FINAL TECHNICAL/SCIENTIFIC REPORT

Award Number: DE- EE0005172

Recipient: Forest County Potawatomi Community

Project Title: Assessing the Feasibility of Comprehensive Energy Efficiency Upgrades at Potawatomi Carter Casino Hotel

Project Location: Potawatomi Carter Casino and Hotel and adjacent Potawatomi Carter C-Store and Smoke Shop
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Wabeno, WI 54566

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Date of Report: March 31, 2014

Report Author: Nathan Karman

EXECUTIVE SUMMARY

The Forest County Potawatomi Community ("FCPC" or "Community") has established an aggressive goal of energy independence using carbon-free or carbon-neutral renewable resources. In connection with this goal, the Community regularly implements energy efficiency improvements at its various facilities. These measures have significantly reduced the Community's energy use, costs, and associated carbon emissions on a per square foot basis. However, not all facilities have demonstrated the same reductions. In particular, Potawatomi Carter Casino Hotel ("PCCH") in Wabeno, Wisconsin, showed an *increase* in energy use, costs, and associated carbon emissions.

Seeking to investigate and ultimately address energy use at PCCH, the Community sought and obtained Department of Energy ("DOE") funding to conduct an energy efficiency feasibility that would identify actionable recommendations to yield at least a 30% reduction in overall energy use at PCCH. The Community selected Grumman/Butkus Associates ("G/BA") to conduct the study at PCCH as well as at the adjacent Potawatomi Carter C-Store and Smoke Shop (the "C-Store").

G/BA prepared comprehensive energy studies for the two properties. The PCCH Energy Study recommended 11 energy conservation measures ("ECMs") that would result in energy savings of 34.66%, with an estimated total cost, after state utility incentives, of $992,838. The C-Store Study recommended four ECMs that would result in energy savings of 27.36%, with an estimated total cost, after state utility incentives, of $30,615.

BACKGROUND OF COMMUNITY AND CONTEXT OF PROJECT

Background of Community

FCPC is organized under the Indian Reorganization Act of 1934 ("IRA"), 25 U.S.C. § 461-479, and exercises governmental authority under a Constitution last adopted in 1982. FCPC has a membership of more than 1,400 people. Its land base includes a Reservation of nearly 13,000 "checkerboarded" acres of trust or homestead lands in Forest County, Wisconsin; approximately 20 acres of trust land on Ceded Territory in Milwaukee County, Wisconsin; and an additional approximately 4,600 acres of fee lands, the majority of which are in Forest County. In the last decade, the Community has greatly expanded its programs, departments, and services, including those relating to environmental protection.

Community's Commitment to Environmental Protection

FCPC tradition and history teaches a strong commitment to protecting and preserving the natural environment, both on and near the reservation and throughout the world. FCPC, like most indigenous peoples, refer to the Earth as "Our Grandmother" or "Mother Earth," and perceive the Earth itself as a living being. FCPC also refer to the Earth as "Pamuk-kumiges," which means "laid out for us"—requiring the Community to act as stewards over the land, water, plants, and animals that the Great Spirit provided. The proper respect and treatment of resources is required to not only assure human safety in an unpredictable world, but also to guarantee balance and harmony in the world itself.

In an effort to formalize these environmental values and implement related action, FCPC adopted the following environmental mission statement:

> The traditional values of the Forest County Potawatomi Community teach us to respect all living things, to take only what we need from Mother Earth, and to preserve the air, water, and soil for our children. Reflecting these values, we take leadership in creating a sustainable and healthy world. We resolve to reduce our own environmental impacts and to take steps to remedy the impacts of others. We encourage others to do the same. We also seek legislative and policy changes that protect the environment for all people, including generations to come.
> (adopted November 20, 2008)

Energy Initiatives and Successes

Recognizing the relationship between the Community's energy policy and its environmental mission, the Community established a goal of energy independence using renewable, carbon-neutral resources. As a bridge toward this goal, the Community purchases renewable energy credits which more than offset its current electric energy use.

In moving toward the goal of energy independence, the Community not only focuses on producing its own clean power, but also implements energy efficiency efforts to reduce its energy consumption and associated carbon footprint. The Community tracks the efficacy of these efforts through quarterly Energy and Greenhouse Gas Emissions Reports. As a result of these efforts, compared to its baseline year of 2007, the Community's energy use at its major occupied facilities has decreased by 13.88% per square foot, its costs have decreased by 13.71% per square foot, and associated carbon emissions have decreased by 22.3% per square foot.

PCCH an Exception to Energy Reductions

Notwithstanding these dramatic overall reductions, certain facilities have not shown such reductions. One extreme example was Potawatomi Carter Casino Hotel ("PCCH"), located at 618 State Highway 32, Wabeno, WI, 54566, where energy consumption *increased by 9.1%* from 2007 through 2010. PCCH is an approximately 100 room hotel adjacent to an 18,000 square foot casino which includes slot machines, table games, and a 4,500 square foot bingo hall. PCCH also includes two restaurants, a swimming pool and a fitness center, and spaces for meetings and banquets. PCCH employee areas include laundry facilities, kitchens, offices, storage and mechanical space. Electricity and natural gas are utilized to power the PCCH. PCCH receives electric and gas from Wisconsin Public Service ("WPS"). WPS is a large energy supplier, serving 24 counties in Wisconsin, including Forest County.

To address the anomalous energy consumption at PCCH and thereby advance it's environmental and energy goals, the Community sought and obtained funding from the Tribal Energy Program ("TEP") within DOE's Weatherization and Intergovernmental

Program to investigate potential energy efficient improvements at PCCH that would yield at least a 30% reduction in overall energy use at PCCH.

Selecting a Contractor

On November 8, 2011, the Tribe issued a Request for Proposal ("RFP") and evaluated the responses in accordance with the criteria identified in the RFP, namely:

- Background in conducting feasibility studies and providing engineering services for energy efficiency improvements at casinos, hotels, and other similar commercial facilities;
- Experience working with Indian tribes, including the Community;
- Ability to satisfy the schedule requirements;
- Other qualifications deemed relevant by the respondent in providing services pursuant to the RFP, including prior experience working with the DOE or other federal agencies;
- References from former clients; and
- Total estimated compensation for services described in the RFP.

Based on these criteria, the Community selected G/BA, Energy Efficiency Consultants and Sustainable Design engineers, located at 1011 N. Mayfair Road, Suite 300, Wauwatosa, WI 53226, to perform the energy audit services. In addition, based on cost savings resulting from the RFP process, the Community was able to add the C-Store to the G/BA's services.

PROJECT SUMMARY

G/BA completed two reports for the Community pursuant to Award Number DE- EE000250:

- Potawatomi Carter Casino Hotel Energy Study – Final Report – 12/31/2012 (the "PCCH Energy Study"); and

- Potawatomi Carter C-Store and Smoke Shop – Final Report – 10/31/2013 (the "C-Store Energy Study") (collectively, the "Energy Studies").

Additional detail regarding the Energy Studies is set forth below.

The PCCH Energy Study

The PCCH Energy Study recommended 11 ECMs that would result in energy savings of 34.66% when compared to the Community's consumption during its 2011 Fiscal Year (i.e., from October 2010 through September 2011). G/BA estimated that these recommended ECMS would have a total capital cost of $1,136,000, but would have incentives available from Focus on Energy, the Wisconsin utilities' statewide energy efficiency and renewable resource program, of $143,162, for an estimated net capital cost totaling $992,838. G/BA estimates that the recommended ECMs would save approximately $194,411 annually, providing a simple payback period of 5.11 years. Additional detail regarding the recommended ECMs is set forth below.

Casino Displacement Ventilation with Heat Recovery Chiller (ECM 2)

Displacement ventilation conditions are for large open spaces with high ceilings like the gaming floor. This measure involves removing the existing diffusers and installing new pendant displacement diffusers, which would allow for reduced air flow and still provide the required smoke control. The airflow reductions would require a cooling system upgrade. The current cooling system is inadequate even for current use and requires PCCH personnel to replace compressors approximately every other year, at an estimated cost of $19,500. This is one of the reasons why ECM 1 was not selected. After the diffusers are installed, the existing cooling system would be removed and new coils would be installed. The heat recovery chiller utilizes rejected energy to heat the domestic hot water and reheat hot water during the summer months.

Bingo Hall RTU Demand Controlled Ventilation (ECM 3)

This measure would replace outdoor, return, and exhaust air damper actuators to the air handling unit, which operates continuously. It would also add a variable frequency drive to the exhaust fans, add mixed gas and carbon dioxide sensors to control the outside air and exhaust fans, and test and balance the unit to coordinate the return and exhaust damper position with exhaust fan, thereby maintaining space pressurization.

Springs Kitchen Variable Volume Hood Exhaust and Makeup (ECM 4)

Banquet Kitchen Variable Volume Hood Exhaust and Makeup (ECM 5)

Flames Kitchen Variable Volume Hood Exhaust and Makeup (ECM 6)

These three measures would install an optical sensor for each hood in the respective kitchens and variable frequency drives (VFDs) for each fan. This would allow kitchen staff to turn on the exhaust fans to a preset minimum speed of 10 to 50%, which they can manually bypass if required. The fan speed is modulated by exhaust air temperatures, increasing as more heat is given off by the cooking appliances. When smoke or vapor is present, the exhaust fans go to maximum speed until these particulates are removed. The make-up air unit can be controlled in conjunction with the exhaust fans and provide only the necessary outside air. Doing so will condition less outside air and save fan electricity usage.

Retro-Commissioning (ECM 9)

This measure would undertake a retrocomissioning process that would schedule or modify certain rooftop units' operations based on occupancy, heat requirements, and pressurization or infiltration.

Energy Miser for Vending Machines (ECM 10)

Non Energy Star vending machines operate continuously even when it is not required. This measure would reduce the hours of operation of the units while maintaining product quality by

installing Vending Miser, a packaged product that incorporates an occupancy sensor to determine when the machine should receive power.

Lighting Fixture and Control Upgrades (ECM 11)

This measure would address interior lighting, depending on the space use, by undertaking the following measures: (1) installing occupancy sensors instead of switched lights, (2) installing LED fixtures to replace existing lights, (3) removing lamps in areas that are over-lit.

Retrofit Casino Slot Machines with LED Lights (ECM 12)

PCCH has 520 slot machines on the gaming floor, each of which is lit by a 38 watt fluorescent lamp. The recommended kits replace the fluorescent lamps with a 17 watt LED array.

Room PTHP and Guest Room Management System (ECM 13)

The majority of the rooms at PCCH are served by aging PTAC systems that are inefficient and at the end of their useful life. This measure would replace existing PTAC units with new high efficiency PTHP system with supplemental electric heat and install a guest room management system that integrates to the existing guest room management system. PCCH tested a PTHP system and realized approximately 25% savings during a 45 day test.

Conference Room Unit Replacement Upgrade (ECM 15)

The existing rooftop units that serve the conference spaces closest to the Springs Restaurant are reaching the end of their service life. They are constant volume dx rooftop units with gas heat and currently run continuously because they are not integrated into the existing building BAS system. This measure would replace the existing rooftop units with high efficiency units with the latest controls and incorporate them into the building automation.

The PCCH Energy Study, without appendices, provides additional detail regarding PCCH and the recommended ECMs and is attached hereto as Exhibit 1.[1]

The C-Store Energy Study

The C-Store Energy Study recommended four ECMs that would result in energy savings of 27.36% when compared to the facility's consumption during Calendar Year 2012. G/BA estimated that these recommended ECMS would have a total capital cost of $32,910, but would have $2,295 worth of incentives available from Focus on Energy, for an estimated net capital cost totaling $30,615. G/BA estimates that the recommended ECMs would save approximately $7,861 annually, providing a simple payback period of 3.89 years. Additional detail regarding the recommended ECMs is set forth below.

[1] The remainder of the 492-page document may be available upon request.

Interior Lighting (ECM 1)

This measure would replace the existing fluorescent lights with new LED fixtures, thereby decreasing electricity consumed and reducing the heating required (though somewhat increasing heating requirements during certain portions of the year).

Economizer (ECM 2)

This measure would add a new outside air duct into the existing furnace return duct and add a dry bulb economizer with dampers and sensors to mix the air returning to the furnace and provide a mixed air temperature close to the desired supply air set point.

Cooler Lights (ECM 3)

This measure would replace the 18 fluorescent lamps in the cooler with new LED fixtures, thereby decreasing the electricity consumed and reducing the cooling load.

Exterior Lighting (ECM 4)

This measure would replace existing halogen canopy lights with LED fixtures, thereby decreasing the electricity consumed.

A full copy of the C-Store Energy Study is attached hereto as Exhibit 2.

COMPARISON OF THE ACTUAL ACCOMPLISHMENTS WITH THE GOALS AND OBJECTIVES OF THE PROJECT

The Energy Studies met the project's objectives by identifying cost-effective energy efficient improvements that, when implemented, will result in energy savings of greater than 30 percent and save energy costs of approximately $200,000 per year. These savings are consistent with the Community's environmental and energy goals which underwrite the project, and would bring PCCH and the C-Store in line with the reductions already achieved at other Community facilities. In addition, as consistent with one of the project's goals, the G/BA effectively engaged PCCH and C-Store personnel and management, clearly explaining and justifying the ECMs from an economic and operational perspective. As a result, the facilities have already begun implementing the recommended ECMs.

