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3.0 Part 2: Energy Audit

3.1 Acknowledgements of Part 2: Energy Audit

The Energy Audit Report and Excel RPCA Model were completed by Jason Bing and Henry McElvery of AKT Peerless. AKT Peerless certifies that the report preparers meet the qualifications identified in the RAD Physical Condition Assessment Statement of Work and Contractor Qualifications Part 2.1 (Version 2, December 2013).

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Date: February 21, 2014

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Date:___________________________

AKTPEERLESS

Rental Assistance Demonstration (RAD):

PART 2: ENERGY AUDIT

106 Packard Street, Ann Arbor, Michigan 48104

BAKER COMMONS

PREPARED FOR Norstar Development USA, LP
733 Broadway
Albany, NY 12207

ON BEHALF OF The Ann Arbor
Housing Commission
727 Miller Ave
Ann Arbor, MI 48103

PROJECT # 8212E-2-96

PIC # MI064

DATE October 7, 2013

AKTPEERLESS

TABLE OF CONTENTS

Energy Audit

Baker Commons

106 PACKARD STREET
ANN ARBOR, MICHIGAN 48104

for

Ann Arbor Housing Commission

727 MILLER AVE
ANN ARBOR, MICHIGAN 48103

AKT PEERLESS PROJECT NO. #8212E-2-96

1.0 Executive Summary

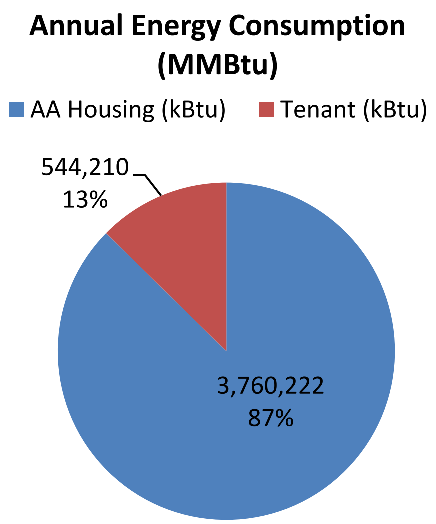
This report presents the findings and recommendations from a RPCA Energy Audit conducted at Baker Commons located at 106 Packard Street in Ann Arbor, Michigan. The Energy Audit follows industry standards and acceptable practice for assessing energy and water performance of commercial and multi-family buildings. The audit has been conducted by AKT Peerless and has involved a coordinated effort between AKT Peerless, the Client and building operating staff.

Documents were provided for review, interviews and field investigations were conducted, and building systems were analyzed. In the year analyzed (January, 2012 to December, 2013) the Ann Arbor Housing Commission spent an estimated $71,540 on all utilities at the subject property. All together, the tenants spent an estimated $27,776 on utilities.

AKT Peerless identified six (6) separate Energy Conservation Measures (ECMs). The annualized savings of all recommendations totals $9,697 (at current energy and water prices), with the potential to reduce total energy consumption and GHG emissions by 13%. If fully implemented, the payback period from annual energy savings for these ECMs is estimated to be 1.8 years. Measures associated with common areas (PHA expenses) and measures specific to tenant units have been separated for planning purposes.

Measures best suited for implementation at the End of Useful Life (EUL), advanced ECMs, and measures recommended for further evaluation have been identified and are included in Sections 11-12 of this report.

A preliminary energy use assessment was conducted prior to the cost reduction measure analysis. The figure below describes the historical annual energy consumption and cost for the subject property.



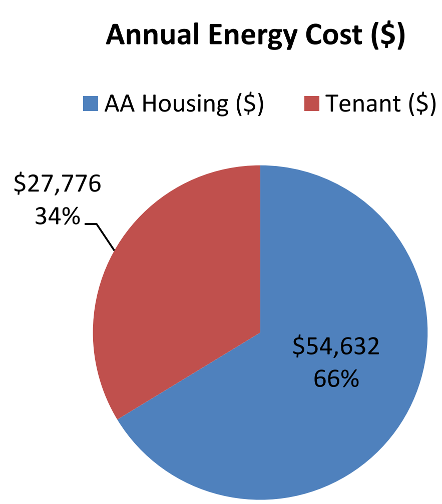


Figure 1. Historical Annual Energy Consumption and Cost

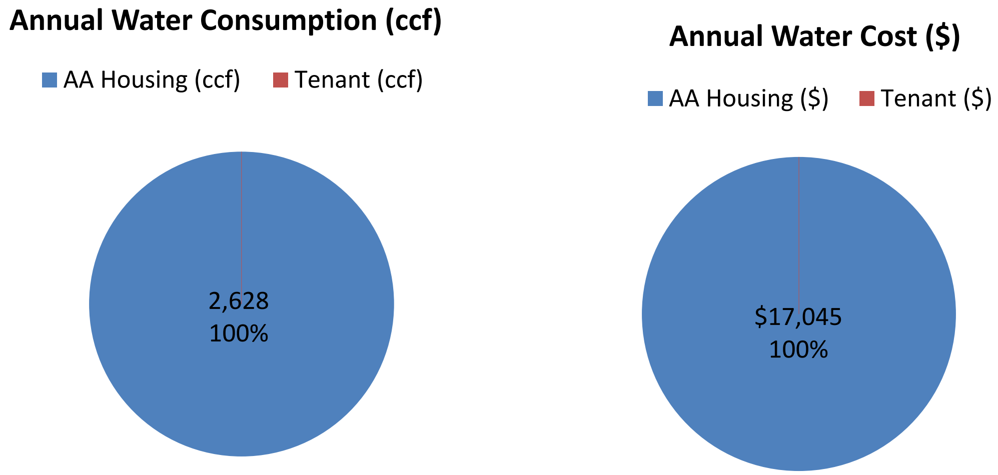


Figure 2. Historical Annual Water Consumption and Cost

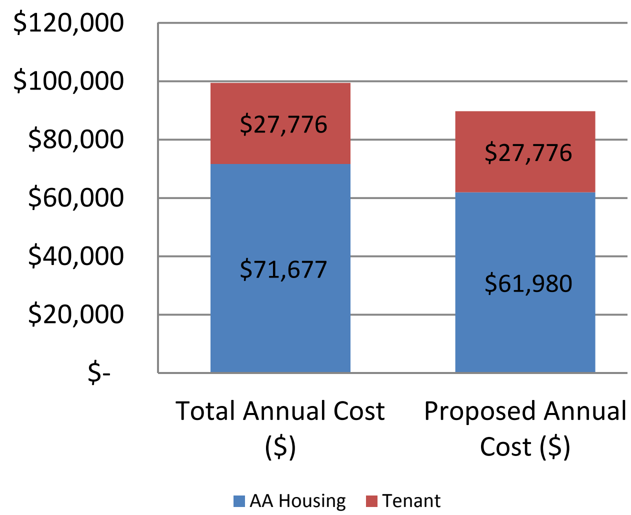
The implementation costs and annual savings estimates for each proposed Energy and Water Conservation Measure are presented in Table 1 and Table 2. Table 1 outlines ECMs and WCMs that will directly impact the Owner's annual costs.

Table 1. Financial Summary of All Energy Conservation Measures (Owner)

Energy or Water Conservation Measure	ID	Additional First Cost	Annual Savings	Simple Payback (yrs)
Install Occupancy Sensors in Common Areas	ECM1	$150	$307	0.5
Interior Lighting Retrofit	ECM2	$6,870	$1,328	5.2
Exterior Lighting Retrofit	ECM3	$2,679	$1,314	2.0
Install Controls on Vending Machines	ECM4	$128	$283	0.5
Install Premium Efficiency Motors on HVAC Equipment	ECM5	$655	$126	5.2
Repair MUA Unit and Control Outdoor Air Ventilation	ECM7	$7,300	$6,339	1.2
	Totals	**$17,782**	**$9,697**	**1.8**

Table 2. Impact Summary

% Energy Savings	16%
% Water Savings	0%
% Cost Savings	10%
Annual Cost Savings ($)	$9,697
% Reduction in GHG Emissions (CO_2 Equivalent Metric Tons)	13%



2.0 Purpose and Scope

Norstar Development USA, LP, on behalf of the Ann Arbor Housing Commission (the Client), retained AKT Peerless Environmental & Energy Services (AKT Peerless) to conduct a RPCA Energy Audit of Baker Commons located at the 106 Packard Street in Ann Arbor, Michigan.

AKT Peerless' scope of work for this Energy Audit is based on its proposal PE-14249, dated January 9, 2013 and revised on March 15, 2013 and authorized by Norstar Development USA, LP on behalf of the Ann Arbor Housing Commission (the Client), and the terms and conditions of that agreement.

The purpose of this report is to assist the Client in evaluating the current energy and water use and energy and water cost of the subject property relative to other, similar properties; and also to identify and develop modifications that will reduce the energy and water use and /or cost of operating the property. This report will identify and provide the savings and cost analysis of all practical measures that meet the client's constraints and economic criteria, along with a discussion of any changes to operation and maintenance procedures. It may also provide a listing of potential capital-intensive improvements that require more thorough data collection and engineering analysis, and a judgment of potential costs and savings. Additionally, this report will identify the feasibility of green energy technologies, as well as, determine if further analysis is recommended.

Relevant documentation has been requested from the client that could aid in the understanding of the subject property's historical energy use. The review of submitted documents does not include comment on the accuracy of such documents or their preparation, methodology, or protocol. The following documents were available for review while performing the analysis:

- Energy Utility Bills
- 2009 United States Greenhouse Gas Inventory, Annex 2
- USEPA Climate Leaders Calculator for Low Emitters
- HUD Residential Energy Benchmark Tool
- HUD Residential Water Use Benchmarking Tool
- National Oceanic Atmospheric Administration "Normal Monthly Heating Degree Days (Base 65)" and "Normal Monthly Cooling Degree Days (Base 65)"

3.0 Additional Scope Considerations

In addition to fully satisfying the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Procedures for Commercial Building Energy Audits, Second Edition 2011, Level II guidelines, this report includes all the necessary requirements of an Energy Audit as defined in the Rental Assistance Demonstration (RAD): Physical Condition Assessment (RPCA) statement of Work and Contractor Qualifications released by the Department of Housing and Urban Development (HUD) in December 2013 (Version 2). These items are identified as follows:

- An initial assessment of the potential feasibility of installing alternative technologies for electricity, heating and cooling systems, and hot water heating at the property. (See Section 13.0)
- An expected end of useful life study for all recommended energy and water efficiency measures.
- Recommendations of any additional professional reports needed (including, for example alternative energy system feasibility studies, air infiltration tests for energy loss and ventilation needs, blower door tests, infrared imaging, duct blasting, etc.)

4.0 General Information

4.1 Audit Team

This audit is the result of a collaborative process between the following AKT Peerless and client personnel:

Name	Organization	Title
Linnea Fraser	AKT Peerless	Energy Engineer
Lance Mitchell	Ann Arbor Housing Commission	Facilities & Maintenance Property Manager
Jennifer Hall	Ann Arbor Housing Commission	Executive Director

4.2 Audit Process

AKT Peerless collected historical energy data and floor plans for the building, when available. The square footage of all spaces was determined and the size and location of pertinent mechanical equipment was documented. AKT Peerless conducted a walk-through survey of the building on November 13th 2012 and then on April 18, 2013 collecting specific information on the mechanical, electrical, and plumbing systems as well as occupancy, scheduling, and use patterns.

AKT Peerless utilized industry accepted measuring devices, including but not limited to: a blower door to quantify air infiltration, an infrared camera to visually identify areas of potential energy loss, and a ballast discriminator to identify existing T12 lighting or improper T8 retrofits. Light levels were measured using a light meter in various areas to compare to Illuminating Engineering Society of North America (IESNA) recommended levels.

A visual inspection of the mechanical equipment, lighting systems, controls, building envelope and plug loads was performed. Mechanical equipment nameplate data was recorded and the specifications and performance data were reviewed and used in this analysis.

4.3 Energy Calculations Methodology

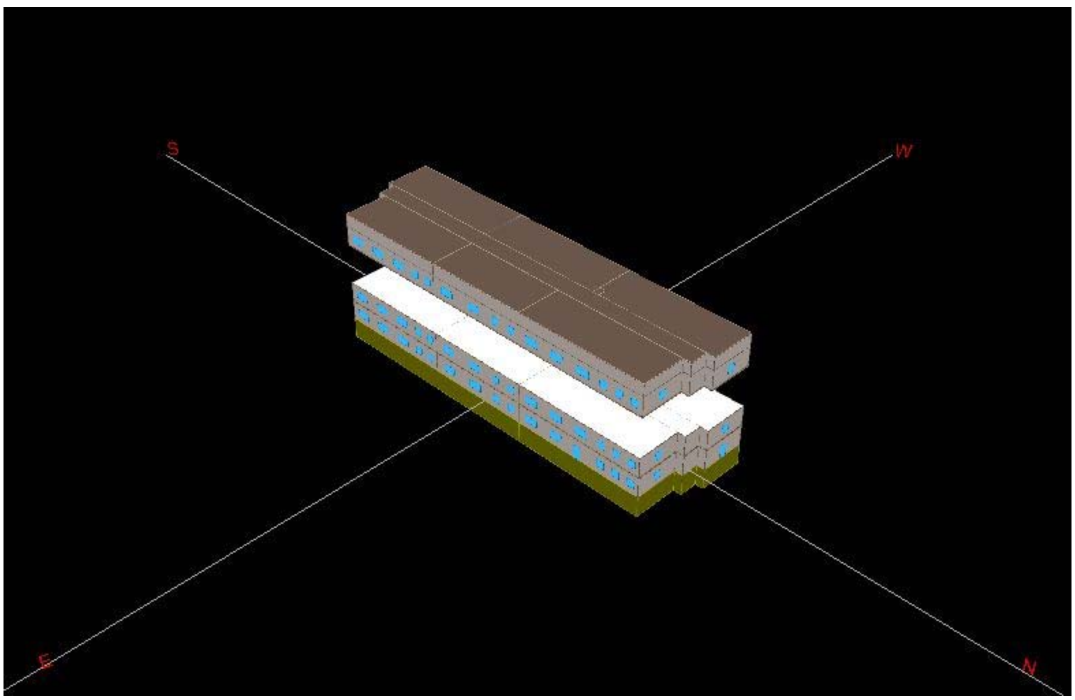
The primary methods of energy calculation for this analysis were simplified manual and spreadsheet tabulations based on professional standards. Actual calculation methods are discussed in each applicable section.

Additional energy calculation for this analysis utilized an hourly energy simulation model. The model was developed using eQUEST, which is an industry accepted standard package. This program uses the DOE-2.2 analysis routine originally developed by the U.S. Department of Energy. The program performs hourly simulations of the building and its energy consuming equipment, including the HVAC systems, lighting, plug loads and other energy consuming equipment. Detailed schedules were set up for key parameters such as building occupancy, system start/stop times, lighting on/off patterns, etc.

Simulations are performed over an entire calendar year using standardized hourly weather data (Typical Meteorological Year – TMY2). This program meets the rigorous standards set by ASHRAE Standard 90.1-2004 and the International Measurement and Verification Protocol for building simulation modeling.

The end use consumption breakdown, found later in this report, is based on 2003 Commercial Buildings Energy Consumption Survey (CBECS) data for lodgings of relatively similar scale and age.

Because current utility bill information was not available for all the tenant spaces, the audit team did not have an accurate accounting of all energy consumption in the facility. For this reason, average tenant utility bill information from the previous energy audit of the subject property is being used in this report. Because the tenants are only responsible for electrical consumption of personal lighting and appliances, it is assumed that the usage has not changed significantly within the last five years. Thus, the study period for the common area utility is identified in this report as June 2011 to May 2012.



View of eQuest energy model utilized in this analysis

5.0 Property Description

This section summarizes physical characteristics and general use of the subject property.

5.1 Location

The subject property is located in ASHRAE Climate Zone 5A. According to National Oceanic and Atmospheric Administration recording of heating and cooling degree days, on an annual basis Ann Arbor, MI is expected to experience an average of 6,818 heating degree days (HDD) and 840 cooling degree days (CDD) with a basepoint temperature of 65 degrees Fahrenheit.

5.2 Property Characteristics

General information pertaining to the subject building is summarized in the following table:

Table 3. Property Characteristics

Primary Building Type / Occupancy	Multi-Family (General)
Region	ASHRAE 5A
Date of Construction	1980
Approximate Total Square Footage	46,270 sq ft

The subject property Primary Building Type is designated as Multi-Family (General). For all energy performance comparisons presented in this report the subject building will be compared to similar buildings of the same Primary Building Type.

5.3 Property Spaces

Spaces refer to the building as a whole and the rooms that comprise the building. Typically, the various space types will serve specific functions within the facility. The following table identifies the space types for the subject building. An estimate of common area was based on the assumption that the average size of a unit apartment was around 663 square feet.

Table 4. Summary of Property Spaces

Space	Use	Sq Footage	% of Total Area
Common	First floor, corridors, and stairwells	4,600 ft^2	10%
Sixty-Four (64) 1-bdr unit	Residential Apartments	42,400 ft^2	90%

5.4 Building Occupancy

Occupancy schedule has a significant impact on a facilities energy usage. In fact, the relationship between occupancy and system operating schedules and setpoints are typically more important than equipment efficiencies. The occupancy schedules for the subject building as follows:

Table 5. Building Occupancy Schedule

Day	Time	Use	Average Population
Community Area			
Monday-Friday	Varies (based on events)	Staff and Community	10-25
Administrative Office			
Monday-Friday	8:00am-5:00pm	Office Work	4-5
Residential Apartments			
Sunday-Monday	All Day	Primary Residence	64 (1 per unit)

5.5 Building Envelope

This section summarizes physical characteristics of the subject building envelope.

5.5.1 Walls and Wall Insulation

The above grade wall construction is a 5-story standard brick and block assembly on a concrete foundation. Exterior walls are structural, concrete masonry unit (CMU) construction with a brick veneer finish. Tenant living spaces are finished to the interior with painted drywall. It was reported that these walls are insulated, and the overall effective R-value is estimated to be no greater than R-11. The foundation walls in the basement are poured concrete and are uninsulated. This is generally regarded as standard efficiency construction.

5.5.2 Roof and Roof Insulation

The roof construction at the subject property is comprised of two pitched roofs running (primarily north-south, with prefabricated or site-built trusses bearing on east and west exterior wall and interior (corridor) structural bearing walls. The pitched roofs have recently been refinished with standing seam steel roofing on top of a weatherproofing membrane adhered to exterior grade decking. The new metal roofing is grey in color.

A flat roof between the pitched roofs acts as an access path directly above the building corridors and is finished with a rubberized membrane.

Passive and mechanical exhaust vents for restrooms and mechanical equipment penetrate the pitched roofs at regular intervals.

The attic space floor at the pitched roofs was observed to contain approximately 6 inches of fiberglass batt insulation, laid on the ceiling with an overall insulation value approximated at R-19. There did not appear to be significant displacement, and insulation appeared in fair condition. This is generally regarded as substandard efficiency (<R-21).

5.5.3 Windows and Other Fenestrations

The windows found in the residential units at Baker Commons appear to be standard efficiency double pane glazing, in a slider type, aluminum frame window. The assembly is set, finished and sealed in the masonry opening. Windows appear to be thermally broken. There are higher efficiency alternatives available.

It was noted that several tenants complained about the draft from these windows and issues with opening them.

It appears that commercial storefront glazing systems set in aluminum frames exist in common area spaces at the first and second levels.

5.5.4 Doors

All of the main entrance doors are standard hollow metal doors with glass panels. The overhead service door is constructed of uninsulated corrugated panels and is mechanically operated.

5.6 Heating, Ventilation, and Air Conditioning (HVAC)

The central HVAC system provides the primary heating and cooling needs of the facility. In the subject property, there are two types of systems conditioning the corridors and tenant units, respectively. The tenant spaces and community center contain two-pipe fan coil units that are connected to both a hot water and chilled water plant located in the basement. The hot water plant consists of two Lochinvar gas-fired boilers, model #KBN500, rated at 500 MBH input each, and one Raypack gas-fired boiler, rated at 333 MBH. The two newer Lochinvar boilers are modulating - condensing boilers and the other is a 32 year old (original to the building), atmospheric draft, 80% efficiency, boiler piped in parallel for peak load conditions. The chilled water system consists of one air-cooled Trane chiller, rated at 70 tons and a 10.2 EER. The fan coils operate on a seasonal schedule based on an outside temperature of 65°F. The temperature in each unit is controlled by a manual Honeywell thermostat. Based on tenant input, the typical temperature setpoints for the fan coil units are around 71°F in the winter and 76°F in the summer.

