additional sources. We are adept at identifying the lowest hanging fruit for maximum economic return and benefit as well as identifying secondary benefits to clean energy inclusion in your infrastructural portfolio.

In recent months solar energy has seemingly come of age and represents an excellent investment. Costs involved with installing solar energy systems has reduced significantly in the past year and NRES has been a long term partner with Ho Chunk in Winnebago who will soon be the second member of the 100Kw+ club in Nebraska.

Past Energy Consumption

We reviewed the electric bills for the Norfolk Facility and drew a comparison for energy consumption for the preceding three years as well as the projected energy production of a 100 and 200 kW solar system in comparison. As illustrated in the chart, the energy usage has been highly irregular through the years with the peak usages occurring during months that are not associated with electrical peak usage. Further investigations have been made to more fully account for the various usage spikes in the chart. These are most likely related to electric heating in the four plex apartments.

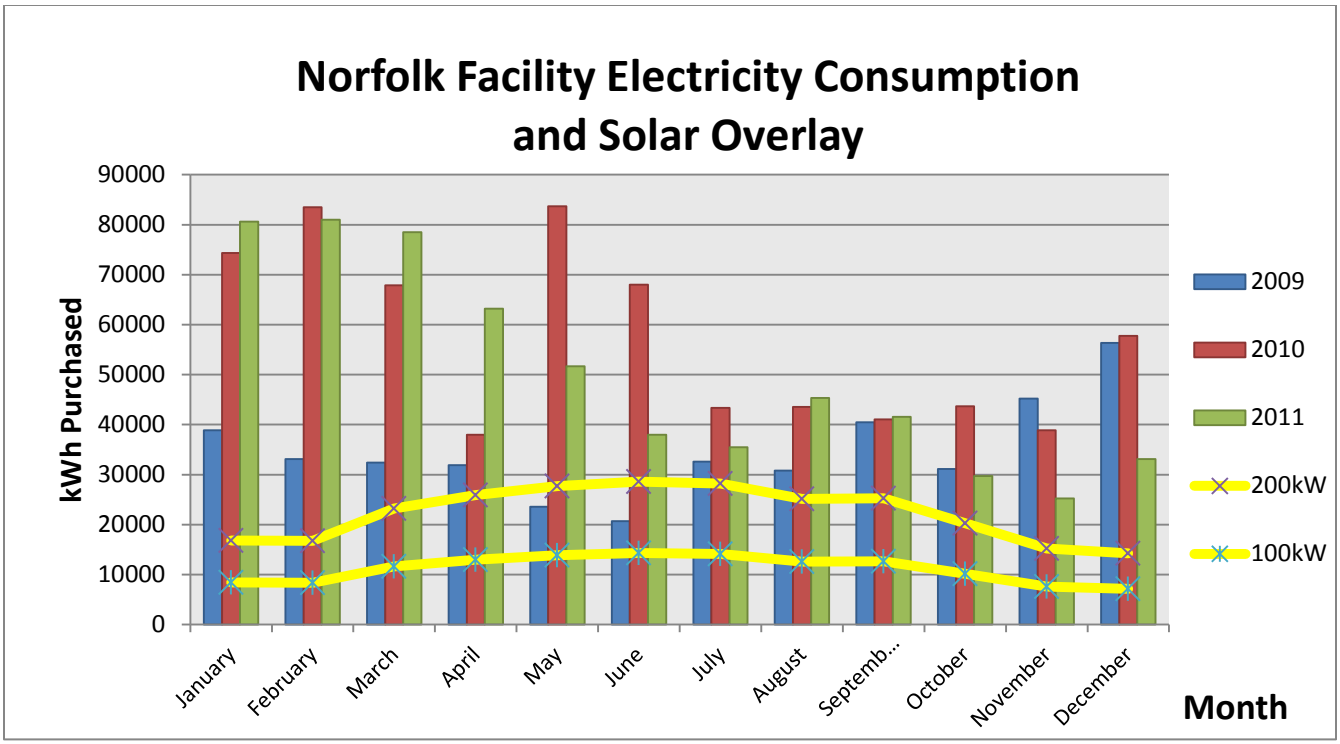

Figure 1: Energy consumption profile for the Norfolk facility

While usage spikes are focused in months favoring wind energy, solar energy will provide energy during the higher value summer months that will create better economics. Staff changes may account for some of this as projects open and close

Current Electricity Break Down

NRES would like to thank Don Millard for the time he took to show us around and explain the details of the power system there. His input was invaluable to this study.

Kilowatt hour energy consumption trends are shown below based on the supplied records. It is clear there have been several changes in the electrical use patterns over the past several years and additional changes are planned so the historical study was of limited value. A clear trend is the general increase in consumption and large variations month to month. The former dormitory building was confirmed offline and was not considered in our survey, as electrical consumption at that facility ceased about one year ago. Each of the graphs is presented as a portion of the average annual total site consumption.