For example, PCCH personnel working with Focus on Energy, completed a retrocommissioning project (ECM 9) for a net cost of $1,026 which provided verified energy savings totaling $21,605 annually, for a simple payback period of a half month. In addition, PCCH personnel have replaced the guest room PTAC units with new PTHP units (ECM 13), anticipating $13,000 in annual energy savings, which would provide a payback of just over three years. PCCH personnel continue to seek funding to implement the remaining measures. Similarly, C-Store personnel are working with Focus on Energy to obtain bids and implement all recommend ECMs by the year's close.

PRODUCTS DEVELOPED

This project resulted in the completion of two energy studies, copies of which are set forth at Exhibit 1 and Exhibit 2, respectively. The Community also presented at DOE's annual TEP Review in Colorado the past several years. The most recent presentation is attached as Exhibit 3.

Exhibit 1 to Final Scientific/Technical Report for Award DE-EE005172

("Assessing the Feasibility of Comprehensive Energy Efficiency Upgrades at Potawatomi Carter Casino Hotel")

PCCH Energy Study (excerpt)

ENERGY STUDY

Final Report – 12/31/2012

POTAWATOMI CARTER CASINO HOTEL

Potawatomi Carter Casino Hotel

618 State Hwy 32
Wabeno, WI 54566

Grumman/Butkus Associates
Energy Efficiency Consultants and Sustainable Design Engineers
1011 North Mayfair Road; Suite 300
Wauwatosa, Wisconsin 53326-3431
414 476.8980 FAX 476.2470

Energy Study

Potawatomi Carter Casino Hotel
618 State Hwy 32
Wabeno, WI 54566

G/BA #11452

December 31, 2012 - FINAL

Grumman/Butkus Associates
Energy Efficiency Consultants and Sustainable Design Engineers
1011 N. Mayfair Road, Suite 300
Wauwatosa, Wisconsin 53132

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INTRODUCTION

The Forest County Potawatomi Community with the aid of a Department of Energy Grant commissioned Grumman/Butkus Associates to develop a comprehensive feasibility study with the goal of achieving at least a 30% reduction in energy consumption at the Potawatomi Carter Casino and Hotel (PCCH).

The Potawatomi Carter Casino and Hotel is a 99 room hotel gaming center. Guest services include two restaurants, a swimming pool, and a fitness center. The gaming center has an 18,000 ft² casino with slot machines and table games and a 4,500 ft² bingo hall. There are also spaces for meetings and banquets. Employee areas include laundry facilities, kitchens, offices, storage and mechanical space. This report focuses mainly on these public and employee areas of the hotel.

This report has four main purposes: To identify and evaluate potential energy conservation measures (ECMs), to make recommendations regarding implementation of ECMs in the context of current and anticipated infrastructure upgrades, to identify operations and maintenance procedures as they relate to energy, and to provide guidance for the planned hotel renovation. Historical energy consumption and energy costs have been included for an overview of building usage patterns and to give context for potential savings.

EXECUTIVE SUMMARY

Potawatomi Carter Casino & Hotel has 147,580 square feet of conditioned space. Included in this area are 99 guest rooms, lobbies, restaurants, a pool, fitness center, meeting spaces, ball room, office space, kitchens, bingo hall, gaming space, laundry and mechanical rooms.

Cost data provided by Strategic Hotels & Resorts show the following cost and Energy Usage Intensity (EUI) benchmarking metrics. The usage and cost intensity values are calculated using the approximate conditioned building area. The units of MMBtu indicate millions of Btus and "room" is abbreviated as "rm". The term "night" in the table represents one overnight guest stay in the hotel.

Table 1: Potawatomi Carter Casino & Hotel Energy Usage Intensity Benchmarks

Calendar Year 2010-11 Utility	Annual Energy Consumption (MMBtu/yr)	Annual Energy Cost ($/yr)	Energy Usage Intensity (Btu/ft²-yr)	Energy Cost Intensity ($/ft²-yr)	Energy Usage Intensity ($/night)	Energy Cost Intensity ($/rm-yr)
Electricity	20,219	$384,281	137,006	$2.60	$18.91	$3,882
Natural Gas	24,743	$171,663	167,655	$1.16	$8.45	$1,734
Total Energy	44,961	$555,944	304,661	$3.76	$27.36	$5,616

Energy conservation measures (ECMs) in this report are evaluated according to energy and operational costs that are affected by the project. Further breakdown of the energy usage allocated to end-use is presented in the following section of this report.

Benchmarking Comparisons

There has not been a concerted effort to collect a benchmark data for energy use for tribal casinos and hotels. Energy Usage Intensity (EUI) is the BTUs of energy used per square foot per year. Based on our research, the EUI for tribal casinos varies greatly, with no published data. Other facility types are highlighted to provide a meaningful comparison of energy use for PCCH. The national average EUI for a lodging facility is 100.0. The national average EUI for a hospital is 249.2. A hospital was chosen as a benchmark comparison because it is a 24 hour facility with large ventilation requirements which is similar to the casino floor at PCCH. PCCH's EUI is 304.7, this indicates that there is room for improvement for the facility.

Based on the goal for a 30% reduction in total energy use in the facility the target EUI is 213.5, which is achievable by implementing the recommended ECMs included in this report.

Summary of Available Cost Savings

Eleven recommended Energy Conservation Measures (ECMs) are presented in this report, totaling $193,300 in annual utility savings with a combined simple payback of 5.6 years. At a total capital cost of $1,065,000, these are intended to address energy conservation, cost management and environmental stewardship.

The approximate percentage of annual utility cost savings performing all of the recommended ECMs is presented in Figure 1. A summary of annual cost savings and paybacks expected from each ECM is displayed in Table 3.

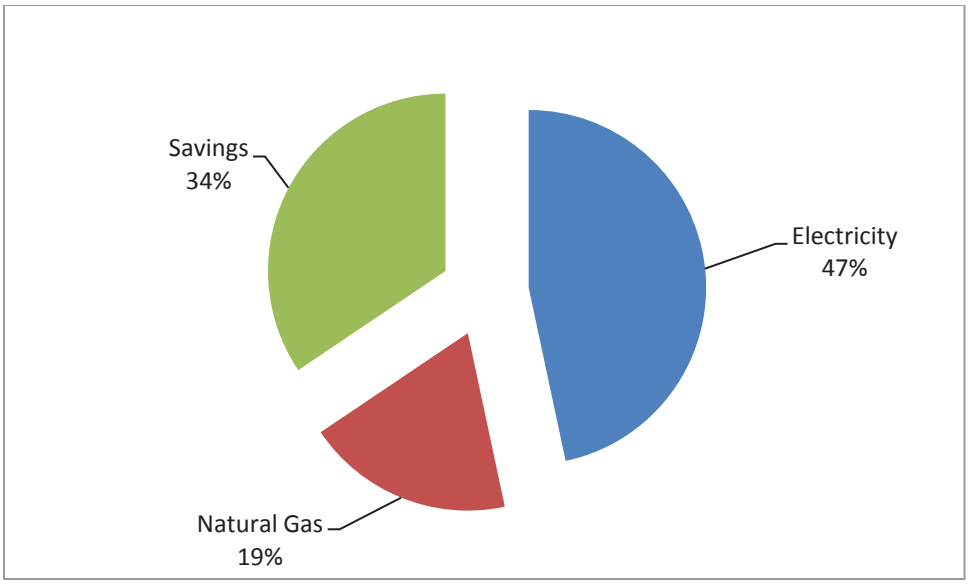

Figure 1: Total Annual Cost and Savings by Percent

Figure 2 illustrates the cash flow analysis for the recommended ECMs. This analysis assumes that the work and costs for the project would all occur in the first year. It also assumes that half of the payback for these projects would be realized in year 1 due to construction times. In year two, the Focus on Energy rebate money is assumed to be paid and the full energy savings is provided. This graph does not take into account any increases in utility prices that would likely occur. The analysis also ends at year fifteen. That is where the end of useful equipment life would start occurring. Data on the estimated service life for equipment can be found in exhibit 4.

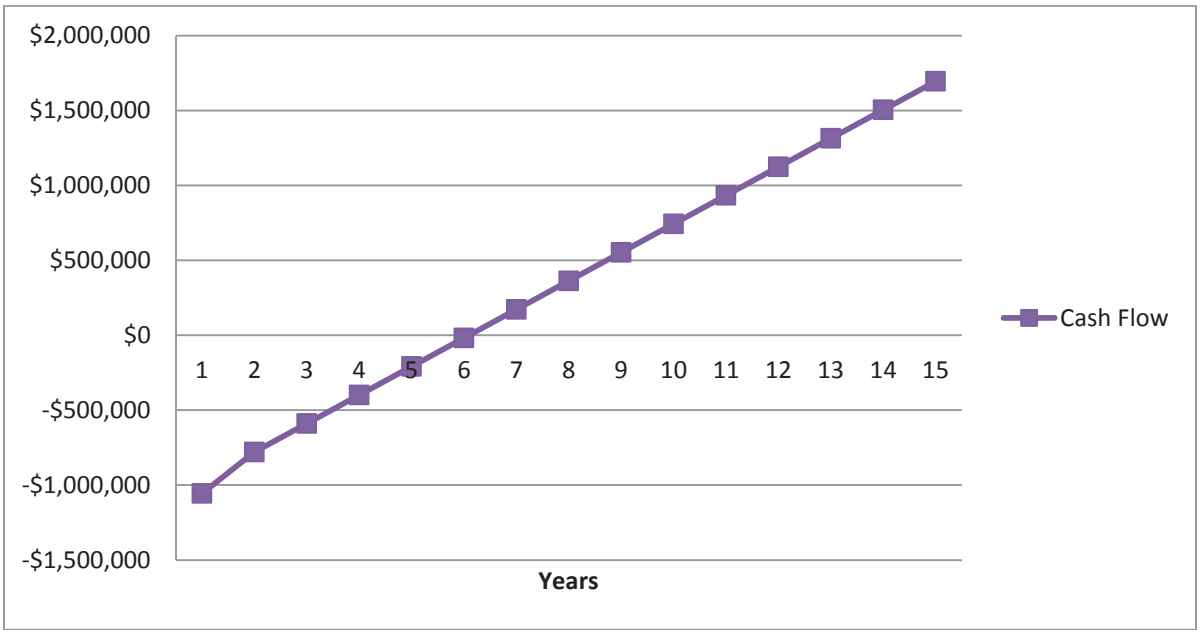

Figure 2: Cash Flow Analysis of Recommended ECMS

Table 2: Summary of Recommended Energy Conservation Measures

ECM	Description of ECM	Electricity		Natural Gas		Energy		O&M	Investment Economics			
		Energy Savings (kWh/yr)	Energy Savings ($/yr)	Energy Savings (therms/yr)	Energy Savings ($/yr)	BTU Savings (kBTU/yr)	% Energy Use Savings	O&M Savings ($/yr)	Total Cost Savings ($/yr)	Estimated Capital Cost ($) (5)	Focus on Energy Incentive ($) (2)	Simple Payback Before / After Incentive (years)
2	Casino Displacement Ventilation with Heat Recovery Chiller	1,048,461	$68,150	42,478	$29,265	7,826,197	17.41%	$10,000	$107,415	$864,000	$105,288	8.04 / 7.06
3	Bingo Hall RTU Demand Controlled Ventilation	44,059	$2,860	6,655	$4,585	815,873	1.81%	$0	$7,445	$26,250	$2,908	3.56 / 3.13
4	Springs Kitchen Variable Volume Hood Exhaust and Makeup	46,700	$3,000	3,800	$2,615	539,387	1.20%	$0	$5,615	$52,500	$2,000	9.25 / 8.99
5	Banquet Kitchen Variable Volume Hood Exhaust and Makeup	46,700	$3,000	3,800	$2,615	539,387	1.20%	$0	$5,615	$52,500	$2,000	9.25 / 8.99
6	Flames Kitchen Variable Volume Hood Exhaust and Makeup	74,800	$4,860	8,000	$5,510	1,055,262	2.35%	$0	$10,370	$26,250	$3,480	2.54 / 2.19
9	Retro-Commissioning (8)	208,405	$13,500	23,480	$16,150	3,059,286	6.80%	$0	$29,650	$11,500	$4,750	0.39 / 0.23
10	Energy Miser for Vending Machines (1)	5,200	$336	0	0	17,748	0.04%	$0	$336	$756	$240	2.25 / 1.54
11	Lighting Fixture and Control Upgrades	89,651	$5,800	0	$0	282,596	0.63%	$0	$5,800	$22,155	TBD	3.82
12	Retrofit Casino Slot Machines with LED lights	96,000	$6,200	0	0	327,648	0.73%	$0	$6,200	$28,665	$5,191	4.62 / 3.78
13	Room PTHP and Guest Room Management System (3)	200,000	$13,000	0	0	682,600	1.52%	$0	$13,000	$42,000*	$17,325	3.23 / 2.42
15	Conference Room Unit replacement upgrade (6)	8,700	$565	4,100	$2,825	439,693	0.98%	$0	$3,390	$8,000**		2.36

Total: Recommended Projects Budget Value	1,861,825	$120,847	92,313	$63,565	15,585,709	34.66%	$10,000	$194,411	$1,136,000	$143,162	5.84
Total Recommend Projects – After WFOE Grants								$194,411	$992,838		5.11

Table 3: Summary of Non-Recommended Energy Conservation Measures

ECM	Description	Electricity		Natural Gas		Energy		O&M	Investment Economics		
		Energy Savings (kWh/yr)	Energy Savings ($/yr)	Energy Savings (therms/yr)	Energy Savings ($/yr)	BTU Savings (kBTU/yr)	% Energy Use Savings	O&M Savings ($/yr)	Total Cost Savings ($/yr)	Estimated Capital Cost ($)	Simple Payback (years)
1	RTU-1 & RTU-2 Demand Controlled Ventilation	271,472	$17,600	30,387	$20,900	2,266,529	5.0%	$0	$38,500	$78,750	2.04
7	Replace Domestic Hot Water Heaters w/ High Efficiency Units	0	$0	6,600	$4,300	660,000	1.47%	$0	$4,300	$58,800	13.67
8	Condensing Heating Hot Water Boiler & Temp Reset	0	$0	7,500	$4,875	750,000	1.67%	$0	$4,875	$26,250	5.38
14	Central VRF System – No Guest Room Management – Central Control & Alarm (4)	225,000	$14,625	0	0		1.71%	$0	$14,625	$864,000 ($671,000)	45.88

Notes:

1. This measure assumes four vending machines are equipped with a vending miser.
2. Focus on Energy rebates are estimates based on incentives effective April 1, 2013 through March 31, 2014.
3. ECM-13 – Room PTHP not included in budget figures – dollar amount for payback analysis purposes.
4. ECM-14 – Central VRF this figure includes additional general construction and AE costs beyond what would be required for ECM 13.
5. ECMs include construction management and additional engineering fees in excess of any known DOE or WFOE grants.
6. ECM 15 factors replacing the RTU in both conference rooms. The estimated capital cost is an incremental cost increase from a standard RTU with a simple thermostat for control.
7. Any work associated with the new pool is not included in any savings analysis, until final design is determined. See next page for proposed ECMs to be considered when design is finalized.
8. Incentive includes prescriptive incentives for Demand Controlled Ventilation and Boiler Temperature Reset Controls.