The corridors of each floor and community room (first floor) are conditioned with two fan coil units on each end. The Sanyo fan coil units are part of an air-to-air heat pump split system with condensing units located outside near the building. The interior fan coil units come with supplemental electric resistance heating, rated at 1.8 kW. The temperature for these units is controlled by individual thermostats.

Fresh outdoor air (OA) for ventilation is supplied to the center of each corridor via an indirect gas-fired makeup air (MUA) unit in the basement. The louver system which controls the ratio of outdoor air to return air appears to be non-functional on this makeup air unit and it currently brings in 100% outside air. Also, the existing burner on the unit does not ignite and the outside air is not properly conditioned during the colder seasons.

Ventilation for the units is supplied by a ceiling exhaust fan in each bathroom. The bathroom exhaust fans are vented to stacks leading to several ventilation hoods on the roof. Additionally, the kitchen has a ductless range hood fan that exhausts the air with a manual switch.

The property's domestic hot water is supplied by one atmospheric, gas-fired boiler in the basement. This Teledyne Laars boiler is rated at 925 MBH input and 740 MBH output. This boiler is 32 years old (original to the building, and has exceeded its expected useful life.

5.7 Lighting

This section describes this property's interior and exterior lighting.

5.7.1 Interior Lighting

Interior lighting in the common area and corridors is provided by fluorescent light fixtures. Most of the fixtures contain T8 lamps with electronic ballasts. There is a combination of 1x4, 2x4, and 2x2 fixtures throughout the building. In addition, the entrance common area contains recessed fixtures with halogen bulbs. Interior lights are typically on up to 24 hours per day in the lobbies, corridors, and stairwells. Interior lighting is typically turned off at night in the common areas and mechanical rooms. The apartment units are all provided with two 3-lamp fixtures that currently house compact fluorescent lamps as well as a single two foot T8 fluorescent lamp under the bathroom cabinet. Observed units also had table lamps that each contained compact fluorescent lamps.

5.7.2 Exterior Lighting

Exterior lighting consists of five pole mounted flood light fixtures with 250W metal halide lamps and two wall-mounted flood lights. In addition, the entrance area contains ten (10) recessed fixtures with 75 watt halogen bulbs. It should be noted that three of the five pole-mounted lights were on during the morning site-visit.

5.8 Other Equipment (Energy)

Typical apartment unit kitchens include a refrigerator, microwave and range hood for the electric stove. Equipment is generally considered standard efficiency equipment. The range hood appears to only circulate air, and is not vented to the outside.

The community room kitchen and gathering space contains a standard Whirlpool refrigerator, a standard microwave, and an older Kenmore electric stove. More efficient refrigerator models are available for the unit.

5.9 Water Consuming Devices

Each typical apartment unit has devices in the kitchen, bath and basement that consume water. Typical apartment unit kitchens appear to have a standard sink with standard efficiency aerators. The units have one bathroom which has a lavatory, toilet and shower/bath. It appears most units have low-flow devices installed in each of the bathrooms, including showerheads and faucet aerators. Toilets are 1.6 gpf units.

The central laundry room contains a slop sink, two washers, and four dryers. The washers and the slop sink aerators appear to be standard efficiency/flow.

The first floor has two ADA compliant bathrooms, which have a standard flow aerator at the lavatory (2.0gpm) and a 1.6 gpf toilet. The community room kitchen also has a standard sink with standard flow faucet.

5.10 Improvements since Previous Audits

Currently, the subject property is undergoing a metal roof replacement and there are plans to replace the standard dual pane windows in all of the tenant spaces. Additionally, the audit team believes the following equipment replacements/upgrades have taken place since the previous energy/water audits were conducted in 2009:

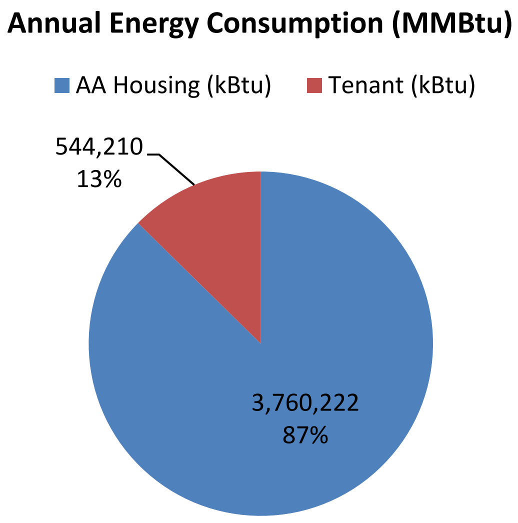
- Two new (high efficiency) boilers
- DTE direct install program participant
  - Tenant low-flow faucets
  - Tenant low-flow showerheads
- Partial LED Exit sign lighting retrofit
- New standing seam steel roofing (2013)

6.0 Energy Use Analysis

This section provides information on energy delivery to the subject property.

Energy use and cost indices for each fuel or demand type, and their combined total, have been developed using generally accepted industry methods and benchmarking tools provided by the Department of Housing and Urban Development (HUD) . The Energy Utilization Index (EUI) and cost index of the subject building are compared with the EUI and cost index of similar buildings evaluated in the HUD Residential Energy Benchmarking Tool.

AKT Peerless could not analyze the utility bills due to a lack of records. The following figures summarize the most recent annual energy consumption and costs for this property. These graphs reflect Ann Arbor's Housing estimated annual utility consumption and cost**.**



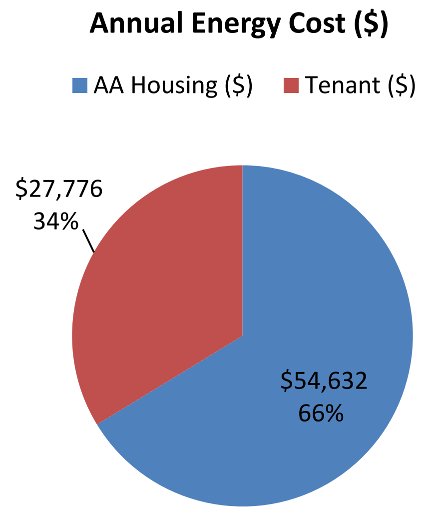


Figure 3. Historical Annual Energy Consumption and Cost

6.1 Electricity

For the time period covered by client provided records, historic electricity use is summarized in the following figures.

Providers	Number of Meters	Unit of Consumption
DTE Energy	65	kWh

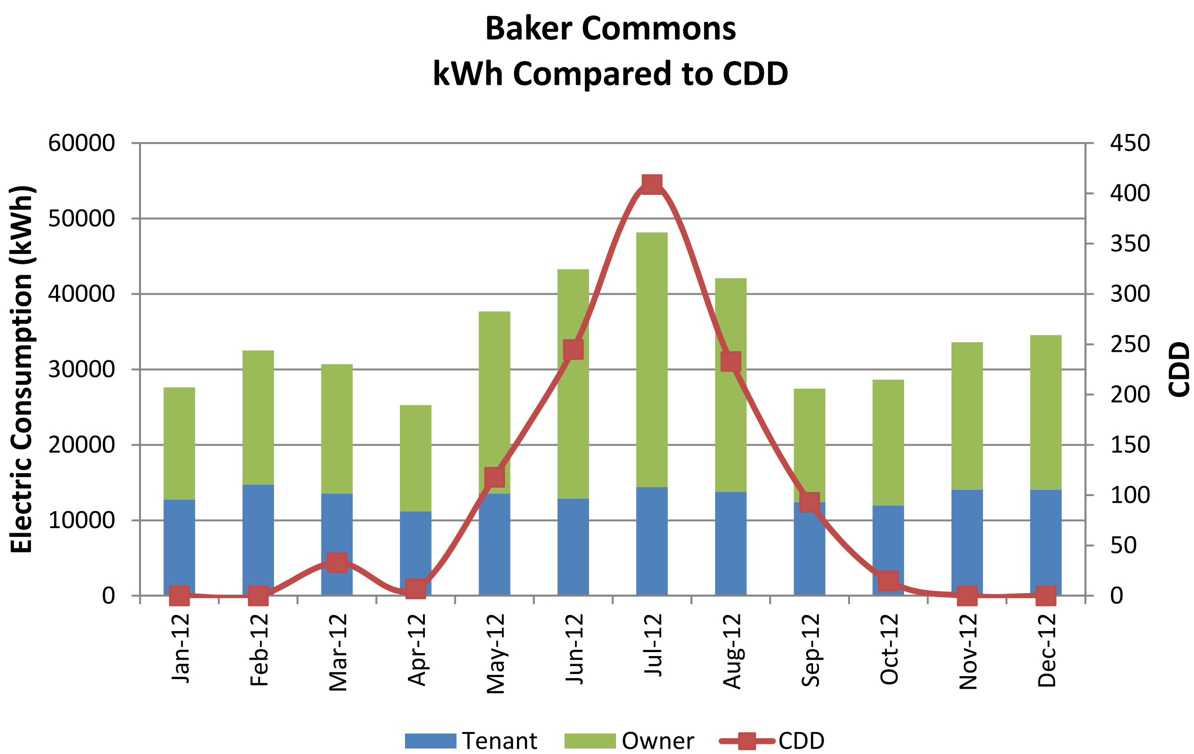


Figure 4. Electricity Consumption Graph

Table 6. Annual Electricity Metrics

	Owner	Tenant
Consumption	252,160 kWh	159,452 kWh
Energy Use Intensity	5.45 kWh / sf	3.45 kWh / sf
MMBtu	861 MMBtu	544 MMBtu

	Owner	Tenant
Cost per kWh	\$0.127 / kWh	\$0.174 / kWh
Cost per ft^2	\$0.69 / sf	\$0.60 / sf
Electricity Cost	\$32,059	\$27,776

Based on the method described in Section 3.3, Energy Calculations Methodology, the following figure shows the estimated electricity consumption per end use.

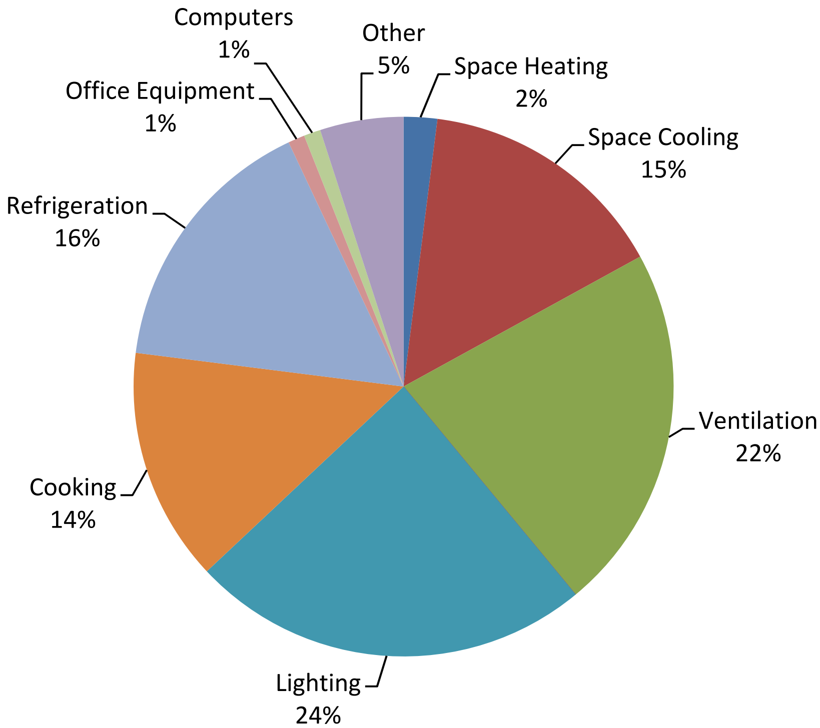


Figure 5. Estimated Electricity Consumption Per End Use

6.2 Natural Gas

For the time period covered by client provided records, historic natural gas use is summarized in the following figures.

Providers	Number of Meters	Unit of Consumption
MichCon	1	therms

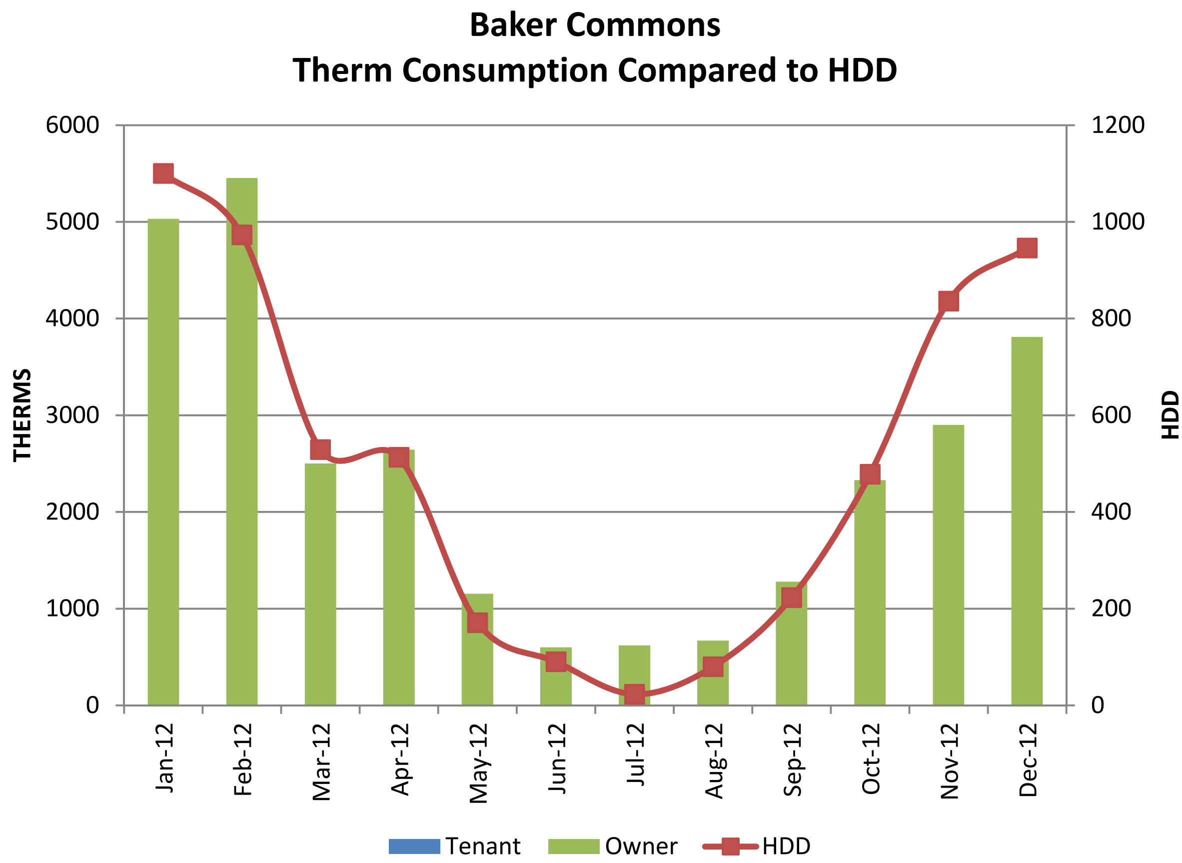


Table 7. Annual Natural Gas Metrics

	Owner
Consumption	28,996 therms
Energy Use Intensity	0.63 therms / ft^2
MMBtu	2,900 MMBtu

	Owner
Cost per therm	$0.778 / therm
Cost per ft^2	$0.49 / ft^2
Natural Gas Cost	$22,573

Based on the method described in Section 3.3, Energy Calculations Methodology, the following figure shows the estimated Natural Gas consumption breakdown by end use.

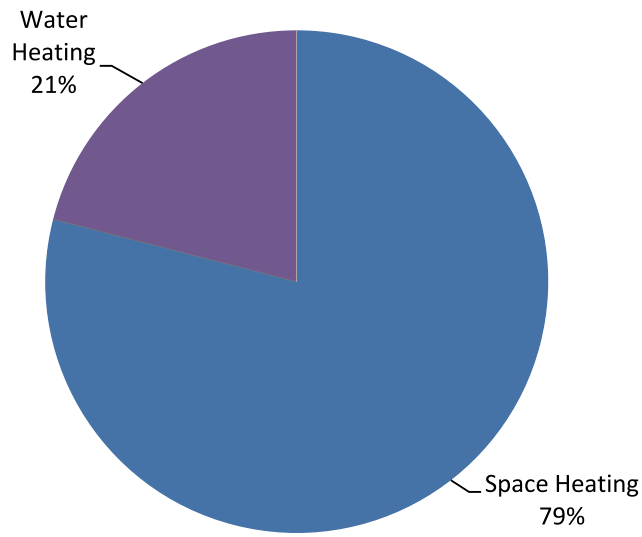


Figure 6. Estimated Natural Gas Consumption Per End Use

6.3 Domestic Water Use

For the time period covered by client provided records, historic domestic water use is summarized in the following figures.

Providers	Number of Meters	Unit of Consumption
City of Ann Arbor	Unknown	CCF

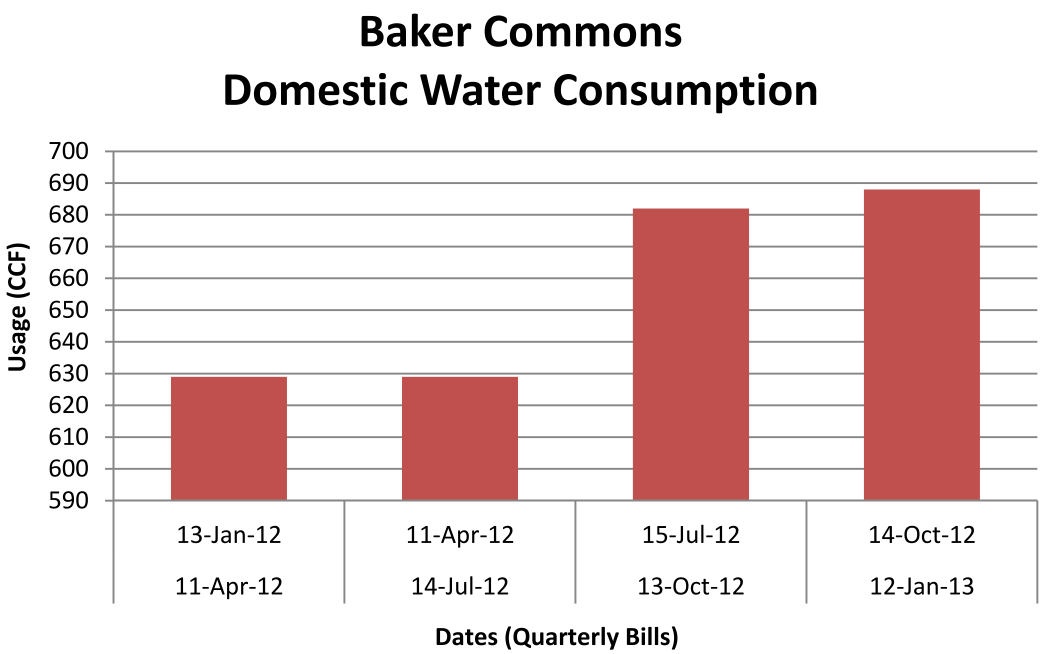


Figure 7. Domestic Water Consumption Graph (Estimated)

Table 8. Annual Domestic Water Metrics

Consumption	2,628 CCF	**Cost per ccf**	$6.49 / CCF
Water Cost	$17,045	**Cost per ft^2**	$0.368 / ft^2

Total annual water consumption was approximately 2,628 CCF. Average cost per CCF for domestic water and sewer on an annual basis is $6.49. Total annual domestic water and sewer cost is $17,045.

According to the EPA, residential water use accounts for more than half of the publicly supplied water in the United States. For this reason, the EPA has introduced the WaterSense program to identify possible water efficiency methods and technologies for consumers throughout the country. Considering the responsibility that typically lies with the tenants, multi-family homes are no stranger to excessive water usage. Fortunately, implementation of improved technologies throughout these facilities can impact the water supply as well as the rising overhead costs associated with distribution and collection.

