

# **Building Audit Report**



PREPARED FOR Large Office Building CEO Johnny Appleseed

> ASSESSMENT SITE 1234 Sample Way Chicago, IL 60601

ASSESSMENT PERFORMED BY OptiMiser LLC.

> ASSESSMENT DATE 8/8/2015

> > REPORT DATE 12/4/2015



#### **Disclaimer**

This energy audit report intents to identify energy savings opportunities associated with recommended upgrades to the equipment and systems of the facility at this site. Approximate saving ranges are included in this report to make decisions about reducing energy use at the facility. However, this report is not intended to serve as a detailed engineering design document. It should be noted that detailed design efforts are required in order to implement some or all of the evaluated improvements.

As a result, OptiMiser is not liable if estimated savings ranges or economics are not actually achieved. All savings and cost estimates in the report are for informational purposes, and are not to be construed as a design document or as guarantees. In no event will OptiMiser be liable for the failure of the customer to achieve a specified amount of energy savings, the operation of customer's facilities, or any incidental or consequential damages of any kind in connection with this report or the installation of the recommended measures.





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#### Section 1 Executive Summary

The goal of this audit is to identify and prioritize potential energy and demand savings opportunities at Large Office Building in Chicago, IL. The following measures were identified:

Step	System	Measure	Electric Energy Savings (kWh)	Peak Electric Demand Savings (kW)	Heating Energy Savings (Therm)	Incentive (\$)	Net Cost (\$)
1	AHU	Install VFD on Supply Fan	54,072	-0.3	1,147	\$10,000	\$35,086
2	AHU	High Efficiency Cooling Unit	215,469	230.0	-	-	\$2,074,557
3	Lighting	Improve Light Fixtures	31,037	12.2	-11	-	\$28,225

These measures, if implemented, could result in annual energy savings of 299,634 kWh and 1,147 therms, with 242 kW of peak demand savings. These are equivalent to annual energy cost savings of \$31,174 and will pay for themselves in about 69 years. The energy savings from recommended measures are approximately 16% of the electric consumption and 1% of the gas consumption for the facility's most recent 12 months of usage, based on billing data for this facility.

These measures will reduce the energy use intensity of the building from 146 kBtu/sf to 49 kBtu/sf, as shown in the Figure 1-1 below:





The remainder of this report is organized as follows:

- Section 2 documents existing systems and conditions for the site
- Section 3 shows and discusses the site's energy use and costs
- Section 4 provides brief descriptions of each energy measure
- Section 5 lists energy measures that are analyzed but not included in the report





# Section 2 Audit and Facility Information

# 2.1 Introduction



Large Office Building



#### 2.2 General Site Information

Large Office Building was built in 2004. Large Office Building has 1 building whose functions, areas, occupancy periods and other information are listed in the table below.

Table 2-1: Building Information Summary									
Building Main Function(s) Quantity Area (sf.) No. of Floors Weekly Occupancy Saturday Occup						Saturday Occupancy	Sunday Occupancy		
LargeOffice	Office	1	100,000	12	1	8:00 AM to 5:00 PM	9:00 AM to 12:00 PM		

#### 2.3 Energy-Using Systems

Table 2-2 and Table 2-3 (on the following page) present lists of equipment installed in Large Office Building .

Lighting

Table 2-2: Major Lighting Equipment Summary

Equipment	Quantity	Watt	<b>Operation Schedule</b>	Occupancy Sensor	Location
32	500	153.1	48 Hrs/Wk	No	LargeOffice





#### HVAC

Table 2-3:	Major	HVAC	Equipment	t Summary
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Equipment	Qty	Capacity (each)	Service Area
VAV_MID	1	Cool: 1.15 MBH - Heat: 0.291 MBH	LargeOffice
VAV_BOT	1	Cool: 1.15 MBH - Heat: 0.241 MBH	LargeOffice
VAV_TOP	1	Cool: 1.15 MBH - Heat: 0.239 MBH	LargeOffice
CV_BASE	1	Cool: 1.15 MBH - Heat: 0.276 MBH	LargeOffice
Clr1	1	1000 tons	LargeOffice
Loop Pump: 109.200109200109	0.74	Flow: 0.9 gpm	
Chiller Pump	1	Flow: 0.74 gpm	
Condensing Water Pump	1	Flow: 65 gpm	
Blr1	1	9000 MBH	LargeOffice
Loop Pump: 109.200109200109	0.9	Flow: 0.74 gpm	
Boiler Pump	1	Flow: 0.74 gpm	





### Section 3 Site Energy Use and Costs

### 3.1 Electricity and Fuel Consumption and Costs

Sample Fuel Company provides the fuel and Sample Electric Company supplies electricity to this building. The consumptions are shown in Figure 3-1 and 3-2.