Because of the nature of the previous site owners, the site is powered by one electrical meter. While this saves money on individual meter fees, it limits the ability to interconnect with each meter because of the 25kw limit that is strictly enforced by NPPD. A buy/sell (net billing)

arrangement would be required to be completed for any significant impact to the 40-80,000 kWh used at the facility each month or about the same amount of electricity as 75 homes.

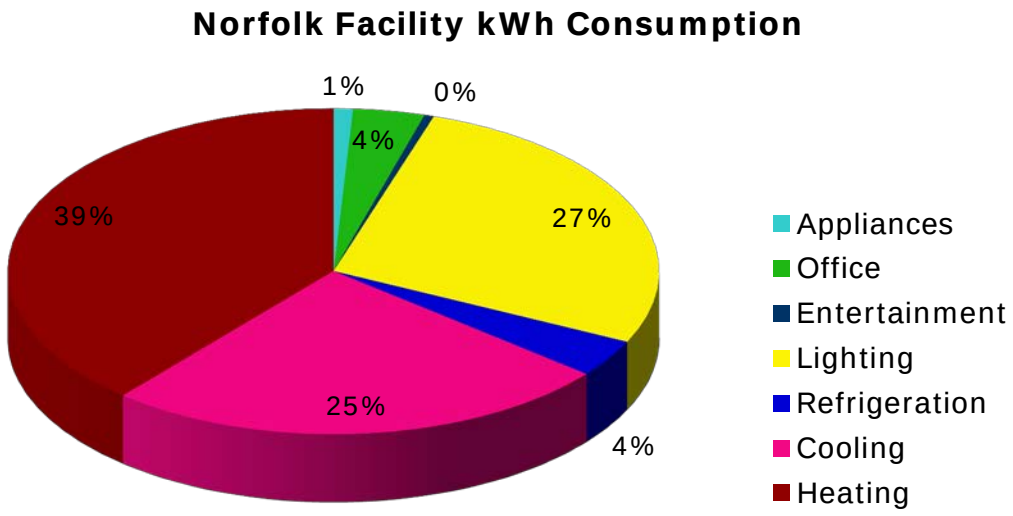

Figure 2: Electrical consumption breakout for the Norfolk facility

The consumption profile above reflects the consumption onsite of the analyzed buildings, excluding the 4-plex apartments. This breakdown reflects the administrative and community roles of the major buildings with lighting and office equipment playing major roles. Lighting totals include the outside area lights.

Assumptions:

Outside lighting was operated 365 days per year on dusk to dawn cycle with 8 hours average on time each day

Auditorium Kitchen use was estimated at 4hrs four times per month for Tribal events and 4hrs eight times per month for nutritional program use.

Shop lights were in use 8hrs a day 5 days per week and back room lighting average of 2 hours per day to account for winter time when these rooms are used for inside work.

T-12 lighting was in use throughout the facility (see recommendations)

Large Winter/Spring loads were attributed to heating with a total of 110MwH annually

Assessment Summary

The property has moderate overall efficiency. However, numerous improvements are possible in order to further improve efficiency. The following is a list of energy conservation strategies, which can greatly improve your overall efficiency.

Potential Energy Conservation Opportunities

Lighting is a huge component of the overall energy consumption on the site. T-12 lighting is outdated and significant opportunities exist to reduce this consumption. Currently, plans are being made to convert lights to T-8, which would provide the opportunity to reduce consumption in the gym. NRES supports this change but would add the following considerations. Skipping ahead to more advanced T-5, LED or Induction lighting should be considered to increase savings further. Also, the NPPD survey was based on 3677 on hours per year which is over ten hours per day, 365 days per year. Our survey indicated that the usage was potentially far lower.

For the gym and other locations that see intermittent use during the day, motion sensors could provide a lot of value by reducing the on times of the existing or replacement lighting units. Based on the intermittent usage of the maintenance areas and auditorium, these systems would be an excellent fit. Bathrooms are also good candidates as they would reduce bacterial transmission, like motion activated toilets, sinks and dispensers.

The facility street lights are a significant load and solar street lights would not only be able to eliminate this of approximately 14MwH/annually. If presenting clean energy as a part of the facility is desired, solar street lights will be a very visible reminder of that commitment. Solar street lighting would provide lighting in the case of grid outage and this system could be very cost effective as the light poles are owned by the facility, which is not typical, thereby reducing the cost and labor associated with complete pole replacement.

The 4 four-plex apartments run off the facility service and are not individually metered. Inclusion of utility use for the apartments is the simplest method, given the infrastructure available which only meters each building, but this type of arrangement will not likely foster

energy conscious operation of the home.