The HUD Energy Benchmarking Tool was used to compare water consumption data for the subject property to typical water consumption data for similar HUD properties. The tool utilizes normalized data from its database of more than 9,100 buildings to provide comparative metrics on domestic water consumption based on a facility's historic water data and design characteristics. Finally, a score is generated for the analyzed building to identify its ranking among similar buildings.

The Residential End Uses of Water study (REUWS) published in 1999 by the AWWA Research Foundation and the American Water Works Association is a research study that examined where water is used in single-family homes in North America. Conducted by Aquacraft, PMCL, and John Olaf Nelson, the REUWS was the largest study of its kind to be completed in North America and efforts are underway to repeat the effort and obtain updated results. The "end uses" of water include all the places where water is used in a single-family home such as toilets, showers, clothes washers, faucets, lawn watering, etc. The full REUWS final report is available to the public at no charge from the Water Research Foundation (WRF).

Figure 8 below shows the REUWS typical domestic water consumption breakdown by end use.

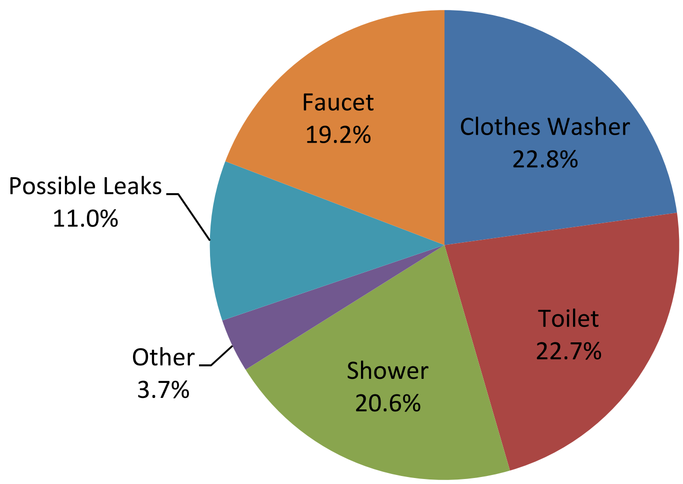


Figure 8. Estimated Domestic Water Consumption Per End Use

6.4 Utility Cost Breakdown

The disparate energy types (electricity and natural gas for this facility) and water costs have been aggregated to provide a breakdown of total utility cost into end use components. The breakdown of energy and water cost is based on the energy use breakdown, as described in Section 3.3, Energy Calculations Methodology.

The following table and charts detail the breakdown of energy and water costs. It should be noted that the consumption percentage identified in Section 5.1 Electricity, Section 5.2 Natural Gas, and Section 5.3 Domestic Water Use and the overall cost percentage for each end use are different. This is due to the cost difference for purchasing each energy type.

Ann Arbor Housing Commission currently pays $37.25 per MMBtu of electricity and $7.78 per MMBtu of natural gas, and $6.49 per CCF of water. Together, all of the tenants at Baker Commons are estimated to pay $51.04 per MMBtu of electricity.

Table 9. Annual Utility Use Breakdown

Categories	Electricity (MMBtu)	NG (MMBtu)	Total Consumption (MMBtu)	Consumption (%)
Space Heating	28	2,301	2330	54%
Cooling	210	0	210	5%
Ventilation	308	0	308	7%
Water Heating	0	612	612	14%
Lighting	337	0	337	8%
Cooking	196	0	196	5%
Refrigeration	224	0	224	5%
Office Equipment	14	0	14	0%
Computers	14	0	14	0%
Other	70	0	70	2%
TOTAL	**1,401**	**2,913**	**4,315**	

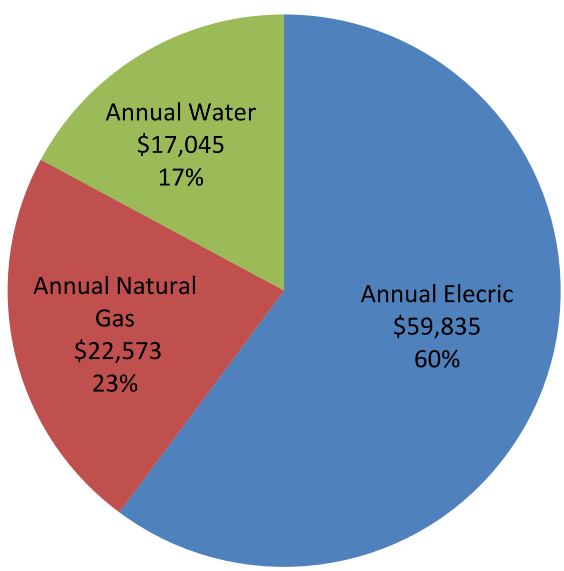


Figure 9. Annual Utility Cost by Type (Owner + Tenant)

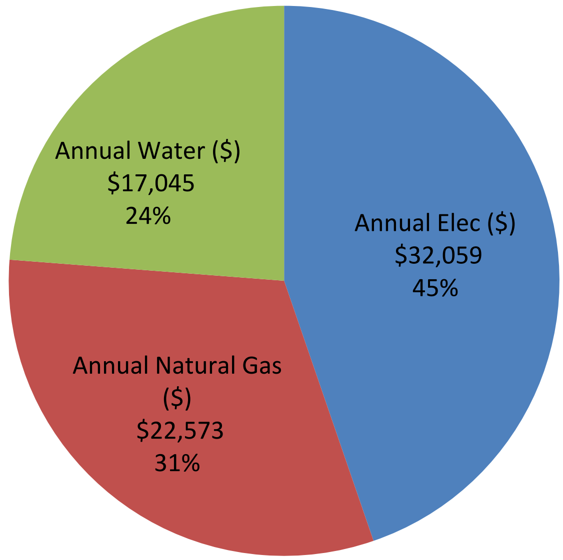


Figure 10. Annual Utility Cost by Type (Owner)

7.0 Energy Performance Benchmark

A benchmark is a standard by which something can be measured. Energy Benchmarking is the comparison of one building's energy consumption to the use of energy in a similar building. HUD's Office of Public and Indian Housing (PIH) has developed the Energy Benchmarking Tool to establish if a building's energy consumption is higher or lower than expected energy usage for similar buildings. AKT Peerless utilized the HUD Energy Benchmarking Tool to quantify the performance of the subject building relative to the family of HUD residential buildings.

This statistical analysis of the HUD tool is based on filters for the building's location, gross square footage, total number of units and year of construction (refer to the appendix for more information regarding dataset filters). This filtered data set is used to calculate the benchmarks for an overall benchmark Energy Use Intensity (EUI) as well as the Energy Cost Intensity (ECI). The benchmarks shown in the portfolio summary are derived from the statistical analysis described in this section.

The following table compares the building energy performance of the subject property and the established benchmark.

Table 10. HUD Residential Energy Use Benchmarking Tool

	Actual	Benchmark
Score Against Peers	14	50
EUI (Energy Use Index)	95.11 kBtu/ft^2	64.10 kBtu/ft^2
$ ECI (Energy Cost Index)	1.78 $ / ft^2	1.20 $ / ft^2

7.1 Estimated Energy Star Score

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy dedicated to helping all building owners save money and protect the environment through energy efficient products and practices.

Results are already adding up. Americans, with the help of ENERGY STAR, saved enough energy in 2010 alone to avoid greenhouse gas emissions equivalent to those from 33 million cars — all while saving nearly $18 billion on their utility bills.

Because a strategic approach to energy management can produce twice the savings — for the bottom line and the environment — as typical approaches, EPA's ENERGY STAR partnership offers a proven energy management strategy that helps in measuring current energy performance, setting goals, tracking savings, and rewarding improvements.

EPA provides an innovative energy performance rating system which businesses have already used for more than 200,000 buildings across the country. EPA also recognizes top performing buildings with the ENERGY STAR.

Energy Star certification is based on your building's performance against typical energy performance of similar buildings. A target efficiency rating of 75 is required to qualify for the Energy Star. Because the audit team does not have all the utility bills for the entire facility, and the energy performance utilized in this investigation is based on estimates generated through best practice software results, the facility at the subject property is not currently eligible for the Energy Star.

If the building owner would like to pursue Energy Star certification in the future, our audit team can work with ownership and tenants/lessees to establish an accurate benchmark and determine the necessary steps towards efficiency improvements required for the certification.

Energy Star Leaders Program

In addition to the Energy Star certificate for individual facilities, the Energy Star program recognizes ENERGY STAR partners who demonstrate continuous improvement organization-wide, not just in individual buildings. Organizations that achieve portfolio-wide energy efficiency improvements of 10%, 20%, 30% (or more) reductions may qualify for recognition as ENERGY STAR Leaders.

Ann Arbor Housing Commission may be eligible for this program. For more information on the program and eligibility, please visit: http://www.energystar.gov/index.cfm?c=leaders.bus_leaders#s2

8.0 Water Performance Benchmark

Water Benchmarking is the comparison of one building's water utilization to the use of water in a similar building. HUD's Office of Public and Indian Housing (PIH) has developed the preliminary benchmarking tool to establish if a building's water utilization is higher or lower than normal usage for similar buildings.

In order to develop the water consumption benchmarking tool, water consumption data was collected through voluntary release of information from thousands of buildings in nearly 350 PHAs nationwide. Regression analyses were performed on these datasets to see which of over 30 characteristics were most closely linked to water conservation.

Your building will score from 0 - 100, where 0 means water consumption is probably excessive and 100 means that the building probably uses water very efficiently. Important: this is a whole-building tool. Water use inputs include resident-paid consumption, when applicable/available.

The table below quantifies the performance of a use-defined building relative to the family of HUD residential buildings.

Table 11. HUD Residential Water Use Benchmarking Tool

	Actual	Benchmark
Score Against Peers	41	50
WUI (Water Use Intensity)	42.5 gal/ft^2	36.2 gal/ft^2
WCI(Water Cost Intensity)	0.37 $ / ft^2	0.31 $ / ft^2

9.0 Operations and Maintenance (O&M) Opportunities

Operation and maintenance make up the largest portion of the economic and environmental life cycle of a building and have become primary considerations of building owners and operators. Effective O&M is one of the most cost-effective methods for ensuring reliability, safety, and energy efficiency. Inadequate maintenance of energy-using systems is a major cause of energy waste in both the Federal government and the private sector. Improvements to facility maintenance programs can often be accomplished immediately and at a relatively low cost.

The following recommendations are believed to have the opportunity to reduce energy and water consumption for the facility.

9.1 Develop a Preventative Maintenance Plan for Equipment

Planned or preventative maintenance is proactive (in contrast to reactive) and allows the maintenance manager control over when and how maintenance activities are completed. When a maintenance manager has control over facility maintenance, budgets can be established accurately, staff time can be used effectively, and the spare parts and supplies inventory can be managed more efficiently.

Regardless of which strategy is used, maintenance should be seen as a way to maximize profit and/or reduce operating costs. From this perspective, the main functions of a maintenance department/staff are as follows:

- Control availability of equipment at minimum cost
- Extend the useful life of equipment
- Keep equipment in a condition to operate as economically and energy efficiently as is practical

The maintenance department/staff would be responsible for the following tasks:

- Maintenance planning
- Organizing resources, including staffing, parts, tools, and equipment
- Developing and executing the maintenance plan
- Controlling maintenance activities
- Budgeting

At the time of the assessment, the Facilities Director indicated that a plan is currently being established for the housing authority. It is recommended this continue. Additional considerations for the future plans should include, but not be limited to:

- Energy efficiency for vacant apartments at move-out
- Tenant education
- Tenant support maintenance program
- Tenant incentives program

9.2 Institute an Energy Star Purchasing Policy

Energy costs associated with electrical plug loads should be minimized where possible. Plug loads are electrical devices plugged into the building's electrical system and generally include things like appliances and fixtures. When purchasing appliances and fixtures, the U.S. EPA ENERGY STAR standards should be specified. Manufacturers are required to meet certain energy efficiency criteria before they can label a product with the ENERGY STAR emblem, so these products represent your best energy saving value.

9.3 Utilize Setbacks on Thermostats (Primarily in Common Areas)

Heating and cooling requirements in residential buildings will typically depend on the comfort level of the occupants; however, the tenants at Baker Commons only have some control over the temperature. The tenant spaces at Baker Commons are conditioned with a two-pipe fan coil system so the tenants can only regulate the blower fan usage of their individual units. Utilizing setbacks, as well as reducing the temperature to an appropriate setting on the tenant thermostats, can provide energy savings by reducing the operating hours of the blower fan.

Recommended heating temperatures for residential buildings is in the range of 68-72°F. These temperatures apply to occupied daytime hours; a reduction of 6-8°F is recommended when homes are unoccupied or occupants are asleep.

Even a minor temperature setback during unoccupied building hours can produce a substantial savings. Owners should consider reviewing current heating temperatures in comparison to recommended levels with their residents. Significant energy savings can often be achieved for FREE by turning the fans off on the thermostat when unoccupied.

The recommended cooling temperature for residential buildings is 76°F during daytime hours. When air conditioning a building, you should try to keep the temperature at the highest possible setting while still maintaining comfort.

The savings can be quite significant for this measure. For example, it can cost up to *36% more* to cool offices to 72°F rather than 76°F.

9.4 Adequately Seal Doors and Windows

Infiltration is the flow of air through openings in a building. In order to reduce infiltration, the cracks and holes in a building must be adequately sealed. Maintaining caulking and weather stripping in good condition saves both money and energy. It also preserves the building and improves the comfort of its occupants. Verify that all windows are adequately sealed. Verify that doors in existing entrance hallways are being closed to prevent unnecessary infiltration. Also, inspect the exterior of the buildings for cracks or other damage.

Older windows can be a major source of heat loss and air leakage, and can greatly impact the heating load on a building. A detailed engineering study is generally required to determine the best way to upgrade windows. However, be sure to consider low-e high performance glazing when window replacement becomes necessary. The additional cost will usually be paid for in energy savings in less than ten years.

9.5 Regularly Clean HVAC Equipment and Fan Coil Units

A typical problem with multifamily properties is the presence of uneven conditioning within each unit. This is often attributed to the distribution system as well as the maintenance of the HVAC equipment.

Scheduled cleaning maintenance of the fan coils and the other HVAC equipment will not only ensure occupants' continued comfort, but will also reduce the unnecessary energy consumption from increased temperature settings. Additionally, the proper maintenance will increase the lifetime of the equipment.

9.6 Operational Timers

Drinking fountains are often refrigerated types that keep chilled water available on a continuous basis. Much of the time, these units can be modified to save energy consumed by the Compressor to refrigerate the water. Overnight or during periods the building is unoccupied, the drinking fountain can be turned off (chilling of water during winter months is often unnecessary, too). Because a drinking fountain can cost as much to operate as a small refrigerator over the course of one year, the savings potential for turning it off when possible makes this measure worth consideration, especially if your facility has several units.

Short of shutting off power to the drinking fountain permanently, the best option is to install a timer to control hours of operation to coincide with building hours. An inexpensive 24-hour plug-in timer can be installed if a drinking fountain is the plug-in type. (For wired drinking fountains, individual timers have to be wired into each unit - usually; the savings will not justify the cost).

This measure would be applicable in the common area hallway.

9.7 Utilize Intelligent Surge Protectors

Intelligent surge protectors work in two ways: first, they automatically turn off electricity to all the things you don't need. For example when you turn off your TV, a smart strip turns off power to DVD players, home theater components, cable boxes, game consoles and so on. When you're not using your computer, have it turn off your monitor, speakers, and all the other electronics you don't need.

Secondly the Smart Strip (a common brand name for intelligent surge protectors) monitors power consumption and can sense the difference between when computers and other devices are on or off. Upon figuring this out, it shuts off the power, eliminating the idle current drawn from them. This stops power consumption for electronics that consume energy even when turned off or also called "vampire" electronics.

This measure would be applicable for the community center in the computer room and office areas.

10.0 Proposed Energy Conservations Measures (ECMs) and Water Conservation Measures (WCMs)

This analysis identified and included three primary types of ECM/WCMs:

- ECM/WCMs impacting the Owner (the Client) costs; and
- ECM/WCMs impacting the Tenant(s) costs; and
- ECM/WCMs to be implemented at the End of Useful Life (EUL) of equipment (includes both Owner and Tenant impacts)

The energy and water audit of the facility identified six (6) energy conservation measures (ECMs). ECMs are estimated to provide approximately $9,697 in annual savings. The investment required to implement all of the measures before the inclusion of applicable utility incentives is estimated to be $17,782. These savings measures are summarized within this section.

Incentives are not included in the calculation of payback times and savings calculations. Utilizing available incentives is expected to reduce project costs and decrease simple payback.

Table 12. Financial Summary of ECMs and WCMs

Energy Cost Reduction Measure (ECM)	ID	Additional First Cost	Annual Savings	Simple Payback (yrs)
Install Occupancy Sensors in Common Areas	ECM1	$150	$307	0.5
Interior Lighting Retrofit	ECM2	$6,870	$1,328	5.2
Exterior Lighting Retrofit	ECM3	$2,679	$1,314	2.0
Install Controls on Vending Machines	ECM4	$128	$283	0.5
Install High Efficiency Motors on HVAC Equipment	ECM5	$655	$126	5.2
Repair MUA Unit and Control Outdoor Air Ventilation	ECM6	$7,300	$6,339	1.2
Totals		**$17,782**	**$9,697**	**1.8**

Table 13. Summary of Energy Savings for ECMs and WCMs

ECM Description	kWh Annual Savings (kWh)	Therm Annual Savings (Therms)	Water Annual Savings (gallons)	GHG Reduction (Metric Tons)
Install Occupancy Sensors in Common Areas	2,112	0	0	1.56
Interior Lighting Retrofit	9,132	0	0	6.76
Exterior Lighting Retrofit	10,332	0	0	7.65
Install Controls on Vending Machines	1,947	0	0	1.44
Install High-Efficiency Motors on HVAC Equipment	868	0	0	0.64
Repair MUA Unit and Control Outdoor Air Ventilation	14,000	5528	0	39.71
Totals	**38,391**	**5,528**	**0**	**57.76**

Table 14. Measures for Consideration at the End of Useful Life (EUL) of Equipment

Energy Cost Reduction Measure (ECM)	ID	Premium Cost	Annual Savings	Simple Payback (yrs)
Utilize High-Efficiency Domestic Water Heater	EUL1	$9,500	$1,168	8.1
Install Energy Star Windows at Scheduled Replacement	EUL2	$10,406	$1,098	9.5
Install "High-Efficiency" Air Conditioners	EUL3	$4,750	$837	5.7
Totals		**$24,656**	**$3,103**	**7.9**

10.1 ECM1 - Occupancy Sensors for Lighting Control

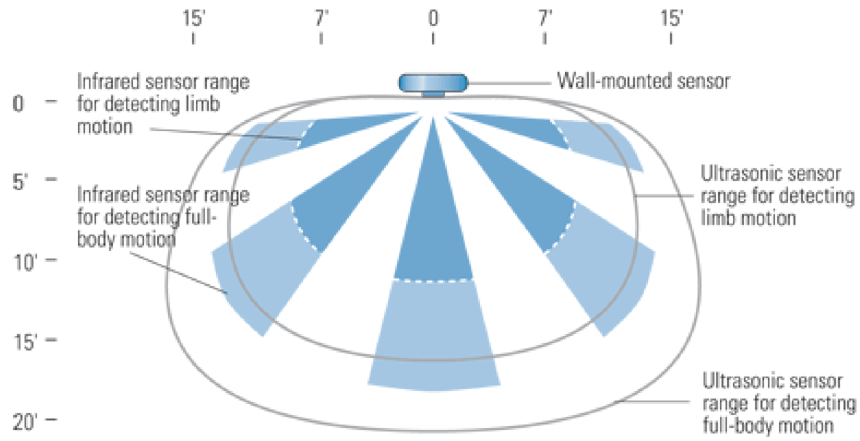
Summary					
Cost to Implement	Estimated Annual Cost Savings	Simple Payback (years)	Electricity Savings (kWh)	Natural Gas Savings (therms)	GHG Reduction (Metric Tons)
$150	$307	0.5	2,112	0	1.56

Recommendation Description

The simplest way to reduce the amount of energy consumed by lighting systems is to turn lights off when they are not needed. In the subject facility, the majority of lighting fixtures are controlled directly with the manual switches which are turned on by the staff or residents.

Occupancy sensors are most effective in spaces where people move in and out frequently in unpredictable patterns: for example, private offices, lecture halls, auditoriums, warehouses, restrooms, and conference rooms. Occupancy sensors are less likely to be effective in open-plan offices, where one or more people may be present throughout the day or in reception areas, lobbies, retail spaces, or hospital rooms. The savings achievable with occupancy sensors, even in the most appropriate spaces, varies widely, depending on local conditions.