Table 4: Pool Area Energy Conservation Measures

ECM	Description	Electricity		Natural Gas		Energy		O&M	Investment Economics		
		Energy Savings (kWh/yr)	Energy Savings ($/yr)	Energy Savings (therms/yr)	Energy Savings ($/yr)	BTU Savings (kBTU/yr)	% Energy Use Savings	O&M Savings ($/yr)	Total Cost Savings ($/yr)	Estimated Capital Cost ($)	Simple Payback (years)
1	Airside Systems.	See Pool Unit Preliminary Design and Analysis Tab for airside options									
2	High efficiency pool water heater.	0	$0	2,000	$1,300	200,000			$1,300	$34,000*	26.2
3	Solar Pool Hot Water System.	0	$0	1,700	$1,100	170,000			$1,100	$95,000*	86

Notes:

1. The assumptions for the pool area equipment are as follows.
    a. Air side: Standard efficiency pool dehumidification air handling unit
    b. Pool Heat: Energy code compliant water heater @ 78% efficient.
2. Savings should reviewed after pool area design has been finalized.
3. Costs included in energy study will be incremental costs above and beyond the base case equipment.

Recommendations

Based on the results of the energy savings calculations and cost estimates, the following are recommended:

1. Complete all of the recommended operation and maintenance suggestions.
2. Invest in all Recommended ECMs to achieve over 30% energy savings.
3. Review purchasing practices to incorporate Energy Star products for all upgrades. Items of particular importance would be ice machines and kitchen equipment. There are WFOE rebates for many of these items to help offset any higher initial first cost.

MAJOR BUILDING ENERGY CONSUMING SYSTEMS

Heating Hot Water Boiler System

There are three boilers in the central plant. Three of the boilers are hot water systems used for building heat. The following summarizes this equipment:

- Heating boilers (3): Lochinvar Model CHL2071, 2,070,000 input, 1,738,800 output, minimum staging 270,000. The boiler is set at 180F (2006)

Primary Heating pumps (3): B&G 2x7 5.875 BFV, 100 gpm, 35' head, 1750 rpm, 1.5 hp (original)

Secondary Heating Pumps (2) B&G 4x4x11, 315 gpm, 85' heat, 1750 rpm

Two heating boilers run all the time. Two boilers are needed at design conditions. The system is a primary/secondary configuration with constant volume primary pumps and variable frequency drives (VFDs) on the secondary pumps.

Domestic Hot Water System

The hotel is served by six, 199,000 Btuh input standard efficiency water heaters and one small electric unit. The Casino is served by two 990,000 Btuh input, 82% efficient units with a circulation loop.

Air Systems

The casino, the Flames restaurant, and the VIP room are served by two constant volume, 100% O.A. air handlings units, equipped with energy recovery, DX cooling coils, hot gas reheat and direct fire furnaces for heating. The total airflow is approximately 85,000 CFM, which equates to eight air changes per hour. The unit operates 24 hours per day, seven days per week (24/7).

The bingo hall is served by a constant volume 100% O.A. air handling units, equipped with energy recovery, DX cooling coils, direct fire furnaces for heating and reheat. The total airflow is approximately 19,000 CFM. The unit operates 24/7.

The office and back-of-house areas of the casino expansion are served by a 32,000 CFM VAV DX cooling, hot water heating air handling unit. This unit also operates 24/7.

The Willow Conference Center is served by a 9500 CFM VAV DX cooling, hot water heating air handling unit. This unit also operates 24/7.

The Springs restaurant and the public areas of the hotel are served by constant volume recirculating systems with a mixing section, filters, gas furnace heat, DX cooling coil and supply fan.

Guest Room HVAC

The majority of the hotel guest rooms are served by Packaged Terminal Air Conditioning units (PTAC). Approximately 10 of the rooms have had Packaged Terminal Heat Pumps (PTHP) installed as the existing units failed. The controls for the packaged units are located on the equipment and do not allow for occupied/unoccupied control.

Lighting Systems

Most of the lighting in common areas is fluorescent lamps controlled by local and centralized dimming systems. Most lighting in back of house areas is fluorescent and utilizes T8 lamps and electronic ballasts.

Occupancy sensors have been installed by hotel engineering staff in many back-of-house areas to control lighting based on occupancy. Guest room corridors utilize wall sconces which have recently been converted from incandescent candelabra lamps to compact fluorescent candelabras.

Refrigeration Systems

There are several walk-in coolers and refrigerators at PCCH. They are served by air cooled DX systems. Based on the field survey all of the coolers compressor motors have been replaced with ECM motors.

BUILDING ENERGY PROFILE

Utility Summary

The hotel is served by electric and natural gas utilities. Hotel staff provided recent utility billing. The following table shows these usages for 2010-2011.

Table 5: Monthly Utility Consumption and Costs for 2010-11

Month	Year	Electricity Usage (kWh)	Peak Demand (kW)	Electricity Cost ($)	Natural Gas (therms)	Natural Gas ($)	Total Cost ($)
Oct	2010	470,788	944	$29,566	15,422.2	$8,456	$38,022
Nov	2010	419,483	817	$25,558	24,412.1	$16,288	$41,846
Dec	2010	475,736	783	$27,457	34,679.2	$24,675	$52,131
Jan	2011	513,589	794	$29,478	36,955.2	$26,307	$55,785
Feb	2011	457,661	794	$28,107	36,926.7	$27,993	$56,101
Mar	2011	440,658	760	$27,051	25,502.2	$18,986	$46,038
Apr	2011	433,892	725	$26,389	20,092.6	$15,374	$41,763
May	2011	479,820	944	$28,975	12,998.1	$7,845	$36,820
Jun	2011	506,685	1,209	$37,123	11,270.6	$6,869	$43,992
Jul	2011	611,355	1,278	$44,463	9,047.7	$5,548	$50,012
Aug	2011	595,443	1,117	$42,229	8,978.9	$5,615	$47,844
Sep	2011	519,115	1,036	$37,884	11,139.3	$6,407	$44,291
Total		5,924,225		$384,281	247,425	$170,362	$554,643

The following figure gives a breakdown of utilities by cost for 2010-2011. Electricity accounts for 69% of utility costs. .

Energy End-Use Allocations

This section contains estimates for energy usage allocated to particular end-uses. These are used as guidelines for further developing energy conservation measures. The values presented are based on a building energy model that was built based on our survey and information provided by PCCH staff. Each resource will have an unallocated balance of energy or water.

Figure 2 shows the estimated end-use allocations for electrical energy. Estimated electrical energy end-use allocations show the largest energy usage is dedicated to the HVAC systems (33% ventilation fans, 22% space cooling, 9% space heating) followed by the slot machines (15%) and lighting (10%).

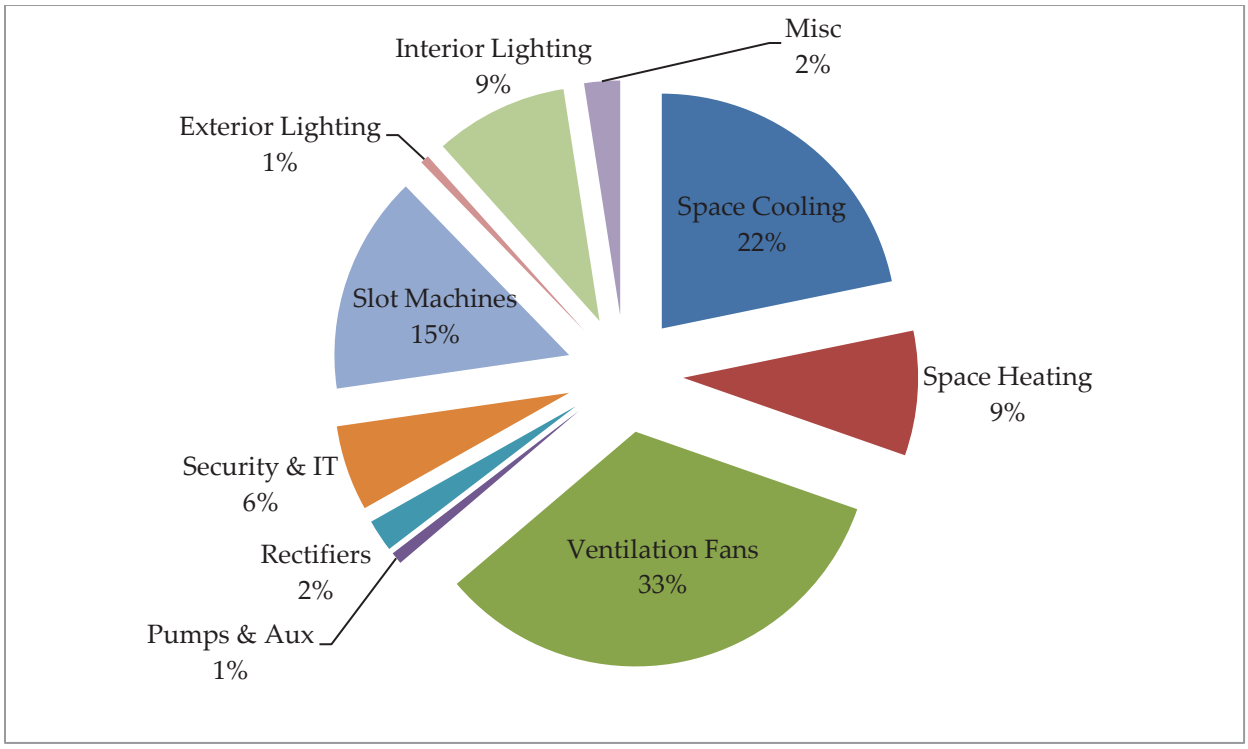

Figure 2: Estimated Electrical Energy End-Use by Application

Figure 3 shows the estimated end-use allocations for natural gas energy. The guest related end-uses were estimated along with the amount of heat needed for cooking, dishwashing and laundry, etc. The space heating values were obtained from the energy model developed for PCCH.

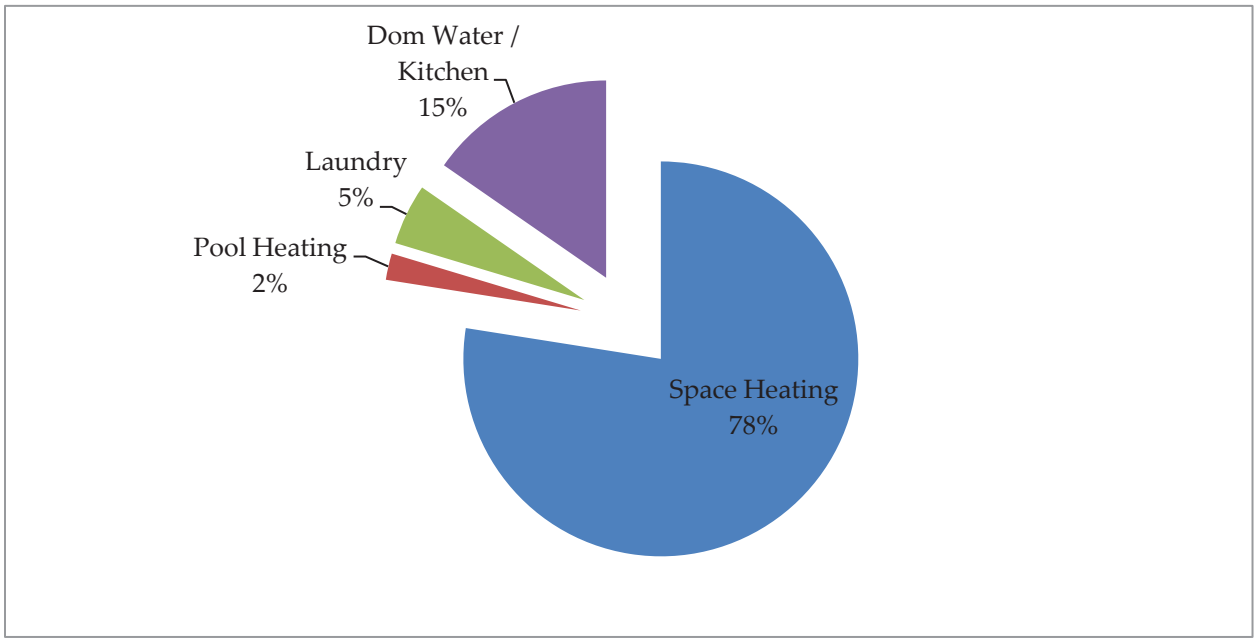

Figure 3: Estimated Natural Gas End-Use by Application

Figure 4 shows the combined energy use in BTUs. This allows us to see where the largest overall areas of energy use to target in the energy study.