Figure 3: Existing and unused metering infrastructure at the four-plexes

Given the available infrastructure, building meters could be monitored and the 4 individual apartments share the energy use cost that is incurred in the building. If this is not deemed acceptable, individual meters could be installed for each apartment could be installed, with a not to exceed installed cost estimate of about $20,000. A shared arrangement using the existing meters would be the best path. Perhaps an arrangement that allows each tenant an allotment of power that is included in the rent which could have a monetary value that would allow the Tribe to determine the KwH allotment for the building. Energy usage amounts above this ceiling could then be added back to monthly rent to protect the Tribe from price increases, encourage energy conservation and utilize the existing metering infrastructure.

Large spikes in usage during winter and spring months are not typical and were largely attributed to heating although the uninspected four-plexes, growth/contraction cycles with personnel, changing dormitory roles and seasonal factors all contribute to what seems to be discretionary use that has seen tremendous growth over the last three years of data analyzed. This is an area that would be worthy of further analysis to foster efficient energy use and awareness.

Window Films now possess outstanding energy conservation properties to reduce both thermal solar gain and retain cool air. There are several installers of these materials in Omaha and their cost reduction to installed cost ratio is exceptional. These would be an outstanding conservation investment at your facility and local suppliers would be glad to provide a facility survey and quote.

Potential for Renewable Energy Implementation

The Norfolk facility has excellent renewable electricity opportunities. Because of the stipulations of Nebraska net metering policy, a 25Kw limit is placed upon a system for each meter. The Norfolk facility is centrally metered, which is very efficient, but it places a 25 Kw limit on such a system to be net metered. A 25Kw net metered system would supply about 43MwH (43,000 KwH) annually with a 20% capacity factor, while well over 750MwH is used at this facility. Anything larger than 25Kw would be interconnecting to the grid under the NPPD buy/sell policy which governs the rates paid for delivered power. This policy can be found on the www.nppd.com website.

Wind Turbine

Wind monitoring has been going on at this site for some time. The site is well located for wind, but proximity to residential areas would likely limit a commercial wind turbine to 100Kw. The highest consumption period for this site is during winter months when wind power is strongest. Any application of a renewable energy system above 25Kw will require a buy/sell agreement with NPPD and set rates for wind supplied power are provided in that agreement. Wind power would be valued with such an agreement at about $0.06/KwH.

A large wind system would require regular maintenance to ensure best results and the Tribe must consider the long term needs of such a system.

Economics involved with a wind system are estimated at $5-6/watt installed depending on model and size selected.

Solar Thermal Air Heating

Reduction of electrical space heating requirements through integration of solar thermal space heating is possible at this location, but limited. The new south facing maintenance facility would benefit from such a system, especially when designed into the building during the new construction phase. On other buildings, there are only limited areas on the south sides of the admin building and auditorium where such devices could be installed on building vertical south faces.

Solar thermal air heaters are a very cost effective technology and could even be built by tribal members who have basic carpentry skills. Plans are available that show how to build and install the insulated box that trap solar heat in the winter and exchange it with inside air.

Biomass heating

Because of high electrical heating requirements of this facility, there is an opportunity to replace this energy consumption with renewable biomass energy sources like wood pellets. These systems have improved tremendously over the years and would provide excellent savings in the years to come, however, the best economics for such a system would be in new

construction. Retrofit opportunities are more expensive and often are challenged economically unless replacing very expensive thermal energy sources (like electricity).

PV Solar

There is excellent potential for using solar cells on the property to reduce yearly electricity consumption. Solar energy is harnessed from the light of the sun and can be converted into heat and electricity. Electricity is created by sunlight using flat plate Photovoltaic (PV) solar panels that can be ground mounted in the field.

Figure 4: The Field in front of the Administration building could comfortably fit 200Kw of solar panels

The fields in front of (east) the admin and auditorium buildings provide excellent solar access which is shown below. The spot seen at high noon in June was a spot on the camera lens; otherwise shading is shown in green at the extremes. Solar access on these otherwise unused fields is excellent. The lower field located near the tennis courts was not considered as they have intermittent sports use and were located at a fair distance from a point of interconnection for the system.