The three most common types of occupancy sensors are passive infrared (PIR), ultrasonic, and those that combine the two technologies. PIR devices are the least expensive and most commonly used type of occupancy sensor. They detect the heat emitted by occupants and are triggered by changes in infrared signals when, for example, a person moves in or out of the sensor's field of view. PIR sensors are quite resistant to false triggering and are best used within a 15-foot radius.



Courtesy: *E source Lighting Technology Atlas* (2005)

Ultrasonic sensors can detect motion at any point within the contour lines. Infrared sensors "see" only in the wedge-shaped zones, and they do not generally see as far as ultrasonic units. Some sensors see farther straight ahead than to the side. The ranges shown here are representative; some sensors may be more or less sensitive.

Ultrasonic devices emit a sound at high frequency—above the levels audible to humans and animals. The sensors are programmed to detect a change in the frequency of the reflected sound. They cover a larger area than PIR sensors and are more sensitive. They are also more prone to false triggering. For example, ultrasonic sensors can be fooled by the air currents produced by a person running past a door, moving curtains, or the on-off cycling of an HVAC system.

Hybrid devices that incorporate both PIR and ultrasonic sensors are also available. These take advantage of the PIR device's resistance to false triggering and the higher sensitivity of the ultrasonic sensor. Some hybrid sensors combine PIR with sensors for audible sound. That design has proved useful in cases where the frequencies used in ultrasonic sensors interfere with equipment such as hearing aids—a problem that is less frequent than it used to be because sensor manufacturers have learned to use frequencies that minimize the issue.

Evaluating the economic feasibility of an installation is best done by monitoring lighting and occupancy patterns. The use of inexpensive automatic data logging systems will indicate the total amount of time the lights are on when the space is vacant, the time of day the savings take place, and the frequency of lamp cycling. Data can also be gathered through the use of recording ammeters connected at lighting breaker panels; through random surveys, such as observing a building's exterior at night or interviewing custodial and security personnel; and through existing timers, scheduling controllers, and energy management systems.

Whatever way the data is gathered, it is important to account for seasonal variations in operation in order to avoid incorrectly extrapolating short-duration data to a full year. This information will help lead to an informed decision on the economic feasibility of potential occupancy-control opportunities.

Sensor placement is also crucial to success. Wall-mounted sensors are suitable in smaller rooms—offices, bathrooms, and equipment rooms that are only intermittently occupied. In larger spaces or wherever the lighting load is higher, it is better to mount the sensor in the ceiling. Some units can be mounted in the corner or on the wall near the ceiling.

Source - www.energystar.gov

Due to the varying occupancy schedule, it is recommended to install occupancy sensors in the laundry room, community center, and television area.

Assumptions

Lighting assumptions are based on a lighting survey of the current lighting count during the walk-through. An approximate count of three (3) occupancy sensors should be installed in this facility.

Savings estimates for this ECM are based on a 25% reduction of existing usage where occupants accidently left the lights on after leaving the area. For this circumstance, the lights were left on 24 hours a day in the community center and laundry room.

Calculations
$$Energy\ Cost\ Savings = Energy\ Consumption\ Savings\ \times Energy\ Cost\ per\ kWh$$ *Where:* $$Energy\ Consumption\ Savings = Existing\ Usage\ \times 25\%$$ $$Usage = \#\ of\ fixtures\ \times watts\ per\ fixture\ \times burn\ hours$$
Incentives
DTE Energy's Multifamily Program is offering incentives to install occupancy sensors in areas of low occupancy. The application and details for this incentive program are included in the appendix of this report.
Expected Useful Life Study
Occupancy sensors typically have an expected useful life of approximately 20 years.

10.2 ECM2 - Interior Lighting Retrofit

Summary					
Cost to Implement	**Estimated Annual Cost Savings**	**Simple Payback (years)**	**Electricity Savings (kWh)**	**Natural Gas Savings (therms)**	**GHG Reduction (Metric Tons)**
$6,870	$1,328	5.2	9,132	0	6.76

Recommendation Description

The common areas at Baker Commons have various types of linear florescent lighting fixtures installed throughout the building. The majority of the building has been upgraded to T8 lamps with electronic ballasts. Site observations revealed fixtures using 2 lamp, 4ft T8 (32 watt), and 2 lamp, 2ft T8 (17 watt) in the common areas.

It is recommended that these fixtures be retrofitted with low power (25 or 28 watt) T8 lamps and high performance electronic ballasts. High performance lighting (32 watt T8's) will provided substantial savings for facilities that operate on 24 hour schedules.

Assumptions

All lamps in common areas are assumed to operate 24 hours per day (8,760 hours per year). It is assumed all of the fluorescents will be replaced with 32 watt T8s. The lighting calculator spreadsheet result is included in the appendix.

Calculations

$$Energy\ Cost\ Savings = Energy\ Consumption\ Savings\ \times Energy\ Cost\ per\ kWh$$

Where:

$$Energy\ Consumption\ Savings = Existing\ Usage - Proposed\ Usage$$
$$Usage = \sum(\#\ of\ fixtures\ \times watts\ per\ fixture\ \times burn\ hours)$$

Incentives

DTE Energy's Multifamily Program is offering incentives for installing low wattage, high performance T8 retrofits in the common areas. The application for this program is included in the appendix of this report.

Expected Useful Life Study

Fluorescent lamps operating twenty-four hours per day have an average life of 3 years. Lighting fixtures typically have an expected useful life of 20-25 years.

10.3 ECM3 - Exterior Lighting Retrofit

Summary					
Cost to Implement	Estimated Annual Cost Savings	Simple Payback (years)	Electricity Savings (kWh)	Natural Gas Savings (therms)	GHG Reduction (Metric Tons)
$2,679	$1,314	2.0	10,332	0	7.65

Recommendation Description

The existing HID exterior lighting is outdated, and significantly more efficient lighting options are readily available. For this application, it is recommended that exterior lighting be retrofitted with more efficient light emitting diode (LED) lighting.

Along with significant electrical savings at equivalent lumen output, maintenance will be greatly reduced as the LED lights proposed have an L_{70} lifespan of 100,000 hours. L_{70} is an industry standard to express the useful lifespan of an LED. It indicates the number of hours before light output drops to 70% of initial output. Maintenance reduction is not factored into the savings calculated for this report. LED lighting is considered a green technology due to the high fixture efficacy and the absence of mercury, arsenic, and ultraviolet (UV) light.

The initial cost of this project is the material cost for seventeen (17) of the subject exterior flood lights in the exterior lights fixture. Again, the additional savings associated with reduced maintenance costs are not included in the calculated savings.

Assumptions

Exterior lighting consists of five (5) 150 watt HID lamps in pole mounted, flood fixtures controlled by photocell, two (2) 70 watt HID lamps on wall mounted flood exterior fixtures, and ten (10) recessed can lighting fixture with 100W HID lamps underneath the canopy. It is assumed that all the lighting is used at night and is property owned. Additionally, two of the seven lamps were on during the day site visit, indicating that the photocells were not working on these fixtures.

Calculations

This ECM was calculated using new LED fixture replacements:

$$Energy\ Cost\ Savings = Energy\ Consumption\ Savings\ \times Energy\ Cost\ per\ kWh$$

Where:

$$Energy\ Consumption\ Savings = Existing\ Usage - Proposed\ Usage$$
$$Usage = \sum(\#\ of\ fixtures\ \times watts\ per\ fixture\ \times burn\ hours)$$

Incentives

DTE Energy's Multifamily Program is offering incentives for replacing existing HID exterior lighting with LED lighting. Existing lighting must operate more than 3,833 hours per year and replacement must result in at least a 40% power reduction. In addition, the replacement lamp must have an efficacy of at least 35 lumens per watt. The application and specifications for these incentives is included in the appendix.

Expected Useful Life Study

Most of the lamps in the exterior light fixtures were installed in 2000 and have an expected useful life of six years. It is believed that the lamps will need to be replaced in the near future. The expected useful life of an LED replacement fixture is typically around 15 years.

10.4 ECM4 - Install Vending Machine Controls

Summary					
Cost to Implement	**Estimated Annual Cost Savings**	**Simple Payback (years)**	**Electricity Savings (kWh)**	**Natural Gas Savings (therms)**	**GHG Reduction (Metric Tons)**
$128	$283	0.5	1,947	0	1.44

Recommendation Description

Vending machines draw electric power to light the interior displays. Beverage machines also draw power to keep the drinks cold. Typically these machines operate 24 hours a day seven days a week or 8,760 hours a year whether the building is occupied or not. Most buildings do not operate on a 24/7 schedule. Substantial savings can be achieved by reducing the operating time of vending machines based on occupancy.

A device can be installed that senses occupancy in the room and turns off the machine when no one is around. In order to maintain the beverage temperature levels, the device will cycle the compressor once every 1 to 3 hours. This results in substantial energy and maintenance savings over typical use. Installation is relatively simple; the miser consists of an occupancy sensor that attaches to the top of the machine and a control that is placed between the plug of the machine and the outlet.

It is recommended that two (2) vending machine controls be installed.

Assumptions

The building has one (1) refrigerated beverage machine and one (1) snack machine which are on 24/7. It is assumed that the common area is typically not occupied during the evening hours.

Calculations

Information for one such device, the VendingMiser by USA Technologies, is included in the appendix with the savings worksheet for the existing machines.

Incentives

DTE Energy's Multifamily Program is not currently offering an incentive to install vending machine controls in common areas.

Expected Useful Life Study

Vending machine controls have a typical expected useful life between five and ten years.

10.5 ECM5 – Install Premium Efficiency Motor on Circulating Pump

Summary					
Cost to Implement	**Estimated Annual Cost Savings**	**Simple Payback (years)**	**Electricity Savings (kWh)**	**Natural Gas Savings (therms)**	**GHG Reduction (Metric Tons)**
$655	$126	5.2	868	0	0.64

Recommendation Description

It was identified that the existing motors on the hot/chilled water circulating pump, as well as the motor on the makeup air unit fan, operate continuously. This ECM evaluates the feasibility of upgrading to NEMA premium efficiency motors in these applications.

The two (2) circulating pump motors are Marathon Electric 5 hp motors with a NEMA nominal efficiency of 87.5%. These pumps operate in a primary/backup method, and evaluation is based on the primary pump. It was reported that either hot or chilled water is continuously circulating through the system, and the evaluation uses 8760 hours per year on the primary pump. It was determined that replacing the primary pump motor (87.5% efficiency) with a premium efficiency motor (90.3% efficiency) would cost $655 installed and provide a payback of 6.3 years.

The MUA unit supply fan motor is a Gould Century 3 hp motors with an **estimated** NEMA nominal efficiency of 87.4%. This efficiency could not be verified during the site visit as the motor was operating and there was limited access to view the nameplate. It was determined that replacing the MUA unit fan motor (87.4% efficiency) with a premium efficiency motor (89.8% efficiency) would cost $585 installed and provide a payback of 10.8 years. Because the actual nameplate of this motor could not be verified, and the longer payback, this replacement is not included in the summary and is recommended for replacement at end of useful life with a premium efficiency motor.

Assumptions

All motors evaluated are assumed to operate continuously (8760 hours per year), at an estimated load of 75%.

Calculations

The savings analysis was performed using MotorMaster+ 4.0 software from US Department of Energy.

Incentives

DTE Energy's Multifamily Program is not offering incentives to install high efficiency motors at this time.

Expected Useful Life Study

Circulation pump motors typically have an expected useful life of twenty years if properly maintained.

10.6 ECM6 - Repair MUA Unit and Control Outdoor Air Ventilation

Summary					
Cost to Implement	**Estimated Annual Cost Savings**	**Simple Payback (years)**	**Electricity Savings (kWh)**	**Natural Gas Savings (therms)**	**GHG Emissions (Metric Tons)**
$7,300	$6,339	*1.2	14,000	5,528	39.71

*See Calculations and Assumptions below

Recommendation Description

Fresh outdoor air (OA) for ventilation is supplied to the center of each corridor via an indirect gas-fired makeup air (MUA) unit in the basement. The louver system which controls the ratio of outdoor air to return air appears to be non-functional on this makeup air unit and it currently brings in 100% outside air, Also, the existing burner on the unit does not ignite and the outside air is not properly conditioned during the colder seasons. Repairing the burner unit for air tempering is not expected to save energy, but it will benefit resident comfort.

Recommendation is to repair the louver system which controls the ratio of outdoor air to return air in the MUA unit. This would allow a minimum outdoor air flow into the corridors when the outdoor temperatures were extreme and allow more airflow when the outdoor temperatures were mild.

Indoor air quality is an important aspect of facility management as it directly relates to resident health. The municipal code may set forth minimum ventilation rates for multi-family buildings, as in many cases local regulations will govern the ventilation requirements.

This report does not attempt to specify the required ventilation for the subject facility, but does comment that the introduction of outside air (OA) has a significant effect on energy use.

ASHRAE 62.1 "Ventilation for Acceptable Indoor Air Quality" is a nationally accepted standard that provides acceptable ventilation rates per person and is related to the occupational density and activity within the space. The ventilation rates specified by ASHRAE effectively dilutes the carbon dioxide and other contaminants created by respiration and other activities; it supplies adequate oxygen to the occupants; and it removes contaminants from the space.

Building with variable occupancy levels, can often reduce both heating and cooling energy consumption by employing demand controlled ventilation (DCV). With DCV, rather than a fixed amount of outdoor air, outside air can be controlled based on the concentration of CO2 and other pollutants inside the building. There are many variables that must be taken into consideration when contemplating a retrofit to demand controlled ventilation. These include the type of air distribution system, already in place, the controllability of various dampers, interconnectivity with building automation system, evaluation of ventilation requirements per current building codes, heating and cooling capacity of existing equipment, and so forth. It is recommended to check your municipal code to find out the minimum ventilation rate required and if a DCV strategy can be implemented with the existing or replacement make up air system.

Calculations & Assumptions
The energy simulation model was used to calculate the savings of this ECM. It is based on the energy consumption difference of introducing 5,000 CFM of outside air via the makeup air unit and using a demand control ventilation scheme monitoring return air CO2. *Savings and paybacks are based on model and will depend on allowable code ventilation control method and rates.
Expected Useful Life Study
Make-up air units typically have an expected useful life of approximately fifteen years.

11.0 ECMs for Replacement at End of EUL

The following are ECMs for which the calculated payback period exceeds the useful life of the product, when considered for immediate replacement. However, these ECMs have a viable payback period when the replacement occurs at the end of the product's estimated useful life (EUL), since the item would be replaced at this time in any case. In order to demonstrate the benefit of upgrading to an energy efficient product, only the premium cost for upgrading to the energy efficient product is considered in the initial investment. The premium cost is the difference between the cost of the energy efficient item and the standard replacement item.

11.1 EUL1 - Utilize High-Efficiency Domestic Water Heater

Summary

Premium Cost	Estimated Annual Cost Savings	Simple Payback (years)	Electricity Savings (kWh)	Natural Gas Savings (therms)	GHG Emissions (Metric Tons)
$9,500	$1,168	8.1	0	1,500	7.97

Recommendation Description

Replacing old domestic water heating equipment can generate considerable savings if the existing equipment is inefficient and/or improperly sized for the building. A boiler near the end of its useful life is a particularly good candidate for replacement with high-efficiency equipment, as is the case for this facility. The existing domestic hot water boiler is 32 years old (original to the building), and has exceeded its expected useful life.

Older boilers may not operate as efficiently as they did when they were new, particularly if they have not been properly maintained over the years. In addition, because of technology advances, new domestic hot water boilers are much more efficient than the older models, presenting opportunities for saving on domestic water heating costs.

The property's domestic hot water is a Teledyne Laars boiler is rated at 925 MBH input and 740 MBH output (80% efficient). Newer, "high efficiency" models are available with efficiencies of 95%.
The payback analysis was calculated for a high efficiency model over a standard efficiency model and yielded a payback of 7.8 years for this replacement. Since the payback is less than the EUL of a new unit, replacement with a high efficiency boiler is recommended.

Incentives

DTE Energy's Multifamily Program is not offering incentives for installing Energy Star rate windows at this time.

Expected Useful Life Study

Domestic hot water heaters typically have an expected useful life of fifteen years.

11.2 EUL2 - Install Energy Star Windows @ Scheduled Replacement

Summary					
Premium Cost	**Estimated Annual Cost Savings**	**Simple Payback (years)**	**Electricity Savings (kWh)**	**Natural Gas Savings (therms)**	**GHG Reduction (Metric Tons)**
$10,406	$1,098	9.5	1,093	1,206	7.21

Recommendation Description

The audit team noted that facilities department suggested the windows at Baker Commons were slated for replacement in a "greening" of the facility effort. The windows found at Baker Commons appear to be standard efficiency double pane glazing, in a slider type, aluminum frame window. The assembly is set, finished and sealed in the masonry opening. Windows appear to be thermally broken. There are higher efficiency alternatives available.

Windows provide natural daylight and views, but building owners and residents often use drapes or blinds to cover them because of comfort concerns. Each tenant interviewed seemed to have concerns about the performance of the existing windows. Window replacement offers the Owner an opportunity to invest in high efficiency windows and reduce energy costs while likely reducing complaints/maintenance calls from tenants.

It is recommended that the existing tenant windows be replaced with Energy Star labeled windows to reduce the overall energy consumption of the building and improve thermal comfort. Energy Star qualified windows allow owners to enjoy light and views while saving on utility bills and protecting interior finishes from excessive exposure (sun damage). Furthermore, replacing inefficient windows can often save 10% to 20% on energy consumption in cold climates.

It is important to choose a window that is right for Southeast Michigan. In most climates, the best energy buy for residential windows is a medium-performance window, such as a gas-filled, double-pane window with low-emissivity glazing and a wood or vinyl frame. This type of window is typically about 5% to 15% more expensive than plain double-pane windows (E Source 1995).

In particular, Energy Star Qualification Criteria for windows in Northern climates (Baker Commons) recommend a U-factor of less than 0.32 and a Solar Heat Gain Coefficient (SHGC) of approximately 0.35 to 0.40. North side windows should be specified at the lowest U-factor available (0.30 or less). See the Energy Star Qualification Criteria below:

ENERGY STAR® Qualification Criteria for Residential Windows, Doors, and Skylights

Windows

Climate Zone	U-Factor[1]	SHGC[2]	
Northern	≤ 0.30	Any	Prescriptive
	=0.31	≥ 0.35	Equivalent Energy Performance
	=0.32	≥ 0.40	
North-Central	≤ 0.32	≤ 0.40	
South-Central	≤ 0.35	≤ 0.30	
Southern	≤ 0.60	≤ 0.27	

[1] Btu/h-ft²-°F

[2] Fraction of incident solar radiation

Doors

Glazing Level	U-Factor[1]	SHGC[2]
Opaque	≤ 0.21	No Rating
≤ ½-Lite	≤ 0.27	≤ 0.30
> ½-Lite	≤ 0.32	≤ 0.30

Skylights

Climate Zone	U-Factor[1]	SHGC[2]
Northern	≤ 0.55	Any
North-Central	≤ 0.55	≤ 0.40
South-Central	≤ 0.57	≤ 0.30
Southern	≤ 0.70	≤ 0.30

Source:

http://www.energystar.gov/ia/partners/prod_development/archives/downloads/windows_doors/Windows_Doors_and_Skylights_Program_Requirements.pdf?8c9b-add8

Assumptions

It is estimated that the building has approximately 2,973 ft^2 of standard double pane window eligible for this ECM. Other assumptions:

- Existing U-factor for currently installed windows is estimated at 0.55 Btu/h*sf*°F
- Replacement U-factors at 0.30 Btu/h*sf*°F
- HDD used in this calculation = 6,818
- Reduced infiltration rate not considered in this calculation, but could increase savings.
- Interaction of measures not considered

This is an estimate and would require further study to increase accuracy of savings predictions.

Incentives

DTE Energy's Multifamily Program is not offering incentives for installing Energy Star labeled windows at this time.

Expected Useful Life Study

New high performance windows have an expected useful life of twenty years if properly maintained.