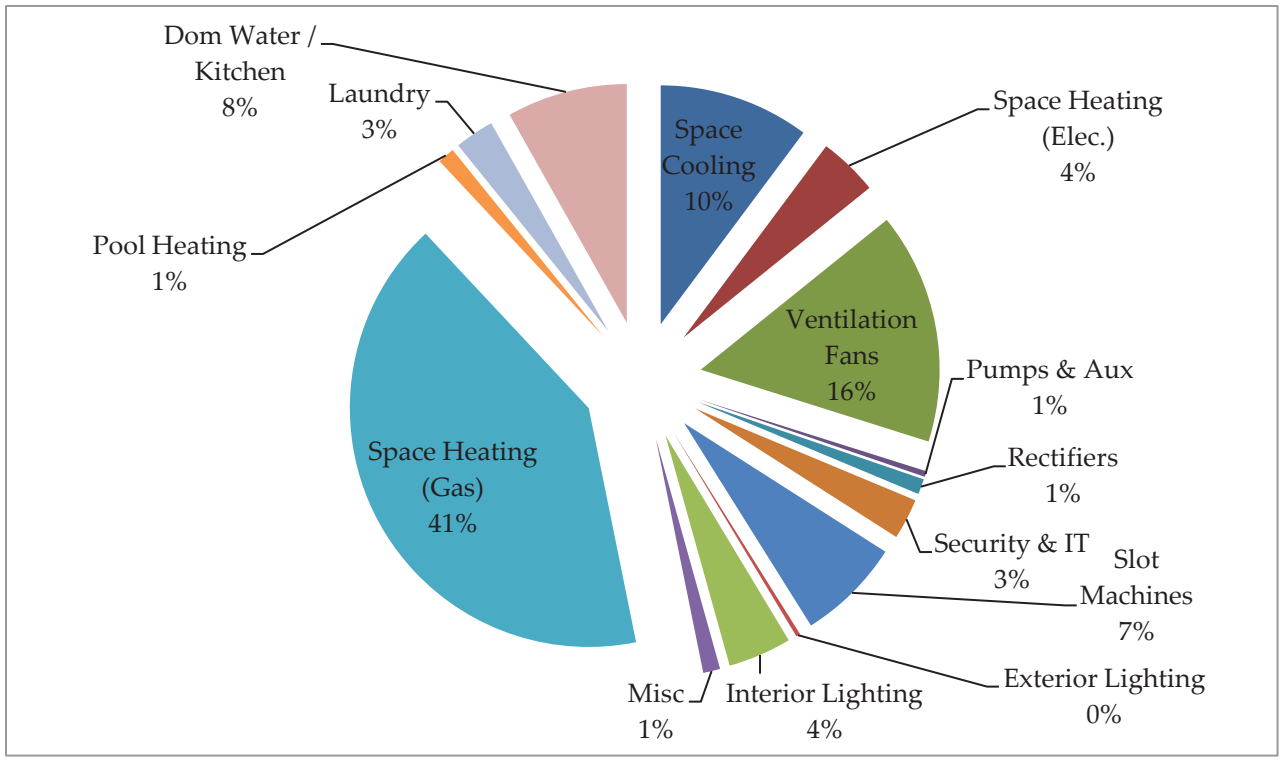

Figure 4: Estimated Total Energy Use by Application

Building Occupancy

The hotel has 99 guest rooms and is open year round. Historical guest room occupancy data since 2006 was provided by hotel staff and is shown in the following table. It should be noted that during discussions with hotel staff, the room occupancy rates were approximately 90% during the weekends, which would indicate that the average weekday occupancy would be approximately 43%.

Table 6: Monthly Occupancies for 2007

Month	Occupancy
January	53.1%
February	66.5%
March	54.8%
April	53.0%
May	52.5%
June	59.1%
July	69.0%
August	65.9%
September	58.5%

October	60.9%
November	46.7%
December	40.1%
Average	**56.7%**

Casino Occupancy

On site are an 18,000 ft² casino and 4,500 ft² bingo hall. The average amount of people in the gaming area varies greatly depending on the time of day. This affects the building load the HVAC systems see and directly relates to the overall energy use. Based on ASHRAE design conditions the design load for the casino is approximately 2,500 people and the Bingo hall is 625.

Table 7: Gaming Area Head Count

Time of Day	Spring	Summer	Fall	Winter	Average
6:00 AM	35	50	35	38	40
7:00 AM	104	117	83	83	97
8:00 AM	343	369	283	270	316
9:00 AM	673	705	499	493	593
10:00 AM	1008	1108	857	850	956
11:00 AM	1505	1630	1267	1085	1372
12:00 PM	1548	1678	1226	1063	1379
1:00 PM	1348	1501	1151	1063	1266
2:00 PM	1238	1450	1050	940	1170
3:00 PM	1243	1419	1042	891	1149
4:00 PM	1193	1273	1037	921	1106
5:00 PM	1378	1403	1144	1031	1239
6:00 PM	1183	1243	1107	1038	1143
7:00 PM	996	1058	1012	907	993
8:00 PM	835	965	882	801	871
9:00 PM	667	799	680	565	678
10:00 PM	448	615	504	552	530
11:00 PM	310	401	330	362	351
12:00 AM	121	152	124	117	129
1:00 AM	54	67	55	60	59
2:00 AM	28	30	28	25	28
3:00 AM	6	13	15	17	13
4:00 AM	9	11	8	11	10
5:00 AM	16	15	16	13	15

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OPERATIONS AND MAINTENANCE

The following list notes improvements that can be made in operations and maintenance which will tend to improve energy efficiency—directly or indirectly. These items were identified during a site survey in April of 2012. Also included are some items which would be considered good practice, or that concern safety. Items are categorized under Mechanical and Electrical.

Mechanical

1. Humidity is an issue for the gaming floor. Based on a review of the systems, it appears that infiltration may be a factor affecting the conditioned floor space. Currently, the exhaust fans do not have adequate make-up air which is causing excessive, unreached air to enter the building through doors and other openings.
2. The Willow conference rooms have had comfort complaints. Verify the unit operation and setpoints to improve comfort.
3. RTU-6's discharge setpoint of 58F has not been reached during observation. Only two of the four stages of cooling have been seen operating. Verify compressors are operating correctly. Reducing the discharge air temperature may help with humidity issues in the building.

Electrical

1. Whenever a new motor is purchased (renovation or replacement) a premium efficiency motor should be specified.
2. Install timer switch for walk-in cooler lights.

ENERGY CONSERVATION MEASURES (ECMS)

Feasible ECMs

This section of the report describes each specific ECM and presents a summary listing of the key economic factors for consideration. Specifically, each summary contains the estimated annual energy and dollar savings for each energy form and the total; estimates of any associated incremental annual operating and maintenance costs or savings; opinions of estimated capital cost to design, acquire and install each ECM; and the simple payback with, and without, operating and maintenance savings.

For each ECM, certain basic data was utilized and assumptions made to arrive at the projected savings. The basic data came primarily from a survey of the hotel, interviews with hotel facilities staff and record drawings.

Energy Savings Calculations

Units of electric energy savings are presented in terms of end-use energy, rather than the original source or generating energy, which would be higher. A conversion factor of 3,413 Btu/kWh is used to determine electrical MMBtu for comparisons between fuel types and for whole facility benchmarking.

Basis for Energy Cost Savings Calculations

The utility costs used to determine cost savings associated with ECMs are shown in Table 8.

Table 8: Approximate Unit Energy Costs for Building ECM Savings

Energy Type	Unit	Unit Cost, Delivered	$/MMBtu
Electricity	kWh	$0.065	$19.04
Natural Gas	therms	$0.689	$6.89

Total annual electricity savings have been rounded to the nearest 1,000 kWh and natural gas to the nearest 100 therm.

Opinions of Capital Costs for ECM Project Budgets

Cost estimates are based on vendor quotes, RS Means *Mechanical Cost Data,* and previous experience on similar projects. However, they do not include the cost to remove or dispose of hazardous materials, unless specifically noted for a given ECM project. Cost estimates will need to be adjusted for removal and disposal of asbestos or any other hazardous materials, if required. Contractor overhead and profit are included in the cost estimates for large projects. These fees are not included in projects to be performed directly by hotel facilities staff.

All opinions of capital cost include design fees where required for implementation. Design fees are expected fees for project packages of $100,000 or more. For project packages of less than $100,000, design fees may need to be adjusted.

For budgeting purposes, the estimated capital costs include a project contingency and cost estimates have been rounded up to the nearest $10,000 for projects greater than $50,000 and rounded up to the nearest

$1,000 for projects less than $50,000. The economics of each ECM were calculated as simple payback, the period of time (in years) that allows the annual savings to equal the capital cost without discounting

ECM 1: RTU-1 & RTU-2 DEMAND CONTROLLED VENTILATION

Recommended Action

Replace the outdoor, return and exhaust air damper actuators. Add Variable Frequency Drives to the exhaust fans. Add mixed gas and carbon dioxide sensors to control the outside air and exhaust fans. Test and balance unit to coordinate the damper position with exhaust fan flow

Background

RTU-1 & RTU-2 are constant volume 100% O.A. air handlings units, equipped with energy recovery, DX cooling coils, hot gas reheat and direct fire furnaces for heating. The total airflow is approximately 85,000 CFM, which equates to eight air changes per hour. The unit operates 24/7. When it is hot and humid outside, the hotel staff places the units in 100% recirculation mode, with the space not being adversely affected by smoke.

Implementation

Replace the outdoor, return and exhaust air damper actuators. Add Variable Frequency Drives to the exhaust fans. Add mixed gas and carbon dioxide sensors to control the outside air and exhaust fans. Test and balance the unit to coordinate the return and exhaust damper position with exhaust fan flow to maintain space pressurization.

Savings

The savings are based on the reduced outside airflows. This reduces the cooling and heating required. Additionally, there is considerable fan energy savings due to the reduced exhaust fan airflow requirements. The following table details the proposed electricity and natural gas usages and cost savings.

Note: Savings between ECM 1 and ECM 2 cannot be combined. Only perform one or the other.

Table 9: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics			
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
271,472	$17,600	30,387	$20,900	$38,500	78,750	*	1.58

* Incentive not estimated due to this ECM not being a recommended measure.

ECM 2: RTU-1 & RTU-2 DISPLACEMENT VENTILATION WITH HEAT RECOVERY CHILLER

Recommended Action

Replace existing diffusers in casino space with displacement diffusers. Add variable frequency drives to the supply and exhaust fans to vary airflow. Remove existing DX system and install hot water reheat coils and chilled water cooling coils. Additionally, install two air cooled chillers, one of which is a heat recovery chiller.

Background

Displacement ventilation is an effective way to condition large open spaces with high ceilings like the gaming floor. The technology allows for reduced airflows, while still providing the desired level of smoke control. Based on conversations with Innovent, they do recommend any reduction in airflow through the existing system. To implement the airflow reductions, the cooling system needs to be replaced. Approximately every other year, a set of existing compressors have had to be replaced at an estimated cost of $19,500.00. This upgrade would eliminate that added maintenance item and cost.

Implementation

The existing diffusers would be removed and new pendant displacement diffusers would be installed. After the diffusers are installed, the existing cooling system would be removed and new coils would be installed. The heat recovery chiller utilizes rejected energy to heat the domestic hot water and reheat hot water during the summer months.

Savings

The savings are based on reducing the total airflows through the system at all times. This reduces the heating and cooling requirements. Additionally, there are significant fan energy savings. The following table details the proposed electricity and natural gas usages and cost savings.

Note: Savings between ECM 1 and ECM 2 cannot be combined. Only perform one or the other.

Table 10: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics				
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	O&M Savings ($/ year)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
1,048,461	$68,150	42,478	$29,265	$97,415	$10,000	$864,000	$105,288	7.06

ECM 3: RTU-3 DEMAND CONTROLLED VENTILATION

Replace the outdoor, return and exhaust air damper actuators. Add a variable frequency drive to the exhaust fan. Add mixed gas and carbon dioxide sensors to control the outside air and exhaust fan. Test and balance unit to coordinate the damper position with exhaust fan flow

Background

RTU-3 is a constant volume 100% O.A. air handling unit, equipped with energy recovery, DX cooling coils, hot gas reheat and direct fire furnaces for heating. The total airflow is approximately 19,000 CFM. The unit operates 24/7.