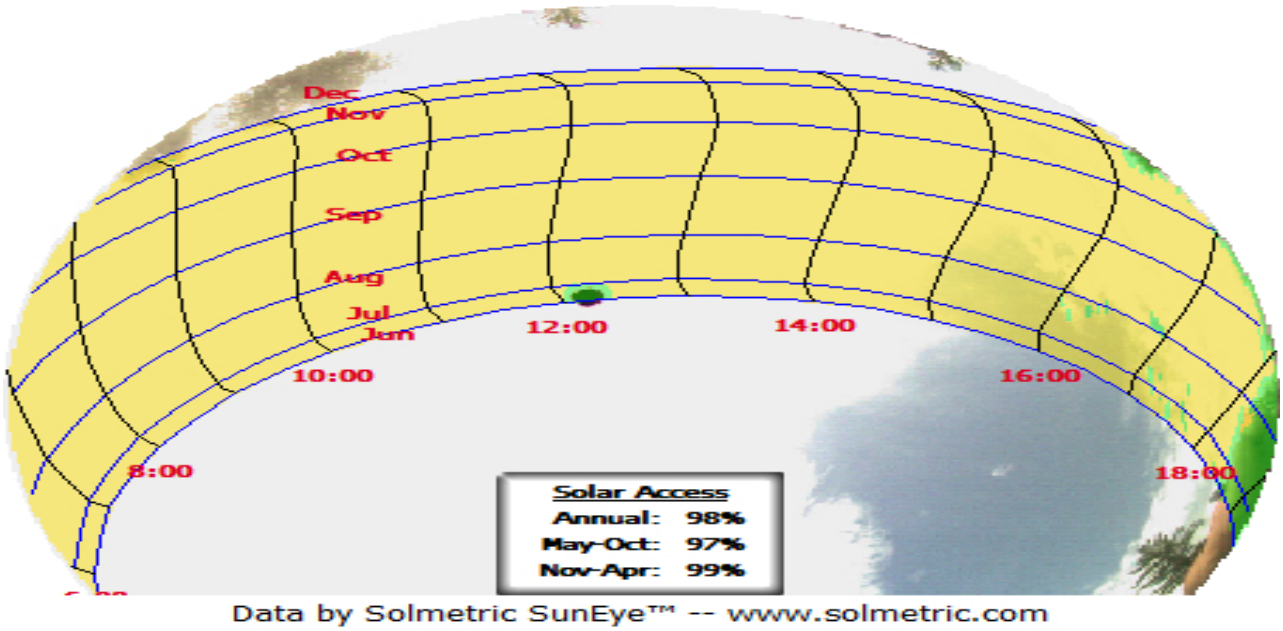

Figure 5: Solar access shot for field in front of administration building

Because solar power is provided predominantly during high cost, peak Summer months, NPPD provides a premium to solar buy/sell contracts compared to Wind. In the Summer solar power recieves $0.09/KwH, far above the avoided cost and wind power rates. Given that a ground mount solar installation will also install for about $5/watt, has no maintenance, include 20 year warranties on panels and make no noise are all significant advantages to consider. NRES has designed 20Kw blocks that would layout well within the dimensions of these fields and could be developed as desired if infrastructure is in place to allow for system growth. There is a spare 400amp slot in the 1200amp power distribution building that would be an excellent intertie location, or accomodation could be made through the new maintence building depending on system size.

In any case, given the economics of net metering, a 20Kw system could be installed quickly in a way that would allow easy expansion to a larger system. NRES has provided basic economic return calculations for a proposed array with a 25% cost share estimation by a supporting agency or grant. Given grant support the IRR is 8.4% and remains a respectable 6.4% without any grants with $0.08/KwH power cost and a $5/watt installed cost for each 20kW ‘module’ desired. This ROI sheet is included.

Thermal Solar Hot Water

Solar hot water would have a very limited application for this site because the locations that have good solar access do not have significant water usage. The nature of the site use precludes optimal use of thermal solar water heating because only small amounts of hot water are used at the facility.

Next Steps:

- Implement desired conservation strategies outlines.
- Make sure there are no zoning regulations, which will limit your potential to install renewable energy technologies.
- Determine which renewable energy technologies you are interested in.
- Consult with industry contacts for bids and scope development
- Identify support sources that could assist with product economics
- Pursue project development steps
- Commission and certify operation
- Maintain and record system operation

Lessons Learned

The lessons learned identified for the implementation of grant DE-EE0005058 were schedule management, internal communication and staff turnaround. If we would have compressed our schedule somewhat we would have had more time to work with the tribal leaders to develop our top priorities and then look for additional funding. In addition, grant management for an energy grant needs to be more open with other departments and locations within the Tribe. In this way we might be able to implement concerns or ideas that are specific to departments or locations. An example of this would be that we received another grant for building a transportation facility at our Norfolk location. Had our two departments been working together closely we would have known they had funding to implement renewables and we could have worked with our contractor regarding which methodologies would be most beneficial at the location for new construction rather than looking at methodologies that could accommodate our current buildings and their use. In losing the Tribal Planner and the Energy Planner within the same year our team lost expertise and vision for our relationship with Department of Energy and this became an issue for continuous funding opportunities.

All of the above stated lessons learned moments are easy to overcome if the Tribe makes a commitment to communicate across departments and work more collaboratively going forward.