11.3 EUL3 - Install "High-Efficiency" Air Conditioners

Summary					
Premium Cost	**Estimated Annual Cost Savings**	**Simple Payback (years)**	**Electricity Savings (kWh)**	**Natural Gas Savings (therms)**	**GHG Reduction (Metric Tons)**
$4,750	$837	5.7	5,754	0	4.26

Recommendation Description

The corridors of each floor and community room (first floor) are conditioned with fan coil units on each end. The Sanyo fan coil units are part of an air-to-air heat pump split system with compressor units located outside near the building. The interior fan coil units come with supplemental electric resistance heating, rated at 1.8 kW. The temperature for these units is controlled by individual thermostats.

There are ten (10) units, rated at 2 tons each, serving the corridors, and two (2) units, rated at 3 tons each, which serve the community center. All of the air-to-air heat pump split systems have a Seasonal Energy Efficiency Ratio (SEER) of 10.0. The SEER rating of a unit is the cooling output during a typical cooling-season divided by the total electric energy input during the same period. The higher the unit's SEER rating the more energy efficient it is.

Technological developments have produced great advances in air conditioning efficiency, with current split system SEER of 18 or better. **It is recommended the high efficiency units are installed over standard efficiency units at the end of useful life of current equipment.** This ECM calculated the cost and benefit of using SEER 16 "high efficiency" over SEER 13 "standard efficiency" units.

The existing **refrigerant line insulation** for the subject systems is in poor/failed condition and should be replaced. It is difficult to quantify the energy waste from the failed insulation, but it directly affects the efficiency of the units and a quick payback is assured.

It should be noted that the manufacturer of the existing heat pump split systems (Sanyo) also offers a variable refrigerant flow (VRF) line of outdoor compressor units. These systems (ECO-i) lead the industry in high efficiency units (SEER up to 20) and are of a modular design. One outdoor unit, available in 8 or 12 tons, can be connected to several indoor units. This minimizes the equipment footprint and reduces the number of equipment pieces to maintain.

VRF systems utilize advanced inverter controlled compressor technology. By varying the rotational speed of the compressor, the inverter control can precisely match the amount of refrigerant being delivered to the needs of each zone. This intelligent approach helps realize excellent efficiencies during partial-load conditions. This allows all occupants to enjoy consistent room temperature, regardless of any increases or decreases in the heat load during the day.

Calculations
The energy simulation model (eQUEST) developed for the building was used for this analysis of SEER 16 “high efficiency” over SEER 13 “standard efficiency” for all of the units. Cost of efficiency upgrade is $390 for 2 ton units (10 total) and $425 for 3 ton units (2 total), based on Goodman model series #SSZ pricing.
Incentives
DTE Energy’s Multifamily Program is not currently offering incentives to replace air conditioners.
Expected Useful Life Study
Condensing units typically have an expected useful life of approximately 15 years.

12.0 Advanced ECMs and/or ECMs Recommended for Further Evaluation

The following capital intensive measures may be feasible but would require an additional, detailed engineering analysis.

12.1 FE1 - Integrate Building Automation System (BAS)

Recommendation Description
Building controls, particularly centralized building controls that are part of an Energy Management System (EMS) or Building Automation System (BAS), can perform a wide range of functions. Energy systems almost always have some type of control, even if only a switch on the wall. Improving the level of control of energy systems – lighting, heating, cooling, ventilation, and others – often provides some of the most impressive energy savings in buildings. This level of control works to further optimize all the recommendations already identified in this report. It appears the existing controls systems are limited at the subject building, and rely on independent controls and switches. Newer digital controls, referred to as Direct Digital Controls (DDC), can provide an easy to use alternative to the current systems. Instead of manual or zonal controls located throughout the building, in separate areas of the building, a building operator can access all setpoints, timers, reset controls, etc. from one web-based platform. This can be particularly useful for a building owner/operator that has several facilities within their portfolio. The web-based interface allows for control of multiple facilities from one location (or any location with internet access). The audit team was not able to accurately estimate the first cost to install a digital controls system, as a more detailed investigation would be required. For evaluation purposes the team estimated the additional cost to investigate and integrate controls at \$2.00/sf or \$94,000. Annual savings after adding controls are typically estimated at 10% of total energy costs or greater. This could save the building owners an additional \$7,141 or greater per year.
Expected Useful Life Study
An energy management system has a typical expected useful life of approximately fifteen years.

13.0 Feasibility Study of Green Technologies

The following Green Energy Technologies were evaluated for their application at the subject property:

13.1 Photovoltaic for Electricity

Implementing photovoltaic panels for electricity at the subject property has been considered by the Ann Arbor Housing Commission. The south-facing orientation of each of the roofs at this property provides optimal solar energy collection. Unfortunately, renewable energy incentives are not currently available to the Client to reduce high installation costs.

13.2 Solar Thermal for Hot Water Heating

Hot water usage at the subject property is not high enough to justify initial costs of solar heating therefore the property is not a viable candidate of solar thermal for hot water heating. Further study is not recommended.

13.3 Wind Turbine

The property is not a viable candidate of installing wind turbines due to insufficient wind power in this geographic area. Further study is not recommended.

13.4 Combined Heat and Power

The property has less than 80 units (a rule of thumb for minimum number of units for feasibility) and does not have a central power source. The property is not a viable candidate of implementing combined heat and power and further study is not recommended.

13.5 Fuel Cells

Due to the high initial costs associated with fuel cells, implementation is not recommended at the subject property. Further study is not recommended.

14.0 Recommendations & Impact

Based on the analysis described in this report, AKT Peerless believes substantial energy conservation opportunities are available, and recommends implementation of all proposed ECMs.

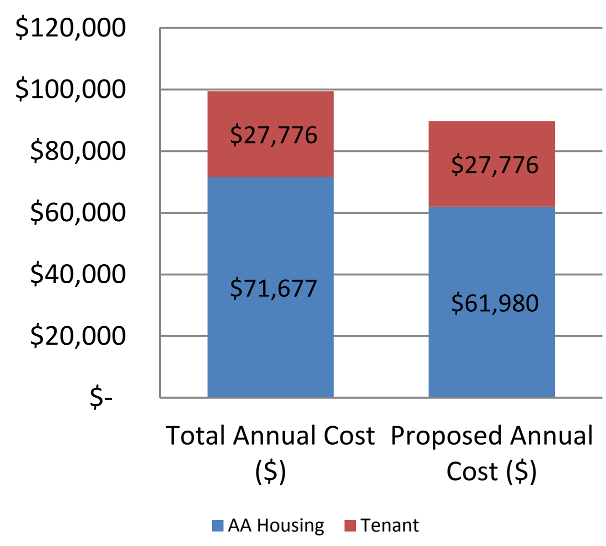
The combined annual EUI for the subject building is 111.90 kBtu per square foot per year. The annual energy cost index is $1.78 per square foot per year. Reduction of fuel (non-electrical) and electrical energy consumption through the implementation of recommended ECMs will potentially result in a reduced EUI of 78.25 kBtu per square foot per year, a potentially reduced annual cost index of $1.57 per square foot per year, and potential total annual energy cost savings of $9,697 per year.

An additional result of implementing the recommended ECMs would be the reduction of greenhouse gas (GHG) emissions by 57.76 metric tons. Measurements of greenhouse gas emissions are based on data gathered from the United States Environmental Protection Agency (USEPA) eGRID database.

The subject building is located in eGRID electric utility sub-region RFCW. Greenhouse gas emissions from electrical consumption are based on emissions data measured at the electrical generating facilities serving consumers located in the specified eGRID utility sub-region, and therefore greenhouse gas emissions and the estimated reduction in greenhouse gas emissions reflect the mix of fuel sources used by the regional electrical utilities serving the subject property. Emissions factors for natural gas consumption are based on data gathered from the 2009 United States Greenhouse Gas Inventory, Annex 2.

Table 15. Impact Summary

% Energy Savings	16%
% Water Savings	0%
% Cost Savings	10%
Annual Cost Savings ($)	$9,697
% Reduction in GHG Emissions (CO_2 Equivalent Metric Tons)	13%



15.0 Limitations

AKT Peerless accepts responsibility for the competent performance of its duties in executing this assignment and preparing this report in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages. Although AKT Peerless believes the results contained in herein are reliable, AKT Peerless cannot warrant or guarantee that the information provided is exhaustive, or that the information provided by the client, third parties, or the secondary information sources cited in this report is complete or accurate.

Nothing in this report constitutes a legal opinion or legal advice. For information regarding individual or organizational liability, AKT Peerless recommends consultation with independent legal counsel.

ASHRAE *Procedures for Commercial Building Energy Audits* recommends that the Energy Analyst apply a consistent definition of building square footage to both the subject building and to similar buildings used for energy performance comparisons. AKT Peerless cannot evaluate the accuracy or consistency of building square footage measurements of similar buildings included in the comparison database.

The Energy Analyst has not verified the accuracy of building floor area as reported by the building owner/operator and has not verified that the building owner/operator’s definition of building usage is consistent with the definitions used in the CBECS.

The Energy Analyst has not evaluated the potential financial savings from changing to a different utility price structure.

Also, the Energy Analyst has not verified that the property owner/operator has reported all sources and records of energy consumed at the subject property. Potentially unreported information may include, but is not limited to, bills, meters, and types of energy consumed. Inaccurate information provided to the energy analyst and information not reported to the energy analyst may influence the findings of report.

16.0 Signatures

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Recent annual electricity consumption, cost is summarized in the following tables:

Natural Gas

NATURAL GAS UBA									
AAHC Site:	Baker Commons								
Meter #:	8196274 08								
Month	Start	End	Days	HDD	Consumption Therms	Actual (0) Estm. (1)	Delivery $	Gas $	Total $
Jan-12	1/13/2012	2/14/2012	32	1100	5,031	0	$ -	$3,893	$3,893
Feb-12	2/14/2012	3/15/2012	30	973	5,454	0	$ -	$4,217	$4,217
Mar-12	3/15/2012	4/13/2012	29	529	2,502	0	$ -	$1,985	$1,985
Apr-12	4/13/2012	5/15/2012	32	513	2,644	0	$ -	$2,097	$2,097
May-12	5/15/2012	6/15/2012	31	171	1,155	0	$ -	$922	$922
Jun-12	6/15/2012	7/14/2012	29	90	600	0	$ -	$495	$495
Jul-12	7/14/2012	8/13/2012	30	23	621	0	$ -	$508	$508
Aug-12	8/13/2012	9/14/2012	32	80	670	0	$ -	$547	$547
Sep-12	9/14/2012	10/12/2012	28	223	1,279	0	$ -	$1,013	$1,013
Oct-12	10/12/2012	11/9/2012	28	478	2,329	0	$ -	$1,806	$1,806
Nov-12	11/9/2012	12/11/2012	32	836	2,900	0	$ -	$2,266	$2,266
Dec-12	12/11/2012	1/14/2013	34	946	3,811	0	$ -	$2,825	$2,825
				5,962	**28,996**				**$22,573**
									$0.7785 $/Therm

Electricity

ELECTRICAL UBA								
AAHC Site:	Baker Commons (Common)							
Meter #:	8821517 08							
Month	Start	End	Days	HDD	CDD	Actual (0) Estm. (1)	Consumption kWh	Total Charges ($)
Jan-12	1/13/2012	2/13/2012	31	1100	0	0	14880	$1,900.12
Feb-12	2/13/2012	3/15/2012	31	973	0	0	17760	$2,259.98
Mar-12	3/15/2012	4/13/2012	29	529	33	0	17120	$2,179.88
Apr-12	4/13/2012	5/15/2012	32	513	7	0	14080	$1,813.25
May-12	5/15/2012	6/15/2012	31	171	118	0	24160	$3,073.31
Jun-12	6/15/2012	7/14/2012	29	90	245	0	30400	$3,871.46
Jul-12	7/14/2012	8/13/2012	30	23	409	0	33760	$4,293.86
Aug-12	8/13/2012	9/12/2012	30	80	233	0	28320	$3,607.80
Sep-12	9/12/2012	10/11/2012	29	223	93	0	15040	$1,922.20
Oct-12	10/11/2012	11/9/2012	29	478	15	0	16640	$2,101.34
Nov-12	11/9/2012	12/11/2012	32	836	0	0	19520	$2,458.76
Dec-12	12/11/2012	1/14/2013	34	946	0	0	20480	$2,577.17
				5962	**1153**		**252,160**	**$32,059.13**
								$0.1271 Blended $/kWh

Tenant Spaces Combined

ELECTRICAL UBA
AAHC Site: **Baker Commons (Tenants)**

Month	Start	End	Days	HDD	CDD	Actual (0) Estm. (1)	Consumption kWh	Total Charges ($)
Jan-12	1/13/2012	2/13/2012	31	1100	0	0	12740	$2,390.64
Feb-12	2/13/2012	3/15/2012	31	973	0	0	14761	$2,646.01
Mar-12	3/15/2012	4/13/2012	29	529	33	0	13567	$2,458.10
Apr-12	4/13/2012	5/15/2012	32	513	7	0	11193	$2,140.11
May-12	5/15/2012	6/15/2012	31	171	118	0	13540	$1,575.67
Jun-12	6/15/2012	7/14/2012	29	90	245	0	12887	$2,373.68
Jul-12	7/14/2012	8/13/2012	30	23	409	0	14399	$2,474.93
Aug-12	8/13/2012	9/12/2012	30	80	233	0	13785	$2,398.52
Sep-12	9/12/2012	10/11/2012	29	223	93	0	12425	$2,220.00
Oct-12	10/11/2012	11/9/2012	29	478	15	0	11993	$2,173.23
Nov-12	11/9/2012	12/11/2012	32	836	0	0	14084	$2,471.61
Dec-12	12/11/2012	1/14/2013	34	946	0	0	14078	$2,453.29
				5962	**1153**		**159,452**	**$27,775.79**
								$0.1742 Blended $/kWh

HUD Residential Energy Use Benchmarking Tool

For single-family, semi-detached, row/townhouse, multi-family walk-up, and elevator buildings.

The HUD Residential Energy Use Benchmarking Tool quantifies the performance of a user-defined building relative to the family of HUD residential buildings. A score of 75 denotes performance at the top 25th percentile of HUD residential buildings. A score of 50 denotes performance at the 50th percentile (in the middle) of HUD residential buildings. For definitions or help on the terms below, simply click on any underlined text. Click on "Return" to come back to this page.

***Directions**: Provide entries in ALL the grey spaces that apply for your Building Description and Annual Energy Consumption.*

Building Description

Preliminary: 9/17/07

Building Name: Baker Commons (optional entry)

5-digit Zip Code: 48103 — *Not Sure?*

Mapping Location: *Ann Arbor, MI*

Heating Degree Days: 6818

Cooling Degree Days: 840

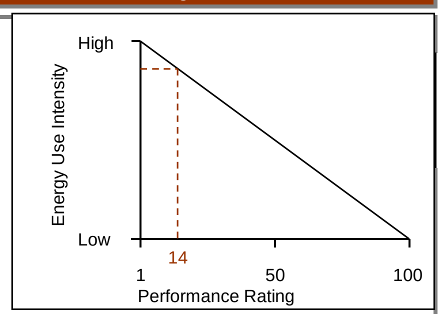
	Gross Floor Area (ft2)	Total Number of Units	Is This a Multifamily Building with Central Laundry? (Y/N)	Is this a Multi-Family Walkup Building? (Y/N)	Heated Floor Area (ft2)	Year Built
Building Description:	46,270	64	Y	Y	46,270	1980

Annual Consumption

	Electricity	Gas	#2 Fuel Oil	#4 Fuel Oil	District Steam	District Hot Water	Propane
Select Units:	kWh	100 CF	Gal	Gal	kLbs	MMBtu	Gal
Energy	411,612	28,996					
Cost ($)	59,835	22,573					
Calculated unit cost:	$0.15 $/kWh	$0.78 $/therm	$/gallon	$/gallon	$/klbs	$/kBtu	$/gallon

Results

	Your Building	HUD Typical
Score Against Peers	**14**	**50**
Building Site Energy Use (kBtu/year)	**4,391,008**	**2,959,906**
Site Energy Use Intensity (kBtu/ft2-year)	**94.90**	**63.97**
Energy Cost Intensity ($/ft2-year)	**1.78**	**1.20**
Total Annual Energy Cost ($/year)	**82,408**	**55,550**



HUD Residential Water Use Benchmarking Tool

For single-family, semi-detached, row/townhouse, multi-family walk-up and elevator buildings.

The HUD Residential Water Use Benchmarking Tool quantifies the performance of a user-defined building relative to the family of HUD residential buildings. A score of 75 denotes performance at the top 25th percentile of HUD residential buildings. A score of 50 denotes performance at the 50th percentile (in the middle) of HUD residential buildings. For definitions or help on the terms below, simply click on any underlined text. Click on "Return" text to come back to this page.

Directions: Provide entries in the gray spaces below with your building description and annual water consumption.

Building Description

ORNL 8/22/2007

Building Name: Baker Commons (optional entry)

5-digit Zip Code: 48103 *Not Sure?*

Mapping Location: *Ann Arbor, MI*

	Gross Floor Area of Building(s) (ft2)	Building(s) is Single-Family Detached or Semi-Detached? (Y/N)	Is Residents Water Use Paid Directly by the PHA? (Y/N)	Number of Units in Building(s)	Number of Units in Building(s) with In-Unit Laundry Hookups or Central Laundry Access?	How Many Buildings share this Water Meter?
Building Description:	46,270	N	N	64	64	1

Annual Consumption

Building Annual Water Use: 1,965,744 (gallons/year)

Building Annual Water Use Cost: 17,045 ($/year)

Average Annual Water Cost: $0.9 ($/100 gallons)

Results

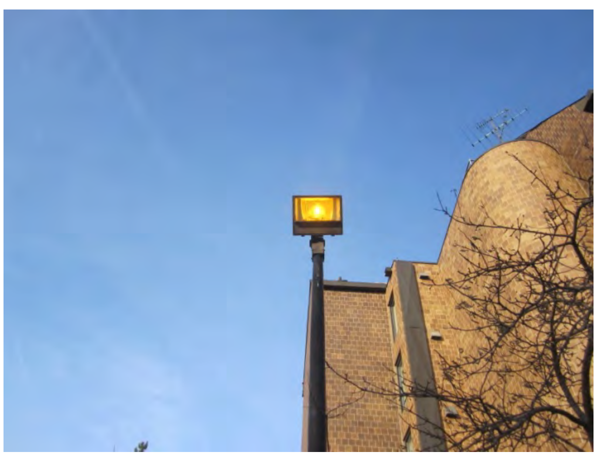
	Your Building	HUD Typical
Score Against Peers	41	50
Annual Water Use (gal/year)	1,965,744	1,677,247
Annual Water Use Intensity (gal/ft2-year)	42.5	36.2
Annual Water Cost Intensity ($/ft2-year)	0.37	0.31
Total Annual Water Cost ($/year)	17,045	14,543