Implementation

Replace the outdoor, return and exhaust air damper actuators. Add a variable frequency drive to the exhaust fans. Add mixed gas and carbon dioxide sensors to control the outside air and exhaust fans. Test and balance the unit to coordinate the return and exhaust damper position with exhaust fan flow to maintain space pressurization.

Savings

The savings are based on the reduced outside airflows. This reduces the cooling and heating required. Additionally, there is considerable fan savings due to the reduced exhaust fan airflow requirements. The following table details the proposed electricity and natural gas usages and cost savings.

Table 11: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics			
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
44,059	$2,860	6,655	$4,585	$7,445	$26,250	$2,908	3.13

ECM 4: SPRINGS KITCHEN VARIABLE VOLUME KITCHEN HOOD EXHAUST AND MAKE-UP AIR

Recommended Action

Use heat and opacity sensors in kitchen hoods to modulate exhaust and corresponding make-up airflow rates depending on usage.

Background

A system such as the Intelli-Hood offered by Melink can modulate the kitchen exhaust airflow and corresponding make-up air. A brochure of the Intelli-Hood system can be found in Exhibit 3. This system provides the kitchen staff the ability to turn on the exhaust fans to a preset minimum speed of 10 to 50%. They can manually bypass modulating control and turn on maximum exhaust when required.

The fan speed is modulated by exhaust air temperatures, increasing as more heat is given off by the cooking appliances. When smoke or vapor is present, the exhaust fans go to maximum speed until these particulates are removed. The make-up air unit can be controlled in conjunction with the exhaust fans so as to provide only the necessary outside air. Doing so will save fan electricity usage. Additionally, there will be energy savings associated with conditioning less outside air.

Implementation

The capital cost includes an optical sensor for each hood, and variable frequency drives (VFDs) for each fan. The existing roof top units will need to be replaced as a part of this project. They are at the end of their useful life, and upgrades are required to allow for the units to modulate as required.

Savings

Savings are dependent upon kitchen usage and are difficult to estimate. The following table details the expected savings associated with operating the Intelli-Hoods for an average airflow of 55% when the units are in operation. Actual scheduling is dependent on kitchen usage. The following table details the proposed electricity and natural gas usages and cost savings.

Table 12: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics			
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
46,700	$3,000	3,800	$2,615	$5,615	$52,500	$2,000	8.99

ECM 5: BANQUET KITCHEN VARIABLE VOLUME KITCHEN HOOD EXHAUST AND MAKE-UP AIR

Recommended Action

Use heat and opacity sensors in kitchen hoods to modulate exhaust and corresponding make-up airflow rates depending on usage.

Background

A system such as the Intelli-Hood offered by Melink can modulate the kitchen exhaust airflow and corresponding make-up air. A brochure of the Intelli-Hood system can be found in Exhibit 3. This system provides the kitchen staff the ability to turn on the exhaust fans to a preset minimum speed of 10 to 50%. They can manually bypass modulating control and turn on maximum exhaust when required.

The fan speed is modulated by exhaust air temperatures, increasing as more heat is given off by the cooking appliances. When smoke or vapor is present, the exhaust fans go to maximum speed until these particulates are removed. The make-up air unit can be controlled in conjunction with the exhaust fans so as to provide only the necessary outside air. Doing so will save fan electricity usage. Additionally, there will be energy savings associated with conditioning less outside air.

Implementation

The capital cost includes an optical sensor for each hood, and variable frequency drives (VFDs) for each fan. Modifications to the existing rooftop may be required to allow it to operate effectively while varying the outside airflow rate..

Savings

Savings are dependent upon kitchen usage and are difficult to estimate. The following table details the expected savings associated with operating the Intelli-Hoods for an average airflow of 55% when the units are in operation. Actual scheduling is dependent on kitchen usage. The following table details the proposed electricity and natural gas usages and cost savings.

Table 13: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics			
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
46,700	$3,000	3,800	$2,615	$5,615	$52,500	$2,000	8.99

ECM 6: FLAMES KITCHEN VARIABLE VOLUME KITCHEN HOOD EXHAUST AND MAKE-UP AIR

Recommended Action

Use heat and opacity sensors in kitchen hoods to modulate exhaust and corresponding make-up airflow rates depending on usage.

Background

A system such as the Intelli-Hood offered by Melink can modulate the kitchen exhaust airflow and corresponding make-up air. A brochure of the Intelli-Hood system can be found in Exhibit 3. This system provides the kitchen staff the ability to turn on the exhaust fans to a preset minimum speed of 10 to 50%. They can manually bypass modulating control and turn on maximum exhaust when required.

The fan speed is modulated by exhaust air temperatures, increasing as more heat is given off by the cooking appliances. When smoke or vapor is present, the exhaust fans go to maximum speed until these particulates are removed. The make-up air unit can be controlled in conjunction with the exhaust fans so as to provide only the necessary outside air. Doing so will save fan electricity usage. Additionally, there will be energy savings associated with conditioning less outside air.

Implementation

The capital cost includes an optical sensor for each hood, and variable frequency drives (VFDs) for each fan. The VAV programming will be linked to the Exhaust fan VFDs to maintain space pressurization and condition the air for the space.

Savings

Savings are dependent upon kitchen usage and are difficult to estimate. The following table details the expected savings associated with operating the Intelli-Hoods for an average airflow of 55% when the units are in operation. Actual scheduling is dependent on kitchen usage. The following table details the proposed electricity and natural gas usages and cost savings.

Table 14: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics			
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
74,800	$4,860	8,000	$5,510	$10,370	$26,250	$3,480	2.19

ECM 7: REPLACE DOMESTIC HOT WATER HEATER WITH HIGH EFFICIENCY UNITS

Recommended Action

Replace the existing standard efficiency hot water heaters with high efficiency models.

Background

There are six 200 MBH water heaters that serve the hotel part of the property. There are two 900 MBH water heaters serving the casino and Flames kitchen area. They serve the guest rooms, laundry facility and Springs kitchen.

Replacing the existing 80-83% efficiency units with 90-95% efficient units will reduce the gas usage for domestic hot water.

Implementation

Replace the existing hot water heaters with new high efficiency models. Reconnect the existing water and gas lines. Upgrade the venting to manufacturers recommendations.

Implementation costs include replacing the existing hot water heater with a newer high efficiency model. Additional venting may be required for the new water heaters.

Savings

This ECM will save gas by the higher efficiency of the units. This ECM was calculated by taking the current estimated gas usage and calculating what the revised value would be with the higher efficiency units.

Table 15: Estimated Energy Savings

Natural Gas		Investment Economics		
Energy Savings (Therms/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
6,600	$4,300	$58,800	$2,580	13.07

ECM 8: INSTALL HIGH EFFICIENCY HEATING HOT WATER BOILER AND ADD TEMP RESET CONTROL SEQUENCE

Recommended Action

Replace an existing standard efficiency boiler with a high efficiency model to operate during the summer months. The hot water temperatures would be reset to take advantage of the more efficient boiler.

Background

There are three existing standard efficiency boilers that supply 180F water year round for heating and reheat loads in the casino portion of the building. The existing boilers cannot operate with the return water temperature below 140F. The high efficiency boiler would allow the hot water heating temperatures to be reduced to approximately 140F supply to allow condensing occur and increasing the efficiency.

Implementation

Replace the existing boiler with a high efficiency boiler. The high efficiency boiler will operate when the temperatures are above 55F, and the hot water temperature can be reset.

Note: If ECM 2 is installed, this ECMs savings would be reduced.

Savings

Savings are based on the reset temperatures and the higher boiler efficiency.

Table 16: Estimated Energy Savings

Natural Gas		Investment Economics		
Energy Savings (Therms/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
7,500	$4,875	$26,250	$1,260	5.13

ECM 9: RETRO-COMMISSIONING

Recommended Action

Perform a systematic retro-commissioning of the facility. The purpose of retro-commissioning is to identify facility improvement measures (FIMs), that once implemented may reduce overall energy consumption, increase occupant comfort, enhance system efficiency, and provide operator training. In September, Focus on Energy will be re-releasing the retro-commissioning grant program.

Background

Based on the energy audit there are several items that would be addressed during the retro commissioning process that could affect energy savings.

- Schedule RTU-3s operation based on occupancy
- Schedule RTU-7s operation based on occupancy
- Set unoccupied airflows for RTU-6 to lower levels when heat is not required
- Verify RTU-6 and 7 outside air damper positions to account for building pressurization and infiltration.
- Reduce RTU-6 and 7's static pressure set point when possible. Consider implementing a static pressure set point adjustment.
- Set unoccupied setback for RTU-6 and 7.
- HW Temperature reset based on OAT

Implementation

GB/A would work within the controls contractor to functionally test equipment and make recommendations.

Savings

Table 17: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics			
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
208,405	$13,500	23,480	$16,150	$29,650	$11,500	$4,750	<1

ECM 10: ENERGY MISER FOR VENDING MACHINES

Recommended Action

Install Energy Miser for hotel vending machines to reduce energy use.

Background

Non Energy Star vending machines operate continuously even when it is not required. This ECM would reduce the hours of operation of the units while maintaining product quality.

Implementation

Vending Miser is a packaged product that incorporates an occupancy sensor to determine when the machine should be receiving power. In addition, the microprocessor automatically repowers the units to ensure that the product stays cold.

Savings

This ECM will save electricity usage in the form of reduced hours of operation. The following table details the proposed electricity usage and cost savings.

Table 18: Estimated Energy Savings per Energy Miser

Electricity		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
1300	$84	$180	60	1.43

Note: Savings and costs are per vending machine. This measure assumes 4 vending machines are equipped with a vending miser.

ECM 11: LIGHTING CONTROL UPGRADES

Recommended Action

See the lighting survey documents for list of measures and study details.

Background

G/BA was commissioned to study the lighting at PCCH. All of the interior lights in the facility were studied. Based on the field survey information, a series of recommendations was provided to reduce the energy used for lighting. There were three main recommendations concerning the interior lights depending on the space use. (1) install occupancy sensors instead of switched lights, (2) install LED fixtures to replace existing, (3) remove lamps in areas that are over-lit.

Implementation

Based on the survey, implement the recommended improvements.

Savings

This ECM will save electricity usage by reducing the lighting loads in the space.

Table 19: Estimated Energy Savings

Electricity		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
89,652	$5,800	$22,155	$TBD	3.82

Note: Focus on energy is currently reviewing potential incentives.

ECM 12: SLOT MACHINE LED RETROFIT

Recommended Action

Install an LED retrofit kit for each slot machine.

Background

There are 520 slot machines on the gaming floor at PCCH. Each of them is lit by a 38 watt fluorescent lamp. The kits replace the fluorescent lamps with a 17 watt LED array.

Implementation

See Appendix two for information from the EPA on LED retrofit kits.

Savings

This ECM will save electricity usage in the form of lower lighting loads. The following table details the proposed electricity usage and cost savings.

Table 20: Estimated Energy Savings

Electricity		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
96,000	$6,200	$28,665	$5,191	3.78

ECM 13: GUEST ROOM PTHP AND GUEST ROOM MANAGEMENT SYSTEM

Recommended Action

Replace existing PTAC units with new high efficiency PTHP system with supplemental electric heat. Install a guest room management system that integrates to the existing guest room management system.

Background

Currently the majority of the rooms are served by aging PTAC systems that are inefficient and at the end of their useful life. This ECM calculates the incremental savings associated with a new PTHP system and a guest room system. The hotel did a test with a PTHP and realized approximately 25% savings during a 45 day test.

Implementation

Replace existing PTAC units with new high efficiency PTHP system with supplemental electric heat. Install a guest room management system that integrates to the existing guest room management system as a part of the hotel guest room renovation.

Savings

This ECM will save on utility costs because it is installing more efficient system than existing, primarily during the periods where heat is required and it is above 32F. The systems will also only operate based on actual occupancy. The following table details the proposed electricity and natural gas usages and cost savings.

Table 21: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Incremental Project Cost ($)	Simple Payback (yrs)
200,000	$13,000	--	--	$13,000	$42,000	3.23

Focus on Energy incentives are as follows: $100 per qualified PTHP installed and $75 per room for the guest room management system. Total estimated incentive is $17,325 for a 99 room hotel.

ECM 14: CENTRAL SYSTEM VRF – NO GUEST ROOM MANAGEMENT – CENTRAL INTEGRATED CONTROL SYSTEM

Recommended Action

Replace existing guest room PTACs with a central Variable Refrigerant Flow system (VRF) with scheduling and integration to existing BAS system.

Background

Based on the existing building layout, with limited space between the first and second floor and the number of individual rooms served, a variable refrigerant flow system is the best energy efficient central system for this application. We compared VRF to a 4-pipe fan coil system and a ground source heat pump system.

Implementation

Replace the existing PTACs with a VRF system.

Savings

The following table details the proposed electricity usages and cost savings.

Table 22: Estimated Energy Savings

Electricity		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Incremental Cost ($)	Simple Payback (yrs)
225,000	$14,625	$14,625	$671,000	45.88

ECM 15: CONFERENCE ROOM UNIT REPLACEMENT UPGRADE

Recommended Action

As a part of the hotel remodel project, it is recommended that the aging rooftop units serving the conference areas be replaced. This measure models the additional costs and savings associated with installing the latest control strategies and highest efficiency units possible. The control strategies would include turning the units into single zone VAV units with demand controlled ventilation.