Photo 1: Parking lot view of complex

Photo 2: Exterior view of the east end of the complex

Photo 3: Side door with wall-mounted lighting

Photo 4: Condensing Units on side of building



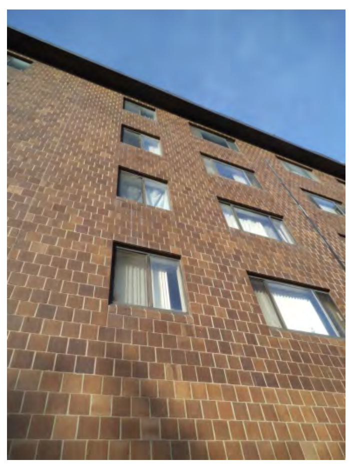


Photo 5: Typical parking lot pole lighting

Photo 6: Windows in apartment units on top floors

Photo 7: Window frame of first floor windows

Photo 8: Housing for outdoor chiller

Photo 9: View of Trane chiller from outside

Photo 10: Additional condensing units near chiller

Photo 11: Overhead garage door for basement

Photo 12: Domestic hot water boiler in basement

Photo 13: Older hot water boiler

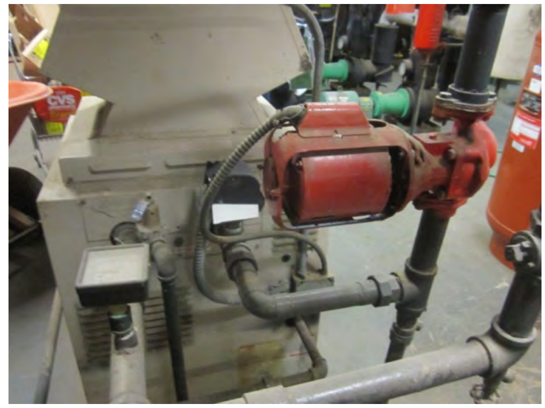


Photo 14: Domestic hot water circulating pump

Photo 15: Hot water circulating pumps

Photo 16: Makeup air unit serving the entire facility

Photo 17: Hot water boilers recently installed

Photo 18: Insulated ducting and outdoor air louver

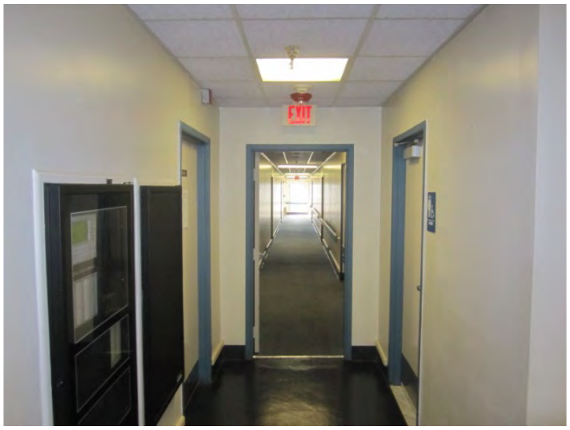


Photo 19: First floor hallway near common area

Photo 20: Typical split system at the end of hall

Photo 21: Remote thermostat for Sanyo units

Photo 22: Casings for thermostats in hallways

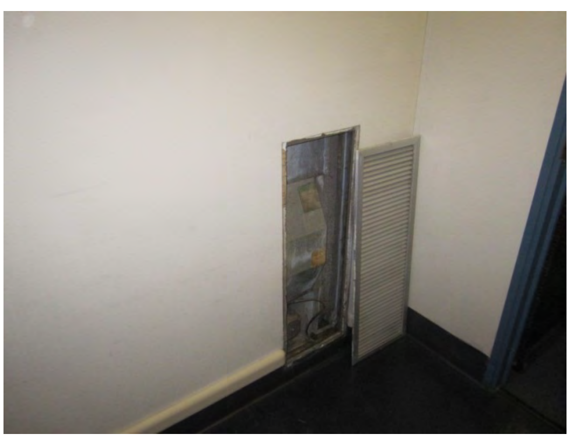
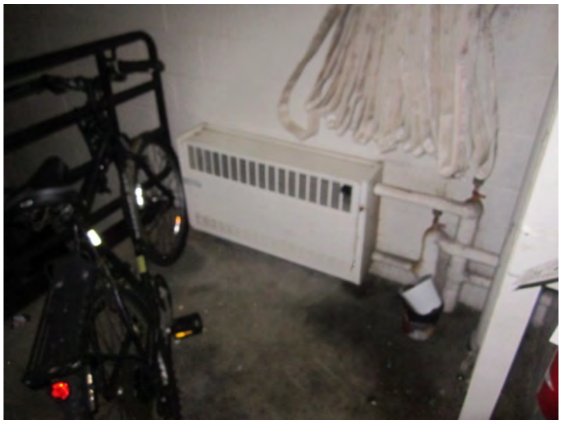


Photo 23: Fan coil units in hallways

Photo 24: Thermostats for fan coil units



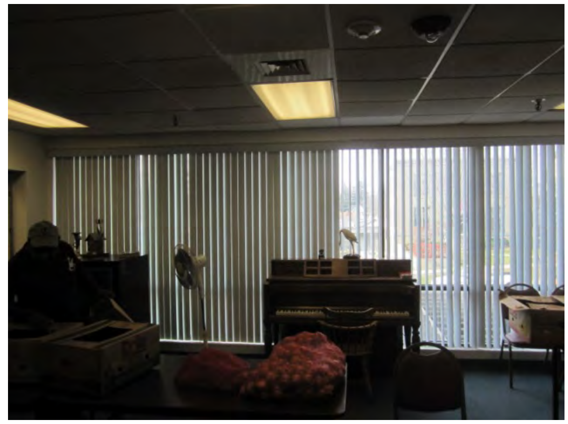
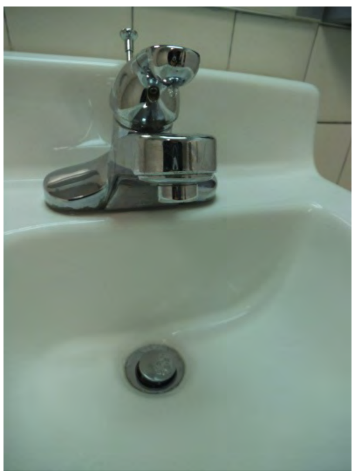


Photo 25: Unit heaters in stairwells

Photo 26: Community center on first floor



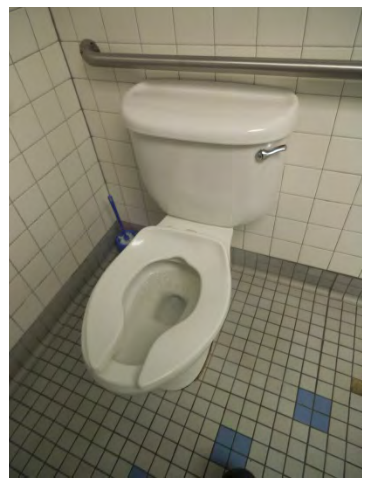


Photo 27: Common area bathroom faucet

Photo 28: ADA accessible common area bathroom

Photo 29: Common area kitchen refrigerator

Photo 30: Common area kitchen sink faucet

Photo 31: Common area kitchen electric stove

Photo 32: Attic space above fifth floor

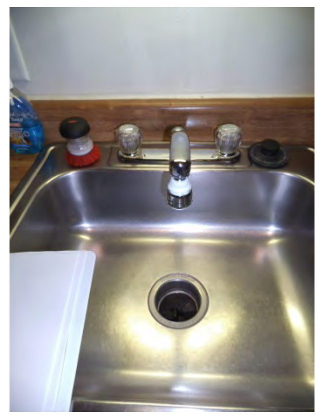


Photo 33: Framing for attic space

Photo 34: Typical faucet aerator for kitchen sink

Photo 35: Typical refrigerator in apartments

Photo 36: Typical electric stove in apartments

Photo 37: Window frame in fifth floor units

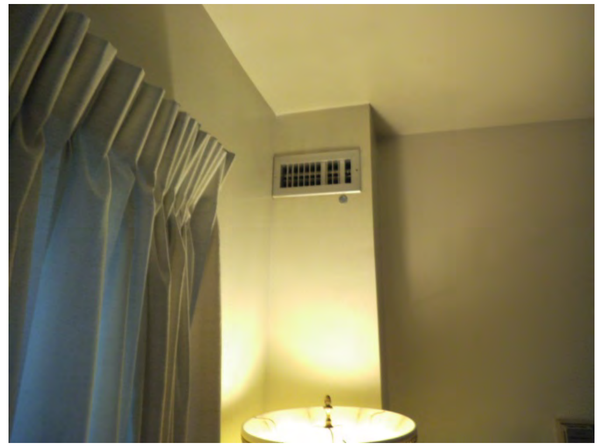


Photo 38: Supply register for fan coil unit in wall

Photo 39: Thermostat for fan coil unit

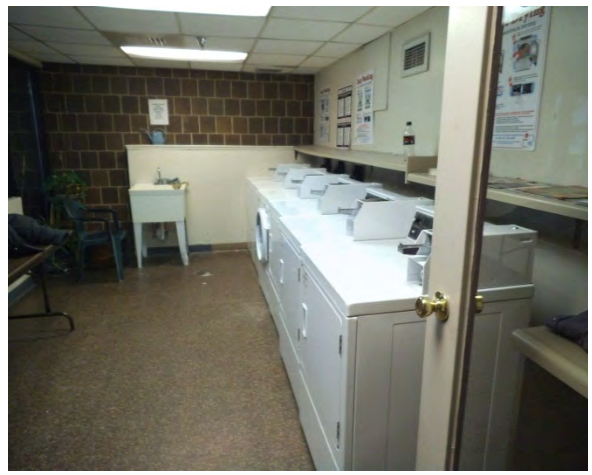


Photo 40: Common area laundry room

Photo 41: Central boiler vent stack on roof

Photo 42: Typical exhaust hoods for unit bathroom

Lighting Summary

Interior Lighting

Zone / Space	Qty	Burn Hours	Existing Fixture Type	Existing Fixture	Input Watts per Fixture	Annual Consumption (kWh)	Proposed Fixture Type	Proposed Fixture	Input Watts per Fixture2	Annual Consumption (kWh)3	Retrofit Cost ($)	Annual Energy Savings (kWh)	Annual Cost Savings ($)	SP (yrs)
First Floor	6	8760	4ft Fluorescent	2L 1x4 wrap F32 T8	58	3,048	4ft Fluorescent	2L 1x4 wrap F28 T8	48	2,523	$369.36	526	$63.07	5.86
First Floor	14	8760	4ft Fluorescent	2L 2x4 F32 T8	58	7,113	4ft Fluorescent	2L 2x4 F28 T8	48	5,887	$861.84	1,226	$147.17	5.86
First Floor	6	8760	4ft Fluorescent	3L 2x4 F32 T8	85	4,468	4ft Fluorescent	2L 2x4 F28 T8	48	2,523	$369.36	1,945	$233.37	1.58
Typical Hallway	32	8760	4ft Fluorescent	2L 1x4 wrap F32 T8	58	16,259	4ft Fluorescent	2L 1x4 wrap F28 T8	48	13,455	$1,969.92	2,803	$336.38	5.86
Typical Hallway	8	8760	4ft Fluorescent	2L 2x4 F32 T8	58	4,065	4ft Fluorescent	2L 2x4 F28 T8	48	3,364	$492.48	701	$84.10	5.86
Second Floor Laundry Room	3	8760	4ft Fluorescent	2L 2x4 F32 T8	58	1,524	4ft Fluorescent	2L 2x4 F28 T8	48	1,261	$184.68	263	$31.54	5.86
Second Floor Office Area	3	2080	4ft Fluorescent	2L 2x4 F32 T8	58	362	4ft Fluorescent	2L 2x4 F28 T8	48	300	$184.68	62	$7.49	24.66
Basement	14	1460	4ft Fluorescent	2L 2x4 F32 T8	58	1,186	4ft Fluorescent	2L 2x4 F28 T8	48	981	$861.84	204	$24.53	35.14
Stairwell	22	8760	4ft Fluorescent	1L 1x4 F32 T8	31	5,974	4ft Fluorescent	1L 1x4 F28 T8	27	5,203	$1,206.92	771	$92.51	13.05
Elevator	4	8760	4ft Fluorescent	2L 1x8 F32 T8 tandem	112	3,924	4ft Fluorescent	2L 1x8 F28 T8 4ft ta	94	3,294	$369.36	631	$75.69	4.88
						37,090					**$6,870.44**	**9,131.92**	**$1,095.83**	**6.27**

Exterior Lighting

Zone / Space	Qty	Burn Hours	Existing Fixture Type	Existing Fixture	Input Watts per Fixture	Annual Consumption (kWh)	Proposed Fixture Type	Proposed Fixture	Input Watts per Fixture2	Annual Consumption (kWh)3	Retrofit Cost ($)	Annual Demand Savings (kW)	Annual Energy Savings (kWh)	Annual Cost Savings ($)	SP (yrs)
Parking Lot Pole Lights	2	3650	Metal Halide	250 W	297	2,168	LED	Pole Mount no PC	91	664	$1,200.00	N/A	1,504	$180.46	6.65
Parking Lot Pole Lights	3	8760	Metal Halide	250 W	297	7,805	LED	Pole Mount no PC	91	2,391	$1,800.00	N/A	5,414	$649.64	2.77
Soffit Lighting	10	3650	Halogen	75 W Flood	75	2,738	LED	PAR30 75W equil.	15	548	$600.00	N/A	2,190	$262.80	2.28
Wall Mount	2	3650	Metal Halide	250 W	297	2168.1	LED	Wall Mounted Flooc	91	664	$1,200.00	N/A	$1,503.80	$180.46	6.65
						14,879					**$4,800.00**		**10,611**	**$1,273.35**	**3.77**

DTE Energy Multifamily Program Lighting Specifications

LIGHTING SPECIFICATIONS

All lighting projects are expected to comply with the Illuminating Engineering Society of North America (IESNA) recommended lighting levels or the local code. All final applications must include manufacturers' specification sheets for lamps and ballasts. All incentives are for one-for-one replacements except as noted.

Compact Fluorescent Lamps, Screw-In (≤ 31 Watts)

Incentives are available for the replacement of incandescent lamps with CFLs that are ENERGY STAR® rated or that meet ENERGY STAR® criteria. The lamps must have a luminous efficacy of ≥ 50 lumens per watt (LPW). Incentive is per lamp. *Note: This incentive is not available for CFLs purchased at retail stores participating in the DTE Energy CFL discount program. Incentives for CFLs purchased from those retailers is included in the discounted price.*

Compact Fluorescent Lamps, Screw-In (> 31 Watts)

Incentives are available for the replacement of incandescent lamps with high wattage CFLs. The new lamp must have a luminous efficacy of ≥ 65 lumens per watt (LPW). Incentive is per lamp. *Note: This incentive is not available for CFLs purchased at retail stores participating in the DTE Energy CFL discount program. Incentives for CFLs purchased from those retailers is included in the discounted price.*

Compact Fluorescent Fixtures

Incentives are available for upgrades to interior hardwired compact fluorescent fixtures. Replacement fixtures must be new fixtures or modular hardwired retrofits with hardwired electronic ballasts. The compact fluorescent ballast must be programmed start or programmed rapid start with a power factor (PF) ≥ 0.90 and a total harmonic distortion (THD) ≤ 20%. Incentive is per fixture.

Compact Fluorescent Reflector Flood Lamps

Incentives are available to install CFL reflector flood lamps to replace incandescent reflector flood lamps. The CFL reflector flood lamps must have a luminous efficacy of ≥ 33 lumens per watt (LPW). Incentive is per lamp. *Note: This incentive is not available for CFL's purchased at retail stores participating in the DTE Energy CFL discount program. Incentives for CFLs purchased from those retailers is included in the discounted price.*

42W 8-Lamp Compact Fluorescent High Bay Fixture

Incentives are available in high-bay applications (ceiling heights over 15 feet) for replacing any lighting fixtures greater than or equal to 350W with 42 Watt, 8 lamp compact fluorescent fixtures. Replacement fixtures must contain specular reflectors and electronic ballasts with a power factor (PF) ≥ 0.90. Incentive is per fixture.

ENERGY STAR® Qualified LED Recessed Down Light

Incentives are available to replace incandescent recessed lights with ENERGY STAR® qualified LED recessed down lights. Replacement lights must have a minimum efficacy of 35 lumens per watt. Incentive is per lamp. *Note: This incentive is not available for lamps purchased at retail stores participating in the DTE Energy lamp discount program. Incentive for lamps purchased from those retailers is included in the discounted price.*

Standard Linear Fluorescent Retrofit

Incentives are available for replacing existing T12 lamps and magnetic ballasts with T8 or T5 lamps and electronic ballasts. The new fixture lamps must have a color rendering index (CRI) ≥ 80. The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for a minimum of 5 years. Ballasts must have a power factor (PF) ≥ 0.90. Ballasts for 4-foot lamps must have total harmonic discharge (THD) ≤ 20 % at full power output. For 2 and 3-foot lamps, ballasts must have THD ≤ 32 % at full light output. Incentive is per fixture.

High Output T8/T5 Lamp and Ballast replacing T12 Fluorescent Lamp

Incentives are available for replacing existing T12 lamps and magnetic ballasts with T5HO or T8HO lamps and electronic ballasts. The replacement lamps must have a CRI ≥ 80. Incentive is per fixture.

Low Wattage 4-foot T8 Lamps (Lamps Only)

Incentives are available for replacing 32 Watt T8 lamps with reduced (low) wattage T8 lamps when an electronic ballast is already present. The lamps must be reduced wattage in accordance with the Consortium for Energy Efficiency© (CEE©) specifications (www.cee1.org) and as summarized in Table 2 below. Low wattage lamps must be either 25W or 28W and CEE© Listed. Qualified products can be found at http://www.cee1.org/com/com-lt/com-lt-main.php3. Incentive is per lamp.

High Performance 4-foot T8 Lamp and Ballast

Incentives are available for replacing existing T12 or T12HO lamps and magnetic ballasts or standard T8 lamps and electronic ballasts with high performance T8 lamps and electronic ballasts. Replacement fixtures must high performance in accordance with the Consortium for Energy Efficiency© (CEE©) high performance T8 specification, available at www.cee1.org, which and is summarized in Table 1 below. A list of qualified lamps and ballasts can be found at: http://www.cee1.org/com/com-lt/com-lt-main.php3. Both the lamp and ballast must meet the specification in order to be eligible for an incentive. Incentive is per fixture.

LIGHTING SPECIFICATIONS

Table 1: High Performance T8 Specifications

High Performance T8 and T5 Characteristics				
Mean System Efficacy	≥ 90 Mean Lumens per Watt (MLPW) for Instant Start Ballasts			
	≥ 88 MLPW for Programmed Rapid Start Ballasts			
Performance Characteristics for Lamps				
Color Rendering Index (CRI)	≥ 80			
Minimum Initial Lamp Lumens	≥ 3100 Lumens *			
Lamp Life	≥ 24,000 Hours			
Lumen Maintenance or Minimum Mean Lumens	≥ 94% or ≥ 2900 Mean Lumens			
Performance Characteristics for Ballasts				
Ballast Efficacy Factor (BEF) BEF = (BFx100)/Ballast Input Watts	**Instant Start Ballast (BEF)**			
	Lamps	Low BF ≤ 0.85	Norm 0.85 < BF ≤ 1.0	High BF ≥ 1.01
	1	> 3.08	> 3.11	NA
	2	> 1.60	> 1.58	> 1.55
	3	≥ 1.04	≥ 1.05	≥ 1.04
	4	≥ 0.79	≥ 0.80	≥ 0.77
	Programmed Rapid Start Ballast (BEF)			
	1	≥ 2.84	≥ 2.84	NA
	2	≥ 1.48	≥ 1.47	≥ 1.51
	3	≥ 0.97	≥ 1.00	≥ 1.00
	4	≥ 0.76	≥ 0.75	≥ 0.75
Ballast Frequency	20 to 33 kHz or ≥ 40 kHz			
Power Factor	≥ 0.90			
Total Harmonic Distortion	≤ 20%			

* For lamp with color temperatures ≥ 4500k. 2950 minimum initial lamp lumens are allowed.

Low Wattage 4-foot T8 Lamp and Ballast

Incentives are available for replacing T12 systems with reduced (low) wattage lamp and electronic ballast systems. The lamps and ballasts must meet the Consortium for Energy Efficiency© (CEE©) specification (www.cee1.org) and summarized in Table 8-2 on the following page. Qualified lamp and ballast products can be found at http://www.cee1.org/com/com-lt/com-lt-main.php3. Both the lamp and ballast must qualify in order to receive an incentive for the system. Incentive is per fixture.

Table 2: Reduced (Low) Wattage 4-foot Lamps and Ballasts

Performance Characteristics for Lamps(1)		
Mean System Efficacy	≥ 90 MLPW	
Color Rendering Index (CRI)	≥ 80	
Minimum Initial Lamp Lumens	≥ 2585 Lumens for 28 W	
	≥ 2400 Lumens for 25 W	
Lamp Life(2)	≥ 18,000 hrs at three hours per start	
Lumen Maintenance –or- Minimum Mean Lumens(3)	≥ 94% -or- ≥ 2430 Lumens for 28 W ≥ 2256 Lumens for 25 W	
Performance Characteristics for 28 and 25 W Ballasts		
Ballast Frequency	20 to 33 Hz or ≥ 40 kHz	
Power Factor	≥ 0.90	
Total Harmonic Distortion	≤ 20%	
Performance Characteristics for Ballasts(4), 28 W systems		
Ballast Efficiency Factor (BEF)	Instant Start Ballast (BEF)	
BEF = [BF x 100]/Ballast Input Watts Based on: (1) Type of ballast (2) No. of lamps driven by ballast (3) Ballast Factor	Lamps	All BEF Ranges
	1	≥ 3.52
	2	≥ 1.76
	3	≥ 1.16
	4	≥ 0.88
Performance Characteristics for Ballasts(4), 25 W systems		
Ballast Efficiency Factor (BEF)	Instant Start Ballast (BEF)	
BEF = [BF x 100]/Ballast Input Watts Based on: (1) Type of ballast (2) No. of lamps driven by ballast (3) Ballast Factor	Lamps	All BEF Ranges
	1	≥ 3.95
	2	≥ 1.98
	3	≥ 1.32
	4	≥ 0.99

(1) Lamps ≥ 4500 K and/or 24,000 hours have a system efficacy specified ≥ 88 MLPW. Minimum initial and mean lumen levels are specified as follows: for 28 W lamps, limits are 2600/2340. For 25 W lamps, limits are 2300/2185.

(2)Life rating is based on an Instant Start Ballast tested in accordance with ANSI protocols. When used for Programmed Start Ballast, life may be increased depending upon the operating hours per start.

(3) Mean lumens measures at 7,200 hours

(4) Multi-Voltage Ballasts must meet or exceed the listed Ballast Efficiency Factor when operated on at least one of the intended operating voltages.

LIGHTING SPECIFICATIONS

High Output T5 and 4-foot T8 New Fixture Replacing HID

Incentives are available for replacements of HID fixtures with T8 or T5HO lamps and electronic ballasts. The T8 or T5HO lamps must have a color rendering index (CRI) ≥ 80. The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for 5 years. Ballasts must have a power factor (PF) ≥ 0.90. Ballasts for 4-foot lamps must have total harmonic distortion (THD) ≤ 20% at full light output. This incentive is available for high-bay and low-bay fluorescent applications. Incentive is per fixture.

Pulse Start Metal Halide (retrofit only)

Incentives are available for replacing existing HID fixtures with pulse start metal halide fixtures in high-bay applications. Incentive is per fixture.

Exterior HID to LED/Induction Lighting Retrofit

Incentives are available for exterior applications for replacing existing high intensity discharge fixtures with LED or Induction fixtures. Existing fixtures must operate > 3,833 hours per year (> 10.5 hours per day). Fixture replacement must result in at least a 40% power reduction. LED fixtures must have a minimum efficacy of 35 lumens per watt. Eligible applications include canopy lighting and wall-packs. This incentive can be combined with incentives for exterior/garage bi-level control. Incentive is per fixture.

Garage HID to LED/Induction Lighting Retrofit

Incentives are available for garage and parking deck applications for replacing existing high intensity discharge fixtures with LED or Induction fixtures. Existing fixtures must operate 8760 hours per year or whenever the garage is open. Fixture replacement must result in at least a 40% power reduction. LED fixtures must have a minimum efficacy of 35 lumens per watt. Incentive is per fixture.

Exit Signs

Incentives are available for high-efficiency exit signs replacing or retrofitting an existing incandescent exit sign. Electroluminescent, T1, and LED exit signs are eligible. Non-electrified and remote exit signs are not eligible. All replacement exit signs must be UL or ETL listed, have a minimum lifetime of 10 years, and have an input wattage ≤ 5 Watts per face or be ENERGY STAR® listed. Incentive is per sign.

LED Traffic and Pedestrian Lights

Incentives are available for LED traffic lights on a per-signal basis (including arrows) that replace or retrofit an existing incandescent traffic signal. At minimum, red and green lamps must be retrofitted to qualify for the signal incentive. LED Signals must have a wattage of ≤17 watts per signal. Incentives are not available for spare lights. Lights must be hardwired, with the exception of pedestrian hand signals. Incentive is per signal.

Occupancy Sensors

Incentives are available for occupancy sensors for low occupancy interior areas, which automatically turn lights on when movement is detected. The minimum amount of time for the lights to stay on when no movement is sensed (delay set time) should be 10 minutes. The sensors can be passive infrared (PIR) or ultrasonic. All sensors should be hard-wired and control interior lighting fixtures. *To assist in rebate processing, provide the inventory of the controlled fixtures with the Final Application*. Incentive is per sensor.

Central Lighting Control

Incentives are available for automated central lighting control systems with override capabilities. This measure includes time clocks, package programmable relay panels, and complete building automation controls. Photo-sensors may also be incorporated into the central lighting control system. Incentive is per 10,000 square feet of controlled area.

Switching Controls for Multilevel Lighting

Incentives are available to install switching controls for multilevel lighting which may be used with daylight or occupancy sensors. If combined with daylight sensors, the controls must be commissioned in order to ensure proper sensor calibration and energy savings. This measure is applicable to spaces that require various lighting schemes such as classrooms, auditoriums, conference rooms and warehouses with skylights. Incentive is per 10,000 square feet of controlled area.

Daylight Sensor Controls

Incentives are available for new daylight sensor controls in spaces with reasonable amounts of sunlight exposure and areas where task lighting is not critical. The controls can be on/off, stepped, or continuous (dimming). The on/off controller should turn off artificial lighting when the interior illuminance meets the desired indoor lighting level. Daylight sensor controls are required to be commissioned in order to ensure proper sensor calibration and energy savings. Incentive is per 10,000 SF of controlled area.

Exterior Lighting, Bi-Level Control with Override

Incentives are available for retrofitting existing, exterior HID lighting with bi-level controls that reduce lighting levels by at least 50% when the space is unoccupied. The HID lighting must have an electronic ballast capable of reduced power levels, and be coupled with motion sensors to bring the light back to full lumen output for security reasons. Eligible controls include on-off controls, dimmers, and hi-lo ballast controls. This measure is applicable to exterior fixtures that are on during the night. Incentive is per fixture.

Light Tube

Incentives are available for new light tubes (tubular skylights) 10 inches to 21 inches in diameter. This measure is applicable to spaces that normally require electric lighting during peak hours (1 - 4 p.m. weekdays during the summer). The light tube must still allow an adequate amount of light during overcast conditions and must be coupled to daylight sensing controls. Incentive is per tube.

Delamping

Incentives are available for the permanent removal of existing fluorescent lamps. Permanent lamp removal is the net reduction in the quantity of lamps after a project is completed. Customers are responsible for determining whether reflectors are necessary in order to maintain adequate lighting levels. Lighting retrofits are expected to meet the Illuminating Engineering Society of North America (IESNA) recommended light levels. Unused lamps, lamp holders, and ballasts must be removed permanently from the fixture and disposed of in accordance with local regulations. This measure is applicable when retrofitting from T12 lamps to T8 lamps only. Removal of lamps from a T12 fixture that is not being retrofitted with T8 lamps is not eligible for this incentive, but may be eligible for other incentives. Incentive is per lamp removed.

REPORT- LS-D Building Monthly Loads Summary WEATHER FILE- Detroit MI TMY2

	- - - COOLING - - -						- - - HEATING - - -						- - - ELEC - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.65226	17	16	47.F	40.F	60.484	-156.971	27	8	-3.F	-4.F	-407.872	10322.	22.595
FEB	1.95021	22	17	46.F	39.F	103.211	-123.587	6	7	-1.F	-2.F	-393.098	9389.	22.595
MAR	12.76203	17	17	64.F	51.F	268.726	-75.572	7	8	19.F	17.F	-267.947	10343.	18.646
APR	30.77422	26	17	66.F	57.F	321.146	-37.084	10	6	20.F	18.F	-265.762	9938.	18.646
MAY	82.86873	31	17	77.F	61.F	424.822	-7.464	23	5	31.F	29.F	-134.888	10378.	22.595
JUN	135.45197	29	18	88.F	73.F	486.397	-0.022	26	5	48.F	44.F	-7.409	9994.	18.646
JUL	158.10464	7	18	91.F	72.F	532.821	-0.002	30	6	52.F	50.F	-0.552	10322.	22.595
AUG	137.32062	17	17	84.F	73.F	454.495	-0.423	28	6	45.F	44.F	-55.338	10342.	18.646
SEP	85.13588	9	16	84.F	78.F	375.227	-4.857	24	6	34.F	33.F	-135.847	10084.	22.595
OCT	28.08462	31	16	62.F	53.F	241.027	-28.229	24	7	30.F	29.F	-177.444	10323.	22.595
NOV	8.39990	1	16	73.F	59.F	228.365	-78.691	26	5	16.F	15.F	-292.407	10175.	22.595
DEC	0.35291	3	16	41.F	35.F	27.369	-142.644	18	7	8.F	7.F	-327.035	10377.	22.595
TOTAL	681.858						-655.545						121988.	
MAX						532.821						-407.872		22.595

REPORT- LS-A Space Peak Loads Summary WEATHER FILE- Detroit MI TMY2

SPACE NAME	MULTIPLIER SPACE	FLOOR	COOLING LOAD (KBTU/HR)	TIME OF PEAK	DRY- BULB	WET- BULB	HEATING LOAD (KBTU/HR)	TIME OF PEAK	DRY- BULB	WET- BULB
EL1 WSW Perim Spc (B.WSW1)	1.	1.	0.000		0.F	0.F	-5.684	MAR 27 3 AM	23.F	20.F
EL1 East Perim Spc (B.E2)	1.	1.	0.212	SEP 30 5 PM	67.F	55.F	-1.752	MAR 27 3 AM	23.F	20.F
EL1 ESE Perim Spc (B.ESE3)	1.	1.	0.000		0.F	0.F	-5.036	MAR 27 3 AM	23.F	20.F
EL1 West Perim Spc (B.W4)	1.	1.	0.000		0.F	0.F	-4.060	MAR 27 3 AM	23.F	20.F
EL1 WNW Perim Spc (B.WNW5)	1.	1.	0.000		0.F	0.F	-5.680	MAR 27 3 AM	23.F	20.F
EL1 East Perim Spc (B.E6)	1.	1.	0.000		0.F	0.F	-3.272	MAR 27 3 AM	23.F	20.F
EL1 ENE Perim Spc (B.ENE7)	1.	1.	0.000		0.F	0.F	-5.610	MAR 27 3 AM	23.F	20.F
EL1 Core Spc (B.C8)	1.	1.	0.006	SEP 30 5 PM	67.F	55.F	-0.001	MAR 27 3 AM	23.F	20.F
EL1 WSW Perim Spc (G.WSW9)	1.	1.	24.548	JUL 7 7 PM	91.F	72.F	-18.872	JAN 27 8 AM	-3.F	-4.F
EL1 East Perim Spc (G.E10)	1.	1.	2.650	JUL 4 6 PM	80.F	71.F	-1.252	JAN 28 3 AM	2.F	1.F
EL1 ESE Perim Spc (G.ESE11)	1.	1.	17.993	JUL 7 11 AM	85.F	71.F	-12.824	JAN 27 8 AM	-3.F	-4.F
EL1 West Perim Spc (G.W12)	1.	1.	24.147	JUL 7 7 PM	91.F	72.F	-9.746	JAN 27 8 AM	-3.F	-4.F
EL1 WNW Perim Spc (G.WNW13)	1.	1.	23.562	JUL 7 7 PM	91.F	72.F	-15.537	JAN 27 8 AM	-3.F	-4.F
EL1 East Perim Spc (G.E14)	1.	1.	15.314	JUL 7 11 AM	85.F	71.F	-6.091	FEB 6 7 AM	-1.F	-2.F
EL1 ENE Perim Spc (G.ENE15)	1.	1.	20.190	JUL 7 11 AM	85.F	71.F	-13.754	JAN 27 8 AM	-3.F	-4.F
EL1 Core Spc (G.C16)	1.	1.	0.025	JUL 4 6 PM	80.F	71.F	0.000		0.F	0.F
EL1 WSW Perim Spc (M.WSW17)	1.	3.	23.784	JUL 7 7 PM	91.F	72.F	-15.954	JAN 27 8 AM	-3.F	-4.F
EL1 East Perim Spc (M.E18)	1.	3.	2.719	JUL 4 7 PM	79.F	71.F	-1.672	JAN 28 3 AM	2.F	1.F
EL1 ESE Perim Spc (M.ESE19)	1.	3.	18.193	JUL 7 11 AM	85.F	71.F	-13.239	JAN 27 8 AM	-3.F	-4.F
EL1 West Perim Spc (M.W20)	1.	3.	22.299	JUL 7 7 PM	91.F	72.F	-12.584	JAN 27 8 AM	-3.F	-4.F
EL1 WNW Perim Spc (M.WNW21)	1.	3.	23.394	JUL 7 7 PM	91.F	72.F	-16.151	JAN 27 8 AM	-3.F	-4.F
EL1 East Perim Spc (M.E22)	1.	3.	13.813	JUL 7 11 AM	85.F	71.F	-8.372	JAN 28 3 AM	2.F	1.F
EL1 ENE Perim Spc (M.ENE23)	1.	3.	20.400	JUL 7 11 AM	85.F	71.F	-15.091	JAN 28 3 AM	2.F	1.F
EL1 Core Spc (M.C24)	1.	3.	0.025	JUL 4 6 PM	80.F	71.F	0.000		0.F	0.F
EL1 WSW Perim Spc (T.WSW25)	1.	1.	26.777	JUL 7 7 PM	91.F	72.F	-16.657	JAN 27 8 AM	-3.F	-4.F
EL1 East Perim Spc (T.E26)	1.	1.	2.772	JUL 4 6 PM	80.F	71.F	-1.733	JAN 28 3 AM	2.F	1.F
EL1 ESE Perim Spc (T.ESE27)	1.	1.	21.021	JUL 7 11 AM	85.F	71.F	-13.202	JAN 27 8 AM	-3.F	-4.F
EL1 West Perim Spc (T.W28)	1.	1.	26.003	JUL 7 7 PM	91.F	72.F	-12.536	JAN 27 8 AM	-3.F	-4.F
EL1 WNW Perim Spc (T.WNW29)	1.	1.	27.043	JUL 7 7 PM	91.F	72.F	-16.190	JAN 27 8 AM	-3.F	-4.F
EL1 East Perim Spc (T.E30)	1.	1.	16.084	JUL 7 11 AM	85.F	71.F	-8.306	FEB 6 7 AM	-1.F	-2.F
EL1 ENE Perim Spc (T.ENE31)	1.	1.	23.669	JUL 7 11 AM	85.F	71.F	-14.973	JAN 27 8 AM	-3.F	-4.F
EL1 Core Spc (T.C32)	1.	1.	0.030	JUL 8 5 PM	93.F	76.F	0.000		0.F	0.F
EL1 WSW Perim Attc (T.WSW33)	1.	1.	22.057	JUL 7 4 PM	91.F	72.F	-22.007	JAN 8 8 AM	-1.F	-1.F
EL1 East Perim Attc (T.E34)	1.	1.	24.918	JUL 7 4 PM	91.F	72.F	-21.750	JAN 8 8 AM	-1.F	-1.F
EL1 ESE Perim Attc (T.ESE35)	1.	1.	20.746	JUL 7 4 PM	91.F	72.F	-19.739	JAN 8 8 AM	-1.F	-1.F
EL1 West Perim Attc (T.W36)	1.	1.	21.667	JUL 7 4 PM	91.F	72.F	-20.764	JAN 8 8 AM	-1.F	-1.F
EL1 WNW Perim Attc (T.WNW37)	1.	1.	21.753	JUL 7 4 PM	91.F	72.F	-21.932	JAN 8 8 AM	-1.F	-1.F
EL1 East Perim Attc (T.E38)	1.	1.	18.319	JUL 7 4 PM	91.F	72.F	-16.735	JAN 8 8 AM	-1.F	-1.F
EL1 ENE Perim Attc (T.ENE39)	1.	1.	23.876	JUL 7 4 PM	91.F	72.F	-22.784	JAN 8 8 AM	-1.F	-1.F
EL1 Core Attc (T.C40)	1.	1.	0.232	JUN 7 3 PM	76.F	63.F	-0.192	JAN 8 8 AM	-1.F	-1.F
			---------				---------			
SUM			799.499				-587.862			
BUILDING PEAK			532.821	JUL 7 7 PM	91.F	72.F	-407.872	JAN 27 8 AM	-3.F	-4.F

DTE Energy Multifamily Program
HVAC & Water Heat Specifications

HVAC (ELECTRIC) SPECIFICATIONS

Programmable Thermostat Setback/Setup (Air Conditioning)

Incentives are available for replacement programmable thermostats that meet ENERGY STAR® criteria and replace any non-programmable thermostat to automatically adjust the temperature at pre-selected times. To meet ENERGY STAR® standards, thermostats must be capable of maintaining two separate programs (to address the different comfort needs of weekdays and weekends) and up to four temperature settings for each program. A current list of ENERGY STAR® qualified thermostats may be found at http://downloads.energystar.gov/bi/qplist/prog_thermostat_prod_list.pdf. Incentive is per thermostat.

GAS SPECIFICATIONS

All final applications must include manufacturers' equipment specification sheets

General Clause for Heating Measures

Prescriptive incentives are available only for retrofit projects using natural gas as the primary fuel source. If a dual-fuel system is used, or if natural gas is the back-up or redundant fuel, the custom incentive application must be used. The incentives for boilers are only available for equipment used in space heating conditions, except for steam traps. Equipment for process load may be eligible for custom incentives.

Steam Trap Repair/Replacement

Incentives are available for the repair or replacement of steam traps that have failed open and that are leaking steam. Incentive is not available for traps that have failed closed or that are plugged. Replacement with an orifice trap is not eligible. Incentive is available once per 24 month period, per facility. Steam trap repair work must be recorded and the service report must be attached to the incentive application. Incentive is per repaired or replaced trap. The report must contain:

- Name of Survey/Repair Technician
- Survey/Repair Date
- System nominal steam pressure
- Annual hours of operation
- Number of steam traps serviced
- Per steam trap:
    - ID tag number, location and type of trap
    - If repair or replaced:
        - Orifice Size
        - Pre-and Post Conditions (e.g., Functioning/Not Functioning, Leaking/Not Leaking)

Pipe Wrap - Steam Boiler

Incentives are available for insulation applied to bare steam boiler piping. Insulation must have an applied thickness of 1 inch and an thermal resistance of R-4. A minimum of 10 linear feet of pipe must be insulated. The bare pipe size must be ½ inch or larger. Incentive is per linear foot of insulation.

Pipe Wrap - Hot Water Boiler

Incentives are available for insulation applied to bare hot water boiler piping. Insulation must have an applied thickness of 1 inch and an thermal resistance of R-4. A minimum of 10 linear feet of pipe must be insulated. The bare pipe size must be ½ inch or larger. Incentive is per linear foot of insulation.

Programmable Thermostat Setback/Setup (Gas Heat)

Incentives are available for new programmable thermostats that meet ENERGY STAR® criteria and replace any non-programmable thermostat to automatically adjust the temperature at pre-selected times. To meet ENERGY STAR® criteria, thermostats must be capable of maintaining two separate programs (to address the different comfort needs of weekdays and weekends) and up to four temperature settings for each program. A current list of ENERGY STAR® qualified thermostats may be found at http://downloads.energystar.gov/bi/qplist/prog_thermostat_prod_list.pdf. Incentive is per thermostat.

GAS SPECIFICATIONS

All final applications must include manufacturers' equipment specification sheets

Boiler Tune-up (Space Heating Boilers Only)

Incentives are available for tune-ups to natural gas fired, space heating boilers. Burners must be adjusted to improve combustion efficiency as needed. The incentive is available once in a 24 month period. Boiler size must be 110 MBH or greater. The service provider must perform before and after combustion analyses and attach the tune-up report to the Final Application. Incentive is per boiler. Tune-up report must contain the following information:

- Name of the technician performing tune-up
- Date of tune-up
- Boiler type (hot water, low pressure steam, high pressure steam)
- Boiler nameplate information (make, model, capacity)
- Annual hours of operation
- Pre-and Post combustion analysis results (an electronic flue gas analyzer must be used) including
    - o Combustion efficiency
    - o Stack temperature
    - o Flue gas levels of O2, CO2 and CO
- Statement that the following were performed:
    - o Check and adjust combustion air flow and air intake as needed
    - o Check burner and gas input
    - o Check draft control dampers
    - o Clean burners, nozzles, combustion chamber and heat exchanger surface (when weather or operating schedule permits
    - o Check combustion chamber seals
    - o Check for proper venting
    - o Complete visual inspection of system piping and installation
    - o Check safety controls

Boiler Water Reset Control

Incentives are available for boiler water reset controls added to existing boilers operating with a constant supply temperature. Incentives are for existing space heating boilers only. A replacement boiler with boiler reset controls is not eligible. The system must be set so that the minimum temperature is not more than 10°F above manufacturer's recommended minimum return temperature. For controls on multiple boilers to be eligible, control strategy must stage the lag boiler(s) only after the lead boiler fails to maintain the desired boiler water temperature. Incentive is per boiler.