Background

The existing rooftop units that serve the conferences spaces closest to the springs restaurant are reaching their end of their service life. They are constant volume dx rooftop units with gas heat. The units currently run 24/7 because they are not integrated into the existing building BAS system. This measure models the additional costs and savings associated with installing the latest control strategies and highest efficiency units possible. The control strategies would include turning the units into single zone VAV units with demand controlled ventilation. This would require digital scroll compressors for the DX system, and a gas heating system with sufficient turndown to accommodate the variable airflow volumes.

Implementation

Replace the existing rooftop units with high efficiency units with the latest controls and incorporate them into the building automation .

Savings

The following table details the proposed electricity usages and cost savings. The savings are associated

Table 23: Estimated Energy Savings

Electricity		Natural Gas		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (therms/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Incremental Project Cost ($)	Simple Payback (yrs)
8,700	$565	4,100	$2,825	$3,390	$8,000	2.36

Exhibit 2 to Final Scientific/Technical Report for Award DE-EE005172

("Assessing the Feasibility of Comprehensive Energy Efficiency Upgrades at Potawatomi Carter Casino Hotel")

C-Store Energy Study

ENERGY STUDY

Final Report – 10/31/2013

POTAWATOMI C-STORE AND SMOKE SHOP

Potawatomi Carter C-Store and Smoke Shop

618 State Hwy 32
Wabeno, WI 54566

Grumman/Butkus Associates
Energy Efficiency Consultants and Sustainable Design Engineers
1011 North Mayfair Road; Suite 300
Wauwatosa, Wisconsin 53326-3431
414 476.8980 FAX 476.2470

Energy Study

Potawatomi C-Store & Smoke Shop
618 State Hwy 32
Wabeno, WI 54566

G/BA #13151

October 31, 2013– Final Report

Grumman/Butkus Associates
Energy Efficiency Consultants and Sustainable Design Engineers
1011 N. Mayfair Road, Suite 300
Wauwatosa, Wisconsin 53132

TABLE OF CONTENTS

INTRODUCTION

The Forest County Potawatomi Community with the aid of a Department of Energy Grant commissioned Grumman/Butkus Associates to develop a comprehensive feasibility study with the goal of achieving a reduction in energy consumption at the Potawatomi C-Store & Smoke Shop.

The Potawatomi C-Store & Smoke Shop is a 3,300 ft^2 gas station convenient store. The store includes a kitchen, office space, and bathrooms. This report focuses on the lighting and HVAC systems. The coolers were also reviewed, with future recommendations provided when it becomes time to replace the existing systems.

This report has two main purposes: To identify and evaluate potential energy conservation measures (ECMs), and to identify operations and maintenance procedures as they relate to energy. Historical energy consumption and energy costs have been included for an overview of building usage patterns and to give context for potential savings.

EXECUTIVE SUMMARY

Potawatomi C-Store and Smoke Shop has 3,300 square feet of conditioned space. Included in this area are display space, office space, storage, bathrooms, kitchen space, and a mechanical room.

Previous energy usage data show the following cost and Energy Usage Intensity (EUI) benchmarking metrics. The usage and cost intensity values are calculated using the approximate conditioned building area. The units of KWH indicate one thousand Watts per hour.

Table 1: Potawatomi C-Store & Smoke Shop Energy Usage Intensity Benchmarks

Calendar Year Utility	Annual Electricity Consumption (KWH/yr)	Estimated Propane Consumption (Gal/Yr)	Annual Energy Cost ($/yr)	Energy Usage Intensity (KBTU/ft²-yr)	Energy Cost Intensity ($/ft²-yr)	Energy Usage Intensity ($/day)
2011-12 Electricity	281,840	50	$29,383	291.2	$8.86	$80.50
2012-13 Electricity	270,080	50	$28,243	271.9	$8.51	$77.38

Energy conservation measures (ECMs) in this report are evaluated according to energy and operational costs that are affected by the project. Further breakdown of the energy usage allocated to end-use is presented in the following section of this report.

Benchmarking Comparisons

Energy Usage Intensity (EUI) is the kBTUs of energy used per square foot per year. From the U.S. Department of Energy's Energy Star Website research, the EUI for gas station convenience stores is 170. The Potawatomi C-Store and Smoke Shop have a EUI of 270 for the previous year. This is 58% higher than the median convenience store with gas station energy use.

There are several factors that lead to the higher than average energy use per square foot for the C-Store compared to the national median.

1. The C-Store and Smoke Shop is a 24/7 Facility
2. The use of air cooled refrigeration equipment in the store leads to higher space cooling requirements.
3. Old inefficient T-12 lights are still being used in the original store area. This adds to cooling loads and leads to higher energy bills.

After reviewing cost effective ECMs, we are projecting a savings of 27% of the total energy use in the building. This would reduce the EUI for the facility to approximately 197, bringing it closer to the median energy use for a convenience store with a gas station.

Summary of Available Cost Savings

Four recommended Energy Conservation Measures (ECMs) are presented in this report, totaling $7,861 in annual utility savings with a combined simple payback of 3.9 years. At a total capital cost of $30,615, these are intended to address energy conservation, cost management and environmental stewardship. The cost savings highlighted only include the energy cost savings. For example, the lighting retrofits do not include any savings associated with a reduction in light bulb replacement frequency.

The approximate percentage of annual utility cost savings performing all of the recommended ECMs is presented in Figure 1. A summary of annual cost savings and paybacks expected from each ECM is displayed in Table 2.

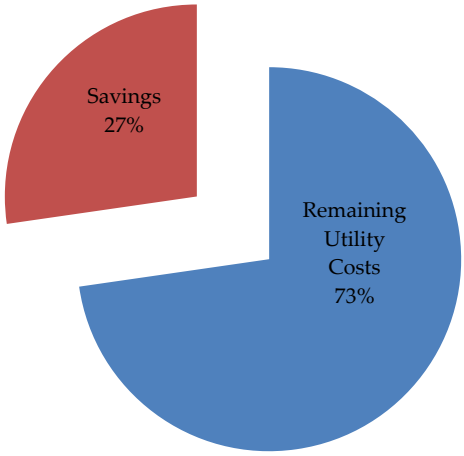


Figure 1: Total Annual Cost and Savings by Percent

Figure 2 illustrates the cash flow analysis for the recommended ECMs. This analysis assumes that the work and costs for the project would all occur in the first year. In year one, the Wisconsin Focus on Energy rebates are included and the full energy savings is provided. This graph does not take into account any increases in utility prices that would likely occur. The analysis also ends at year fifteen. That is where the end of useful equipment life would start occurring. Data on the estimated service life for equipment can be found in exhibit 1.

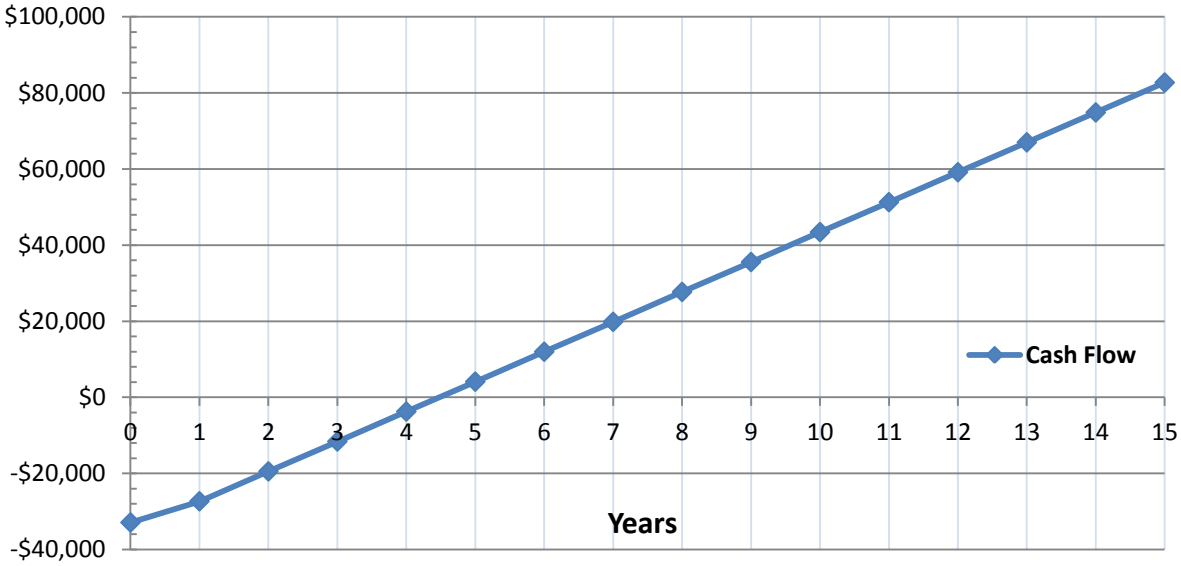


Figure 2: Cash Flow Analysis of Recommended ECMS

Table 2: Summary of Recommended Energy Conservation Measures

ECM	Description of ECM	Electricity		Energy		O&M	Investment Economics			
		Energy Savings (kWh/yr)	Energy Savings ($/yr)	BTU Savings (kBTU/yr)	% Energy Use Savings	O&M Savings ($/yr) (3)	Total Cost Savings ($/yr) (2)	Estimated Capital Cost ($) (4)	Focus on Energy Incentive ($) (1)	Simple Payback Before / After Incentive (years)
1	Interior Lighting	30,226	$3,268	103,161	10.89%	*	$3,116	$12,600	($525)	4.04 / 3.87
2	Economizer	14,353	$1,513	48,978	5.17%	*	$1,513	$5,070	($570)	3.35 / 2.97
3	Cooler Lights	10,807	$1,131	36,884	3.89%	*	$1,080	$1,800	($0)	1.67
4	Exterior Lighting	14,353	$2,152	70,222	7.41%	*	$2,152	$13,440	($1,200)	6.24 / 5.69
Total: Recommended Projects Budget Value		47,862	$8,064	259,245-	27.36%	*	$7,861	$32,910	$2,295	4.18-
Total Recommend Projects – After WFOE Grants										3.89

Notes:

1. Wisconsin Focus on Energy rebates are estimates based on incentives effective April 1, 2013 through March 31, 2014. Coordinate with the Wisconsin Focus on Energy Representative to obtain Rebates.
2. The total cost savings do not match the electricity savings due to ECM interaction and increases in the propane use due to the lower electricity use.
3. O&M Savings are not included since these tasks are performed in-house and may not lead to actual cost savings
4. ECMs include construction management and additional engineering fees in excess of any known DOE or WFOE grants.

MAJOR BUILDING ENERGY CONSUMING SYSTEMS

Air Systems

The C-Store & Smoke Shop are each served by propane fired furnaces for heating, with an evaporator coil for cooling. The total airflow is approximately 2,000 CFM, which equates to 3.6 air changes per hour. The unit operates 24 hours per day, seven days per week (24/7).

Lighting Systems

The C-Store Lamps are all T-12 fluorescent lamps and are on 24 hours per day, seven days per week (24/7). The smoke shop interior lights are T-8 fluorescent lamps and are on 24 hours per day, seven days per week (24/7). There are 24 Metal Haloid Canopy Lights in the gas station parking lot. These lights operate during hours of darkness and are controlled by the employees .

Refrigeration Systems

There is one walk-in cooler, with the condenser located outside and several air cooled refrigerators in the store that reject their heat directly in the space. All of the existing coolers utilize fluorescent lamps to light the product areas.

BUILDING ENERGY PROFILE

Utility Summary

The store is served by electric utilities. Staff provided recent utility billing. The following table shows these usages for 2010-2011.

Table 3: Monthly Utility Consumption and Costs for 2012

Month	Year	Electricity Usage (kWh)	Rate (w/o tax) ($/KWH)	Total Cost ($)
Jan	2012	24,240	0.1045	$38,022
Feb	2012	21,280	0.1046	$41,846
Mar	2012	23,440	0.1045	$52,131
Apr	2012	21,840	0.1045	$55,785
May	2012	20,960	0.1045	$56,101
Jun	2012	23,040	0.1045	$46,038
Jul	2012	24,800	0.1044	$41,763
Aug	2012	22,800	0.1046	$36,820
Sep	2012	23,280	0.1047	$43,992
Oct	2012	20,640	0.1047	$50,012
Nov	2012	21,200	0.1047	$47,844
Dec	2012	22,560	0.1046	$44,291
Total		270,080	0.1046	$28,241

The following figure gives an estimated breakdown of electric utilities by cost for 2011-2012.

Energy End-Use Allocations

This section contains estimates for energy usage allocated to particular end-uses. The values presented are based on a building energy model that was built based on our survey. The goal is to have as much of the energy use as possible being used for the equipment, while still keeping the building comfortable and an enjoyable place to shop.

Error! Reference source not found. 3 shows the estimated end-use allocations for energy based on the existing equipment and conditions. Estimated energy end-use allocations show the largest energy usage is dedicated to the electrical equipment at 46%. This is followed by 22% Interior lights, 15% Exterior lights, 6% System fan, 10% Cooling, and 1% Heating.