YOUR ENERGY SAVINGS

YourEnergySavings.com
DTE Energy

DTE Energy
Multifamily Program

DTE Multifamily Program Application

Required Site Information

SITE NAME		FEDERAL TAX ID
SITE ADDRESS		
CITY	STATE	ZIP CODE
SITE REPRESENTATIVE NAME	SITE REPRESENTATIVE PHONE #	
SITE REPRESENTATIVE EMAIL ADDRESS	SITE REPRESENTATIVE FAX #	
SECONDARY REPRESENTATIVE NAME	SECONDARY REPRESENTATIVE PHONE #	

Required Management Company/Owner Information

MANAGEMENT COMPANY NAME		FEDERAL TAX ID
MAILING ADDRESS		
CITY	STATE	ZIP CODE
MANAGEMENT COMPANY REPRESENTATIVE NAME	MANAGEMENT REPRESENTATIVE PHONE #	
MANAGEMENT COMPANY EMAIL ADDRESS	MANAGEMENT COMPANY FAX #	
SECONDARY REPRESENTATIVE NAME	SECONDARY REPRESENTATIVE PHONE #	

Required Site Information

ELECTRICITY PROVIDER	ELECTRIC ACCOUNT NUMBER	GAS PROVIDER	GAS ACCOUNT NUMBER
YEAR BUILT	TOTAL # OF UNITS	TOTAL # OF BUILDINGS	TOTAL # OF VACANT UNITS

TOTAL NUMBER OF FLOORS	DOES BUILDING HAVE BASEMENTS?	MAX # OF BATHROOMS PER UNIT
MAX # OF SHOWERS PER UNIT	MAX # OF SINKS PER BATHROOM	AVERAGE SQUARE FOOTAGE OF UNITS

Optional Site Information

TOTAL # OF SHOWERS ON PROPERTY	TOTAL # OF SINKS ON PROPERTY	ARE WATER HEATERS IN UNITS?

4.0 Part 3: Utility Consumption Baseline

AKTPEERLESS

4.1 Acknowledgements of Part 3: Utility Consumption Baseline

The Consumption Narrative Report and Utility Consumption – Summary and Utility Consumption – Monthly worksheets in the RPCA Model were completed by Linnea Fraser and Henry McElvery of AKT Peerless. AKT Peerless certifies that the report preparers meet the qualifications identified in the RAD Physical Condition Assessment Statement of Work and Contractor Qualifications Part 3.2 (Version 2, December 2013).

Linnea Fraser

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Building Analyst Professional No. 5023902
Building Performance Institute

Date: February 21, 2014

Part 3 Consumption Narrative Report and Excel RPCA Model were Received and Reviewed by Owner:

____

Lori Harris
Norstar Development USA, LP
733 Broadway
Albany, NY 12207
Phone: 518-431-1051
Fax: 518-431-1053

Date: ________________________

AKTPEERLESS

Rental Assistance Demonstration (RAD):
UTILITY CONSUMPTION BASELINE

106 Packard Avenue, Ann Arbor, Michigan 48104

BAKER COMMONS

PREPARED FOR Norstar Development USA, LP
733 Broadway
Albany, NY 12207

ON BEHALF OF The Ann Arbor
Housing Commission
727 Miller Ave
Ann Arbor, MI 48103

PROJECT # 8212E-3-90

PIC # MI064

DATE February 17, 2014

Table of Contents

AKTPEERLESS

1.0 EXECUTIVE SUMMARY

1.1 Purpose and Scope of Work

The purpose of the Part 3: Utility Consumption Baseline is to establish a twelve-month consumption baseline for normalized heating, cooling, lighting, and other electric, gas and water usage (not cost) for the subject property as defined in the Rental Assistance Demonstration (RAD): Physical Condition Assessment (RPCA) statement of Work and Contractor Qualifications released by the Department of Housing and Urban Development (HUD) in October 2012 (Version 1).

This report contains data on all utility usage at the subject property, both tenant-paid and owner-paid (if applicable), and including all common areas for a full 12-month period. It establishes a baseline to allow for benchmarking, and for future measurement of consumption and costs. As such, the utility baseline creates a whole building consumption profile, addressing missing utility data, vacancies, and weather patterns, in achieving its aim of establishing that standard on which future consumption can be compared.

1.2 Subject Site Description

1.2.1 General Site Description

The subject property is a multi-family building with sixty-four (64) tenant units. The subject building was constructed in 1980 and contains five (5) stories with a basement. The site contains sixty-four (64) one bedroom/one bathroom units. The subject complex is generally referred to as Baker Commons.

1.2.2 Site Utilities and Usage

Each unit at the subject property has a separate electric meter. There is one electric and one gas meter for the common area at the site. Therefore, there are a total of sixty-five (65) electric meters, one (1) natural gas meter, and one (1) water meter at the site.

1.3 Baseline Site Energy Consumption

The Actual Site Energy Use, Energy Use Intensity (EUI), Weather Normalized Site Energy Use and Weather Normalized EUI displayed below are consistent with the ASHRAE Procedures for Commercial Building Energy Audits. This methodology establishes the property's baseline use and cost conditions that are representative of the building's energy performance.

This statistical analysis removes the bias of independent variables such as historic weather, occupancy and operating hours. These calculations have been normalized to the mean values of the independent variables impacting the building's energy performance and represent the most probable performance under actual conditions accounting for weather, occupancy and operating hour variability.

As the subject site has been 100% occupied for the duration of the analysis period, no pro-forma adjustment factors to the consumption have been made.

1.3.1 Actual Site Energy Use and EUI

Actual Site Energy Use	Actual Site Energy Use Intensity (EUI)
4,304,432 kBtu/yr	93.03 kBtu/ ft^2/yr

1.3.2 Weather Normalized Site Energy Use and EUI

Weather Normalized Site Energy Use	Weather Normalized Site Energy Use Intensity (EUI)
4,655,705 kBtu/yr	100.62 kBtu/ft^2/yr

2.0 INTRODUCTION

2.1 Purpose

The purpose of the Part 3: Utility Consumption Baseline is to establish a twelve-month consumption baseline for normalized heating, cooling, lighting, and other electric, gas and water usage (not cost) for the subject property as defined in the Rental Assistance Demonstration (RAD): Physical Condition Assessment (RPCA) statement of Work and Contractor Qualifications released by the Department of Housing and Urban Development (HUD) in October 2012 (Version 1).

This report contains data on all utility usage at the subject property, both tenant-paid and owner-paid (if applicable), and including all common areas for a full 12-month period. It establishes a baseline to allow for benchmarking, and for future measurement of consumption and costs. As such, the utility baseline creates a whole building consumption profile, addressing missing utility data, vacancies, and weather patterns, in achieving its aim of establishing that standard on which future consumption can be compared.

2.2 Scope of Work

AKT Peerless' scope-of-services is based on its proposal PE-14248, dated January 9, 2013 and revised March 15, 2013 and authorized by Norstar Development USA, LP (the Client), and the terms and conditions of that agreement.

The purpose of the Part 3: Utility Consumption Baseline is to establish a twelve-month consumption baseline for normalized heating, cooling, lighting, and other electric, gas and water usage (not cost) for the subject property as defined in the Rental Assistance Demonstration (RAD): Physical Condition Assessment (RPCA) statement of Work and Contractor Qualifications released by the Department of Housing and Urban Development (HUD) in October 2012 (Version 1).

This report contains data on all utility usage at the subject property, both tenant-paid and owner-paid (if applicable), and including all common areas for a full 12-month period. It establishes a baseline to allow for benchmarking, and for future measurement of consumption and costs. As such, the utility baseline creates a whole building consumption profile, addressing missing utility data, vacancies, and weather patterns, in achieving its aim of establishing that standard on which future consumption can be compared.

3.0 SUBJECT SITE DESCRIPTION

3.1 General Site Description

The subject property is a multi-family building with sixty-four (64) tenant units. The subject building was constructed in 1980 and contains five (5) stories with a basement. The site contains sixty-four (64) one bedroom/one bathroom units. The subject complex is generally referred to as Baker Commons.

3.2 Current/Planned Use of the Property

The subject property has been used as a multi-family structure and operated by the AAHC since its initial construction in 1980. AAHC is participating in HUD's Rental Assistance Demonstration pilot program and intends to continue operating the building as a multi-family residential facility.

4.0 ENERGY CONSUMPTION ANALYSIS

This section provides information on energy utilities associated with the subject property.

4.1 Electricity

The following figure (Figure 4.1) identifies monthly electrical consumption (kWh) in comparison to cooling degree days (CDD). Cooling Degree Days (CDD) are roughly proportional to the energy used for cooling a building, while Heating Degree Days, (HDD) are roughly proportional to the energy used for heating a building. In general, daily degree days are the difference between a base point temperature (65 degrees) and the average outside temperature.

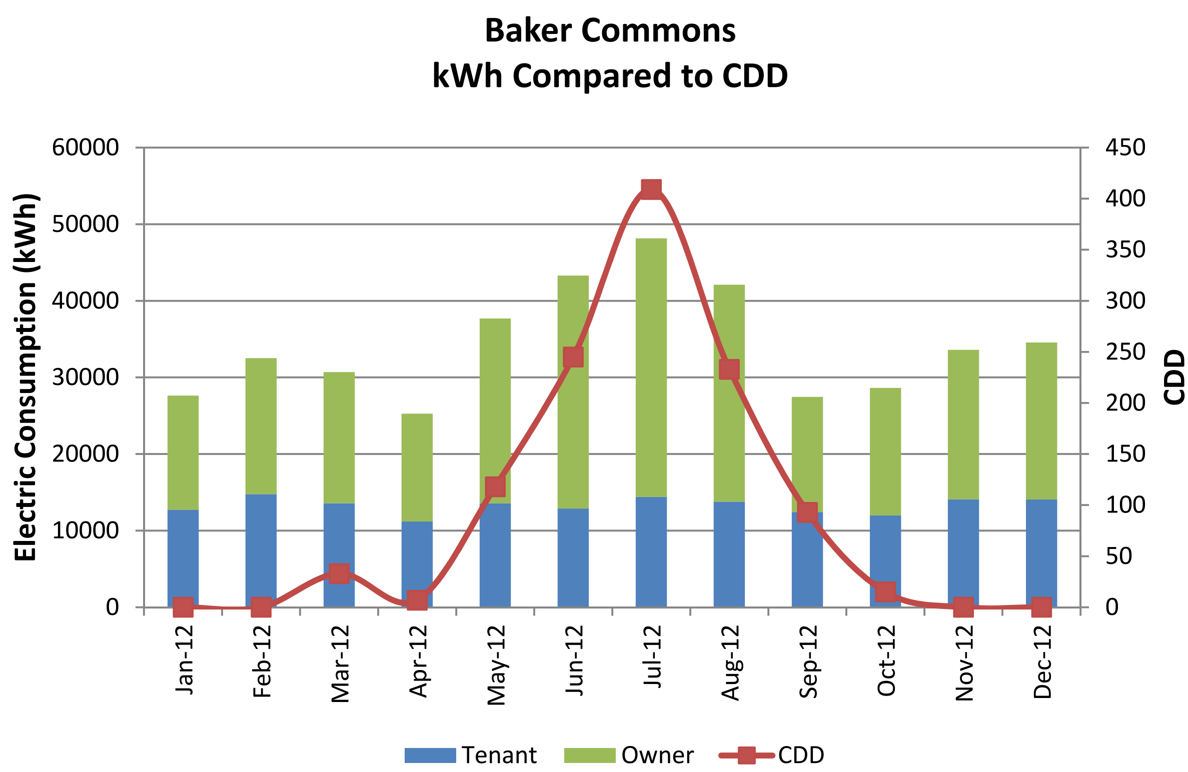

Figure 4.1 Electricity Consumption Graph

The following table (Table 4.1) identifies key information regarding the electric utility associated with the property.

Table 4.1 Annual Electricity Metrics

Vendor	DTE Energy
Meters on Site	Residential - Sixty-four (64) Non-Residential (Common) - One (1)
Use for Residential	Tenant lighting, electric appliances, plug loads
Use for Non-Residential	Exterior lighting, common area lighting, electric appliances, plug loads, electric air conditioning and heating units, and laundry units.
Responsible for Payment	Residential - Tenant Non-Residential - Owner
Rate	Residential - \$0.174 / kWh Non-Residential - \$0.127 / kWh
Site Consumption	411,612 kWh / year (1,404,832 kBtu / year)

Energy Use Intensity (EUI)	8.90 kWh / ft^2 (30.36 kBtu / ft^2)
Weather Normalized Site Consumption	394,051 kWh / year (1,344,897 kBtu / year)
Weather Normalized EUI	8.52 kWh / ft^2 (29.07 kBtu / ft^2)

AKT Peerless received tenant electric bill information in an electronic spreadsheet from the owner (AAHC) for the subject property. This spreadsheet included the following information for each individual unit at the subject property: meter read date, invoice amount ($), usage days per billing period, and net usage (kWh). For the subject property, Baker Commons, monthly electrical data was included from September 2011 to February 2013. The most current twelve (12) months of electrical data that corresponded with the provided natural gas data (January 2012 through December 2012) were used for this analysis and input into the RPCA model.

The actual electric consumption was adjusted to produce a weather-normalized summary of electric consumption. This process involved the following steps:

- CDD for the base year billing periods were calculated. Source for CDD is www.degreedays.net (using temperature data from www.wunderground.com) at weather station ANN ARBOR MUNICIPAL AIRPORT, MI, US (83.74W,42.22N), Station ID: KARB.
- Base year billing consumption (kWh) and CDD were normalized by number of days in each billing period.
- Relationship between usage (kWh/day) and weather (CDD/day) was established by using spreadsheet software (Excel) to determine the "best fit" linear regression trend line and R^2 value. The R^2 value is a statistical indicator that represents goodness of fit of the tread line, with $R^2 > 0.75$ considered an acceptable fit.
- Weather Normalized Site Consumption was calculated using the linear regression equation and the 10 year average CDD per month.

4.2 Natural Gas

The following figure (Figure 4.2) identifies monthly natural gas consumption (therms) in comparison to heating degree days (HDD). HDD are roughly proportional to the energy used for heating a building. In general, daily degree days are the difference between a base point temperature (65 degrees) and the average outside temperature.

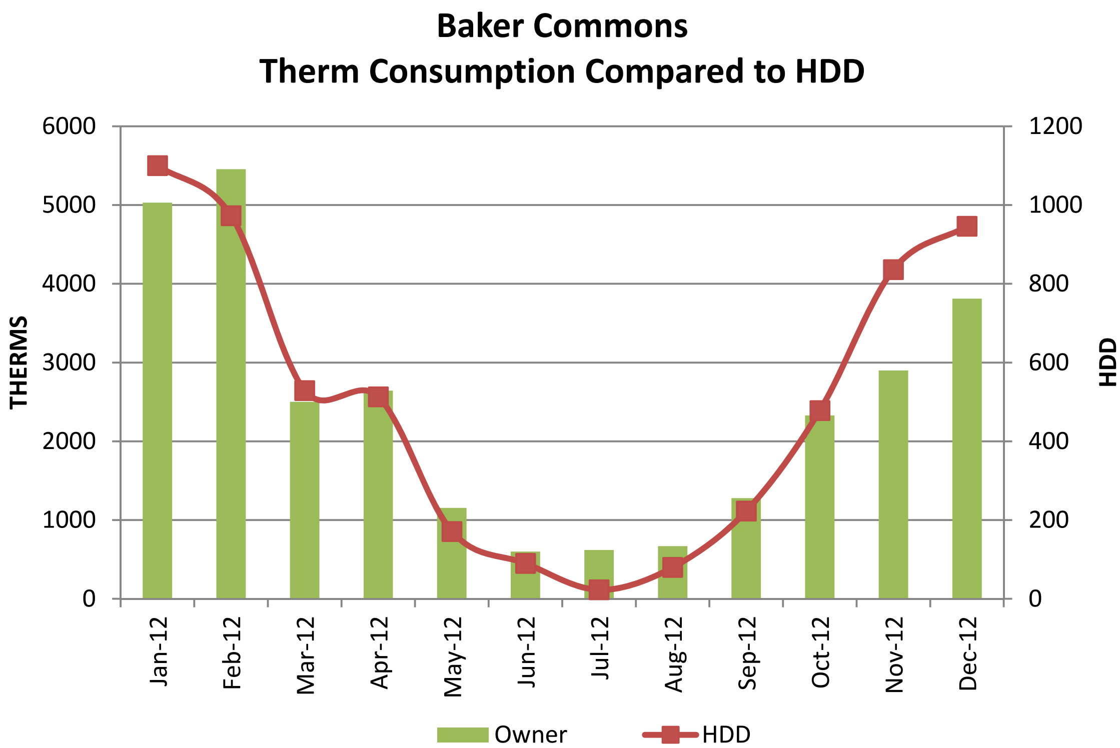

Figure 4.2 Natural Gas Consumption Graph

The following table (Table 4.2) identifies key information regarding the natural gas utility associated with the property.

Table 4.2 Annual Natural Gas Metrics

Vendor	DTE Energy
Meters on Site	Residential and Non-Residential (Common) - One (1)
Use for Residential and Non-Residential	Gas-fired boilers for common area and tenant space heating, dryers for laundry.
Responsible for Payment	Residential and Non-Residential - Owner
Rate	Residential and Non-Residential - $0.778 / therm
Site Consumption	28,996 therms / year (2,899,600 kBtu / year)
Energy Use Intensity (EUI)	62.67 kBtu / ft^2
Weather Normalized Site Consumption	33,108 therms / year (3,310,808 kBtu / year)

Weather Normalized EUI	71.55 kBtu / ft^2

AKT Peerless received tenant natural gas bill information in an electronic spreadsheet from the owner (AAHC) for the subject property. This spreadsheet included the following information for each individual unit at the subject property: meter read date, invoice amount ($), usage days per billing period, and net usage (therms). For the subject property, Baker Commons, monthly natural gas data was included from September 2011 to December 2012. The most current twelve (12) months of natural gas data provided (January 2012 through December 2012) were used for this analysis and input into the RPCA model.

The actual natural gas consumption was adjusted to produce a weather-normalized summary of natural gas consumption. This process involved the following steps:

- HDD for the base year billing periods were calculated. Source for HDD is www.degreedays.net (using temperature data from www.wunderground.com) at weather station ANN ARBOR MUNICIPAL AIRPORT, MI, US (83.74W,42.22N), Station ID: KARB.
- Base year billing consumption (therms) and HDD were normalized by number of days in each billing period.
- Relationship between usage (therms/day) and weather (HDD/day) was established by using spreadsheet software (Excel) to determine the “best fit” linear regression trend line and R^2 value. The R^2 value is a statistical indicator that represents goodness of fit of the tread line, with $R^2 > 0.75$ considered an acceptable fit.
- Weather Normalized Site Consumption was calculated using the linear regression equation and the 10 year average HDD per month.

5.0 LIMITATIONS

5.1 Assumptions

The Ann Arbor Housing Commission (AAHC), the property owner, released utility information to AKT Peerless delivered directly from the utility provider(s), DTE Energy. It is assumed that this monthly usage and cost data is accurate and contains no data gaps or errors.

Information on how the utilities are utilized was generated from conversations with AAHC staff and results of the RPCA through the Energy Audit.

5.2 Limitations and Exceptions

AKT Peerless accepts responsibility for the competent performance of its duties in executing this assignment and preparing this report in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages. Although AKT Peerless believes the results contained herein are reliable, AKT Peerless cannot warrant or guarantee that the information provided is exhaustive, or that the information provided by the client, owner, third parties, or the secondary information sources cited in this report is complete or accurate.

AKT Peerless has not verified that the property owner/operator has reported all sources and records of energy consumed at the subject property. Potentially unreported information may include, but is not limited to, bills, meters, and types of energy consumed. Inaccurate information provided to AKT Peerless and information not reported to AKT Peerless may influence the findings of report.

AKT Peerless has not verified the accuracy of building floor area as reported by the owner.

Should additional information become available to the Client or Owner that differs significantly from our understanding of conditions presented in this report, AKT Peerless requests that such information be forwarded immediately to our attention so that we may reassess the conclusions provided herein and amend this project's scope of services as necessary and appropriate.

Nothing in this report constitutes a legal opinion or legal advice. For information regarding individual or organizational liability, AKT Peerless recommends consultation with independent legal counsel.

6.0 SIGNATURES

Report submitted by:

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