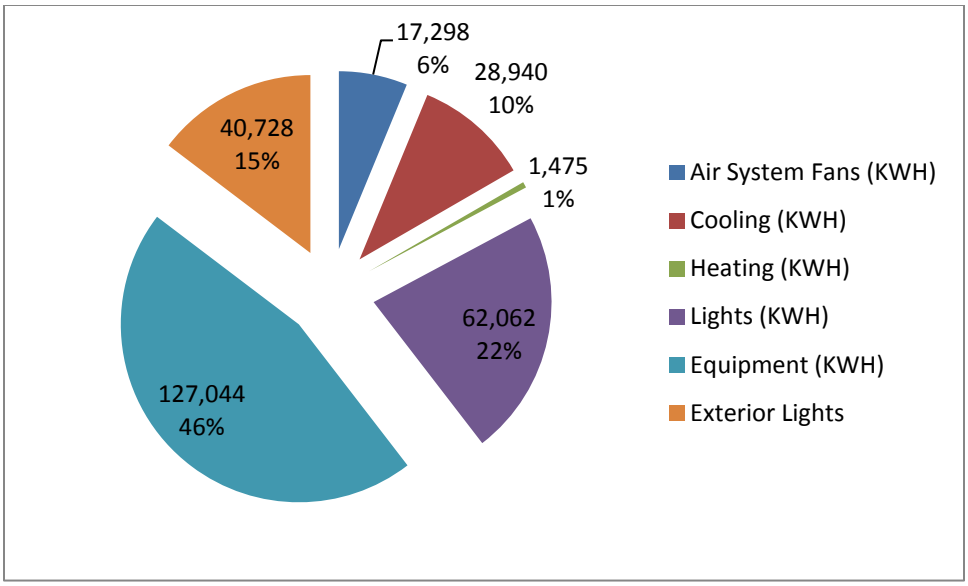


Figure 3 Estimated Energy Use Breakdown - Existing Conditions

Figure 4 shows the estimated end-use allocations for energy after all of the recommended ECMs have been implemented. Estimated energy end-use allocations show the largest energy usage is dedicated to the electrical equipment at 62%. This is followed by 13% Interior lights, 10% Exterior lights, 8% System fan, 6% Cooling, and 1% Heating.

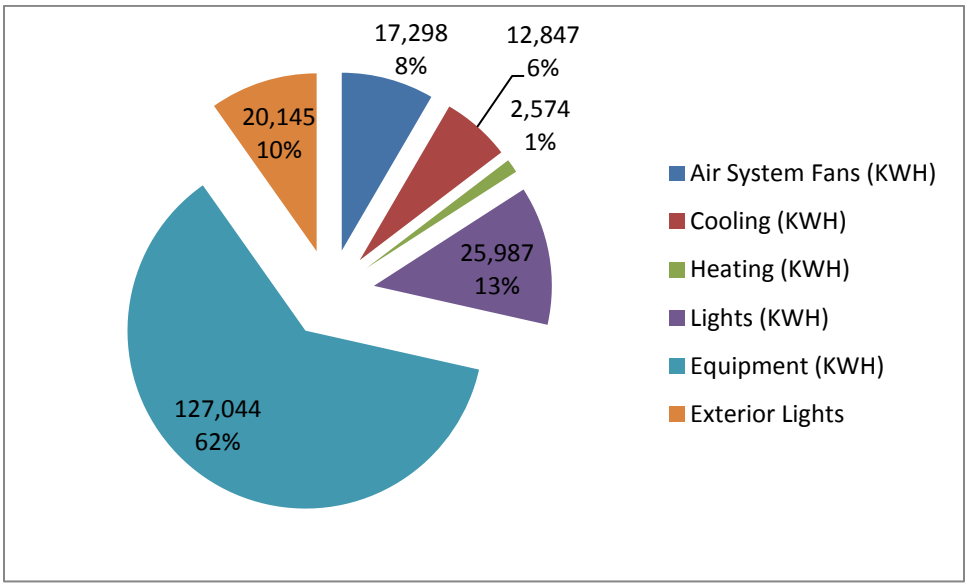


Figure 4 Estimated Energy Use Breakdown - with Recommended ECMs Implemented

ADDITIONAL RECOMMENDATIONS

Purchasing Policy

Consider putting in place a purchasing policy that accounts for any energy savings. For example, newer product coolers utilize LED lights and more efficient cooling systems to reduce energy use. Consider requiring Energy Star labeled equipment when purchasing new equipment.

Facility Recommendations

The facility was constructed approximately 20 years ago, items such as the roof are reaching the end of their expected life. The roof should be inspected to determine how much useful life is remaining, to reduce the chance of serious moisture damage in the facility.

ENERGY CONSERVATION MEASURES (ECMS)

Feasible ECMs

This section of the report describes each specific ECM and presents a summary listing of the key economic factors for consideration. Specifically, each summary contains the estimated annual energy and dollar savings for each energy form and the total; estimates of any associated incremental annual operating and maintenance costs or savings; opinions of estimated capital cost to design, acquire and install each ECM; and the simple payback.

For each ECM, certain basic data was utilized and assumptions made to arrive at the projected savings. The basic data came primarily from a survey of the C-Store & Smoke Shop.

Energy Savings Calculations

Units of electric energy savings are presented in terms of end-use energy, rather than the original source or generating energy, which would be higher. A conversion factor of 0.0915 MMBtu/gal and 0.003412 MMBtu/kWh is used to determine electrical MMBtu for comparisons between fuel types and for whole facility benchmarking.

All of the calculations were performed utilizing the Carrier HAP version 4.70 Building Analysis Program to ensure accuracy and model any interaction between each measure.

Basis for Energy Cost Savings Calculations

The utility costs used to determine cost savings associated with ECMs are shown in Table 4.

Table 4: Approximate Unit Energy Costs for Building ECM Savings

Energy Type	Unit	Unit Cost, Delivered	$/MMBtu
Electricity	kWh	$0.1046	$30.66
Propane	Gallons	$1.52	$16.61

Opinions of Capital Costs for ECM Project Budgets

Cost estimates are based on vendor quotes, RS Means *Mechanical Cost Data,* and previous experience on similar projects. However, they do not include the cost to remove or dispose of hazardous materials, unless specifically noted for a given ECM project. Cost estimates will need to be adjusted for removal and disposal of asbestos or any other hazardous materials, if required. Contractor overhead and profit are included in the cost estimates for large projects. These fees are not included in projects to be performed directly by C-store employees.

The economics of each ECM were calculated as simple payback, the period of time (in years) that allows the annual savings to equal the capital cost.

ECM 1: INTERIOR LIGHTING

Recommended Action

Replace the 35 T-8 and T-12 florescent lights with new LED fixtures.

Background

The lights are on 24/7 and are currently using between 1.94-2.2 kW/Ft.^{2}. The new LED lights will only consume between 0.75-1.4 kW/Ft.^{2}

Implementation

Demolish existing T-8 and T-12 fixtures and replace with LED fixtures.

Cost Estimate

($360 a fixture - $15 FOE Incentive) x 35 fixtures = $12,075

Savings

The savings are based on the reduced energy consumed by the new lights. This also reduces the amount of cooling required in the building, due to the reduced amount of heat produced by the LED lights. However, the heating energy will increase. The following table details the proposed electricity and propane usages and cost savings.

Table 5: Estimated Energy Savings

Electricity		Propane		Investment Economics			
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Energy Savings (Gallons/yr)	Cost Savings ($/yr)	Total Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
30,226	$3,268	-100	-$152	$3,116	$12,600	$525	4.04 / 3.87

ECM 2: ECONOMIZER

Recommended Action

Add a new outside air duct to tap into the existing return duct serving the furnace. Add a dry bulb economizer with all associated sensors and dampers.

Background

The economizer will reduce the load on the furnace. A series of dampers and sensors will be implemented in order to mix the air returning to the furnace with varying amounts of outside air in order to create a mixed air temperature as close as possible to the desired supply air set point.

Savings

The savings are based on the reduced cooling load on the split system condenser.

Table 6: Estimated Energy Savings

Electricity		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
14,353	$1,513	$5,070	$570	3.35 / 2.97

ECM 3: COOLER LIGHTING

Recommended Action

Replace the T-12 lamps in the walk-in cooler with LED lamps.

Background

There are 18 lamps serving the walk-in cooler that are on 24/7. Nine of them consume 56W each, while the other 9 consume 115W each. The replacement LED lamps will consume 28W each.

Savings

The LED lamps with consume less energy than the current T-12 lamps. They will also reduce the cooling load, due to the reduced amount of radiated heat produced by the LED lamps.

Table 7: Estimated Energy Savings

Electricity		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
10,807	$1,080	$1,800	*	1.67

ECM 4: EXTERIOR LIGHTING

Recommended Action

Replace the current 24 Halogen Canopy Lights with the proposed LED fixture.

Background

The current Canopy Lights consume 320 Watts each. The LED fixtures will only consume 82 Watts.

Implementation

Demolish existing metal halide fixtures and replace with LED fixtures.

Cost Estimate

($560 a fixture - $50 FOE Incentive) x 24 fixtures = $12,075

Savings

Savings are due to the reduced energy consumption of the LED fixtures.

Table 8: Estimated Energy Savings

Electricity		Investment Economics		
Energy Savings (kWh/yr)	Cost Savings ($/yr)	Project Cost ($)	WFOE Incentive ($)	Simple Payback (yrs)
20,575	$2,152	$13,440	$1,200	6.24 / 5.69

N:\2013\13151 - FCPC Potawatomi C-Store Energy Audit

Exhibit 3 to Final Scientific/Technical Report for Award DE-EE005172

("Assessing the Feasibility of Comprehensive Energy Efficiency Upgrades at Potawatomi Carter Casino Hotel")

Final TEP Annual Review Presentation from Terry Rye

FOREST COUNTY
POTAWATOMI
Keeper of the Fire

Potawatomi Carter Casino Hotel

2013 Feasibility Study of Comprehensive Energy Efficiency Upgrades

Terry Rye - Director of Facilities

Brief Summary of FCPC

- Forest County Potawatomi Community (FCPC) Tribal enrollment numbers about 1450 with about half living on reservation lands. The FCPC is a federally recognized Indian tribe governed by a 6 person Executive Council.

Brief Summary of FCPC

- Originally located in Eastern Canada, the tribe migrated to the Western Lake Michigan area. As white settlers moved in, the tribe was relocated to Kansas. Many opposed removal and went to live in areas of Northern Wisconsin, Michigan and Canada. The tribe purchased its own land with Treaty monies in 1913.

Brief Summary of FCPC

- The Potawatomi are a member of the Confederacy of the Chippewa and Ottawa, and were given the task of keeping the sacred fire, hence the name "Keeper of the Fire.“

- The Forest County Potawatomi (FCP) has lived in Forest County, Wisconsin, since the late 1800s. Around 1880, groups settled in areas near Blackwell and Wabeno and have lived in that area since, as well as in the Carter and Crandon (or Stone Lake) areas.

Brief Summary of FCPC

- Today, life on the reservation is very different than it was for the elders. They have done much for the younger generation, and it is because of the elders that the younger generations are who they are today.
- By pursuing a diverse set of business models, the Forest County Potawatomi of today are the largest employer in Forest County.
- With revenues from various tribal enterprises, the Potawatomi have invested in the health, wellness, education, environment and future of its people

Brief Summary of FCPC

- Forest County is also home to almost 350,000 acres of national forest land known as the Chequamegon-Nicolet National Forest. In 1998 the two national forests in Wisconsin, the Chequamegon and the Nicolet, were combined in name for administrative purpose

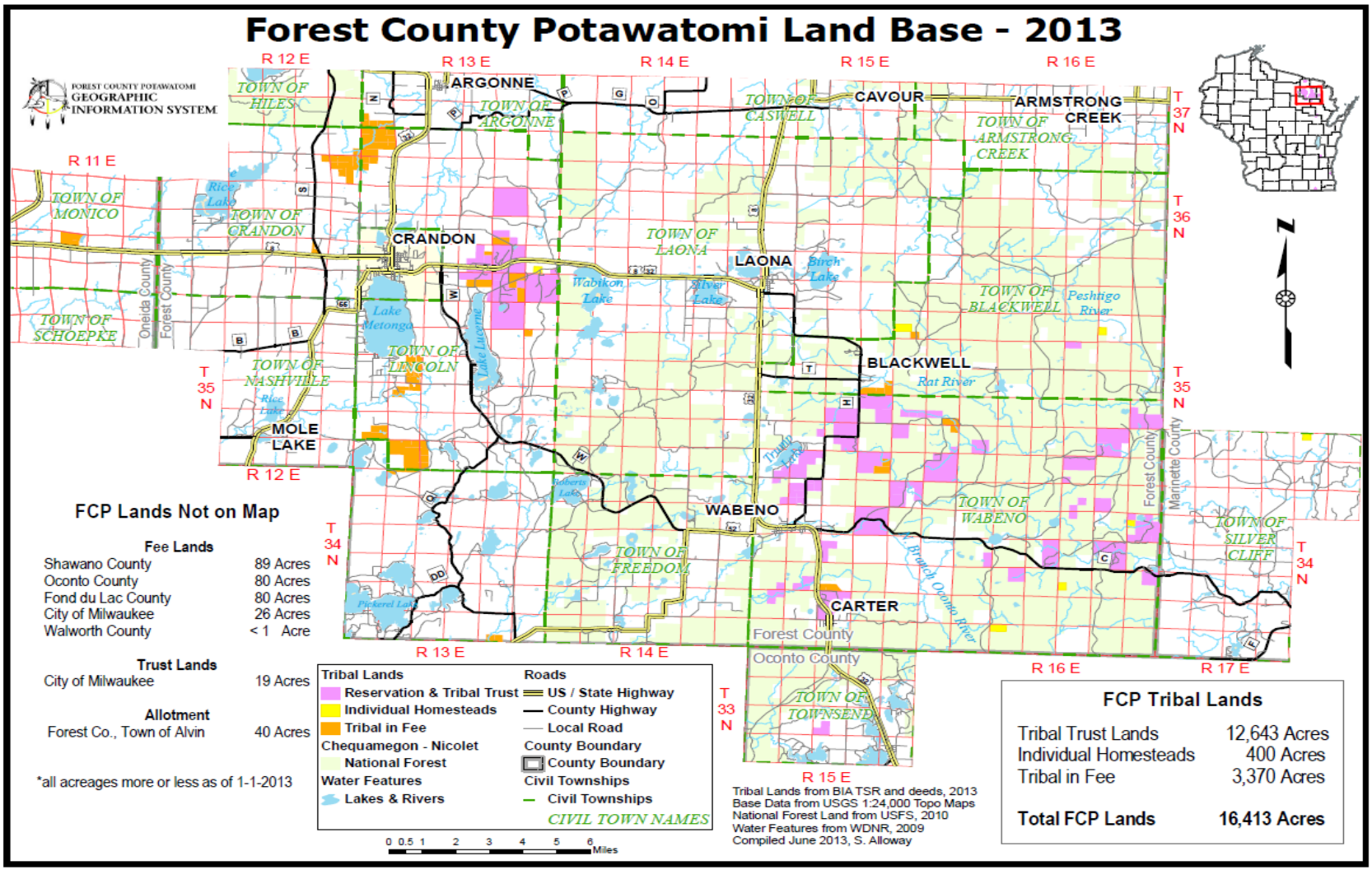
Project Overview

- The Tribe has hired Grumman/Butkus Associates, Energy Efficiency Consultants and Sustainable Design Engineers, located in Wauwatosa WI. to complete a comprehensive energy efficiency feasibility study, including a full-scale energy audit. The PCCH Energy Study was completed 12-31-2012 and contains detailed reports and actionable recommendations to yield at least a 30% reduction in overall energy use, once implemented at the PCCH.

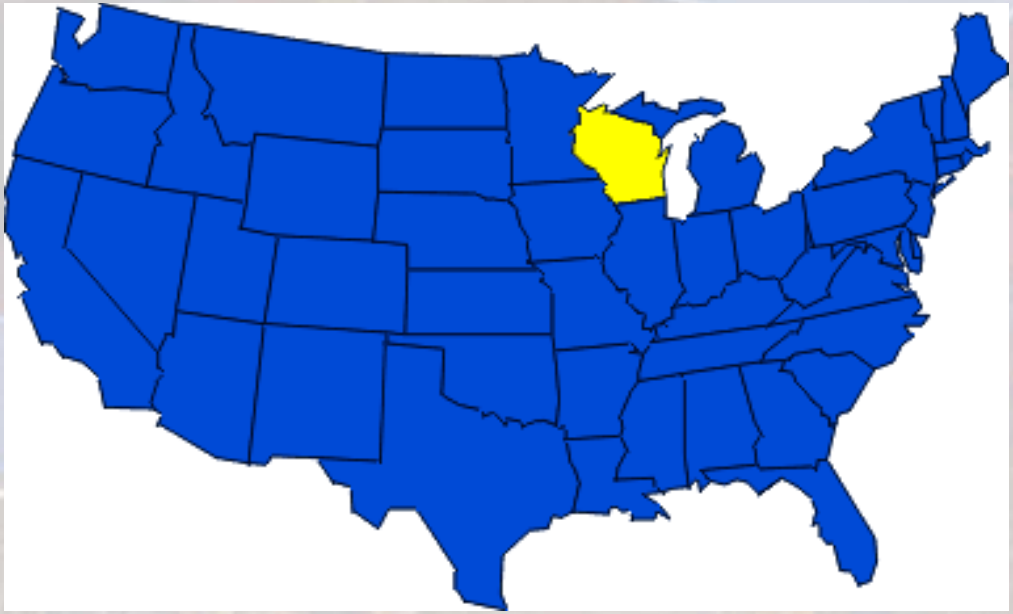
Project Location

- The Forest County Potawatomi Community (FCPC) reservation lands consist of 12,000 acres in rural Forest County, Wisconsin. The Tribe's reservation lands are "checker-boarded" meaning that non-Indian owned land and Tribal reservation land border each other in several locations, resulting in a visual "checkerboard" of Indian and non-Indian lands.

FCPC Land Base



FCPC Location



The proposed project is wholly located at the Potawatomi Carter Casino Hotel in Carter on the FCPC reservation south of the town of Wabeno, Wisconsin.

Project Participants

Contact Information	
Business Contact: Nathan A. Karman Legal Department Forest County Potawatomi Community 313 North 13th Street Milwaukee, WI 53233 Phone: (414) 847-7750 Fax: (414) 847-7721 Email: nathan.karman@fcpotawatomi-nsn.gov	**Technical Contact:** Mr. Terry Rye, Facilities Director Potawatomi Casino Carter Hotel 618 State Highway 32 Wabeno, WI 54566 Phone: (715) 473-6797 Fax: (715) 473-5908 Email: trye@cartercasino.com

Project Participants

Contact Information

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Project Objectives

- The Forest County Potawatomi Community with the aid of a Department of Energy Grant commissioned Grumman/Butkus to develop a comprehensive feasibility study with the goal of achieving at least a 30% reduction in energy consumption at the Potawatomi Carter Casino Hotel (PCCH).

- The Potawatomi Carter Casino and Hotel is a 99 room hotel gaming center. Guest services include two restaurants, a swimming pool and a fitness center. The gaming center has an 18,000 square foot casino with slot machines and table games and a 4500 square foot bingo hall. There are also spaces for meetings and banquets. Employee areas include laundry facilities, kitchens, offices, storage and mechanical space. This report focuses mainly on these public and employee areas of the hotel.

Project Goals

- To identify and evaluate potential energy saving conservation measures, (ECM's)
- To make recommendations regarding implementation of ECM's in the context of current and anticipated infrastructure upgrades.
- To identify operations and maintenance procedures as they relate to energy.
- To provide guidance for the planned hotel renovation.

Past Related Activities

Table 2: Summary of Past Completed Energy Conservation Measures

ECM	Description	Electricity		Natural Gas		Investment Economics			
		Energy Savings (kWh/yr)	Energy Savings ($/yr)	Energy Savings (therms/yr)	Energy Savings ($/yr)	O&M Savings ($/yr)	Focus on Energy Incentive Rebate Amount	Estimated Capital Cost ($)	Simple Payback (years)
1-10-2010	Heating System Tune-Up			5765	$3,975.	$0	$800.00	N/A	0
6-12-2010	Cooling System Tune Up < than 500 tons	43,335	$2816.00			$0	$1,155.60	N/A	0
1-04-2011	Replace 2 Neon "BEVERAGES" signs with LED back illuminated lighting. White acrylic letters on green background.	51.42	$493.44	-----	-----	$0	Did Not Qualify	$4,782.10	9.69
5-12-2011	Replace 17 year old furnace in Grounds Building with Rheem RGRM Furnace, 100,000 BTU with ECM motor and 2 stage gas valve	1076	-----	331	$265.00	$0	$150.00	$3,000.00	10.75
5-31-2011	99 low flow shower heads were installed in all the hotel guest rooms, flow rate is 1.6 GPM.	-----	-----	-----	-----	$0	No FOE incentive rebate available	$430.00	-----
6-15-2011	Installed 8 occupancy lighting sensors in hotel public restrooms	15,556	$1007.00	-----	-----	$0	$60.00	$622.00	.79
6-23-2011	Replacement of 172 150watt incandescent bulbs on Casino gaming floor with 18watt LED Par 38 dimmable floods	154,020	$10,411.72	-----	-----	$0	$4,803.00	$16,011.75	0.89
10-30-11	Replace evaporator motors in 20 (6) Freezers (14) Coolers with Electronically Commutated Motors (ECM's)	25,658	$1,796.44	-----	-----	$0	$1,200.00	$1,746.00	.30

On Going or Completed Projects

- 103 Hotel Guest Room PTAC units 21-22 years old have been replaced with new PTHP units.
- Units are (83) 9000 BTU 3KW Heat Pump and (20) 12000 BTU 3KW Heat Pumps.

On Going or Completed Projects

- These new Package Terminal Heat Pumps in conjunction with the Guest Room Energy Management system being installed in March and April of this year should result in a 40% reduction in energy usage related to this ECM for a $13,000.00 annual energy savings with a payback of just over 3 years.

Retrocommissioning

- Item 1: Add CO2 sensor to RTU-7
- Item 2: Reconfigure Hot water system
- Item 3: Provide Schedule and Setpoint changes for RTU-7
- Item 4: Provide scheduling for RTU-3
- Item 5: Provide Scheduling for RTU-6

Retrocommissioning

Item 1: Add CO2 sensor to RTU-7

- Add a CO2 sensor to the return air of RTU-7. Program the exhibition hall VAV boxes (2 qty) so that the minimum CFM of each box is reset based on CO2 levels.

Retrocommissioning

Item 2: Reconfigure Hot water system

- Provide all hardware and software to reconfigure hot water system as follows:
- Lead boiler to be automatically selected based on runtimes
- Hot water system to be controlled to maintain supply water temperature. Supply water setpoint to be reset based on outside air temperature.
- Each boiler to be staged to maintain setpoint. When one boiler has all of its stages on and their continues to be a call for heating then an additional boiler to stage on.

Retrocommissioning

Item 3: Provide Schedule and Setpoint changes for RTU-7

- Schedule unit to operate based on need and reduce the static pressure setpoint to .75”

Item 4: Provide scheduling for RTU-3

- Provide a schedule for this unit to allow it to go into unoccupied mode when the space is unoccupied.

Retrocommissioning

Item 5: Provide scheduling for RTU-6

- Provide schedules for the 24 VAV zones that GBA has determined can be set to an unoccupied mode. Reset minimum VAV flows to a lower value and reset space temperature set points during unoccupied mode. Make adjustments to RTU to allow it to operate with the lower demand that is caused by the unoccupied modes

Retrocommissioning

- The Total Project Cost was $10,260.00.
- The total Focus on Energy Incentive was $6,669.00.
- The total WPS Bonus Incentive was $2,565.00.
- Total out of pocket expense - $1,026.00
- The energy savings verified were 135,191 kWhs and 17,597 therms. This equates to $21,605.30 in annual energy savings and equals a ½ month payback.

Activities Yet to be Completed

Table 1: Summary of Recommended Energy Conservation Measures

ECM	Description of ECM	Electricity		Natural Gas		Energy		O&M	Investment Economics			
		Energy Savings (kWh/yr)	Energy Savings ($/yr)	Energy Savings (therms/yr)	Energy Savings ($/yr)	BTU Savings (kBTU/yr)	% Energy Use Savings	O&M Savings ($/yr)	Total Cost Savings ($/yr)	Estimated Capital Cost ($) (5)	Focus on Energy Incentive ($) (2)	Simple Payback Before / After Incentive (years)
2	Casino Displacement Ventilation with Heat Recovery Chiller	1,048,461	$68,150	42,478	$29,265	7,826,197	17.41%	$10,000	$107,415	$864,000	$105,288	8.04 / 7.06
3	Bingo Hall RTU Demand Controlled Ventilation	44,059	$2,860	6,655	$4,585	815,873	1.81%	$0	$7,445	$26,250	$2,908	3.56 / 3.13
4	Springs Kitchen Variable Volume Hood Exhaust and Makeup	46,700	$3,000	3,800	$2,615	539,387	1.20%	$0	$5,615	$52,500	$2,000	9.25 / 8.99
5	Banquet Kitchen Variable Volume Hood Exhaust and Makeup	46,700	$3,000	3,800	$2,615	539,387	1.20%	$0	$5,615	$52,500	$2,000	9.25 / 8.99
6	Flames Kitchen Variable Volume Hood Exhaust and Makeup	74,800	$4,860	8,000	$5,510	1,055,262	2.35%	$0	$10,370	$26,250	$3,480	2.54 / 2.19
10	Energy Miser for Vending Machines (1)	5,200	$336	0	0	17,748	0.04%	$0	$336	$756	$240	2.25 / 1.54
11	Lighting Fixture and Control Upgrades	89,651	$5,800	0	$0	282,596	0.63%	$0	$5,800	$22,155	TBD	3.82
12	Retrofit Casino Slot Machines with LED lights	96,000	$6,200	0	0	327,648	0.73%	$0	$6,200	$28,665	$5,191	4.62 / 3.78
15	Conference Room Unit replacement upgrade (6)	8,700	$565	4,100	$2,825	439,693	0.98%	$0	$3,390	$8,000**		2.36
Total: Recommended Projects Budget Value		1,460,271	$94,771	68,833	$47,415	11,843,791	26.35%	$10,000	$152,186	$1,081,076	$1,211,07	5.84

Future Plans

- Continue to seek funding to complete the unfinished Energy Conservation Measures identified in the Summary Graph of Recommended ECM’s

Carter C-Store Plans

Carter C-Store

- The Carter C-Store is in the process of taking action on their energy study.
- They are working with Focus on Energy and are in the process of getting Bids for all the recommended lighting upgrades.
- They are hoping to complete their recommended ECMs this year.

Comments or Questions??

Potawatomi Carter Casino Hotel

2013 Feasibility Study of Comprehensive Energy Efficiency Upgrades

Terry Rye - Director of Facilities