#### **Monthly Electricity Consumption**







#### **Monthly Fuel Consumption**

Figure 3-3 shows the monthly utility costs of Large Office Building. The electric and gas cost used to estimate the annual cost savings of this audit are \$0.1/kWh and \$0.68/therm.



Electricity

Fuel

Figure 3-3: Total Monthly Energy Costs





# 3.2 Energy Breakdown

Figure 3-4 shows a breakdown of different energy end users at Large Office Building .



Figure 3-4: Breakdown of Energy Usage





### 3.3 Benchmarking

Energy use intensity (EUI) is a measure of how much energy a building consumes, normalized by the square footage of the building. This parameter is used to gauge a building's performance relative to similar buildings in the same climate zone.

Based on 12-month period electric and gas billing data and by using Energy Star Portfolio Manager as a benchmarking tool, the calculated site EUI is 90 kBtu/ft2 and source EUI is 153 kBtu/ft2, which is greater than a median property of Portfolio Manager EUI. The Portfolio Manager median Property site EUI is 82 kBtu/ft2 and source EUI is 141 kBtu/ft2. The benchmarking results summary is shown in Table 3-1.

Table 3-1: Portfolio Manager Benchmarking Results Summary							
Metric	Median Property	Property in Use					
Source EUI (kBtu/ft2)	141	153					
Site EUI (kBtu/ft2)	82	90					
Source Energy Use (kBtu)	2,120,458	2,304,889					
Site Energy Use (kBtu)	1,241,725	1,349,726					
Total GHG Emission (Metric Tons)	144	157					
Energy Star Score		45					

The benchmarking results show Large Office Building's energy consumption is higher than the median property in Portfolio Manager, so there is still room for improvement to lower energy consumption at this property. This property currently has an Energy Star Score of 45.





# Section 4 Recommended Energy Efficiency Opportunities

The following sections briefly describe recommended measures, categorized by measure cost and type.

AHU	nstall VFD on Supply Fan					
Est. Install Cost	\$45,086	Existing supply fans are constant speed. VFD fan control is recommended to save supply fan				
Total Annual Savings	\$6,269	energy at partial load conditions. A duct static pressure signal is used to control the VFD and				
Simple Payback Period	7.2 Yrs	the supply fan speed. Zone level terminal boxes may need to be retrofitted to variable air				
CO2 Equivalent Reduction	43 t	volume type in order to achieve maximum supply fan savings.				
Annual kWh Savings	54,072 kWh					
Annual therm Savings	1,147 therms					

AHU	High Efficiency	ligh Efficiency Cooling Unit						
Est. Install Cost. Total Annual Savings Simple Payback Period CO2 Equivalent Reduction Annual kWh Savings Annual therm Savings	\$2,074,557 .\$21,853 >50 Yrs 149 t 215,469 kWh - therms	The package units serving the facility have relatively low cooling efficiency, resulting in high cooling energy consumption. More efficient packaged units can be installed to replace the existing equipment so less cooling energy is used to maintain the same cooling output.						

Improve Light Fixtures					
\$28,225	Interior lighting of the facility consists of old linear fluorescent fixtures. Replacing these				
\$3,052	fixtures with more efficient linear fluorescent lamps/fixtures or LEDs can reduce interior				
9.2 Yrs	lighting energy use while by using less electric lighting power to maintain the same lighting				
21 t	level. Indirect benefits include reduced HVAC energy consumption due to reduced building				
30,093 kWh	cooling load from lower internal loads.				
- therms					
	Improve Light 1 \$28,225 \$3,052 9.2 Yrs 21 t 30,093 kWh - therms				





### Section 5 Potential Energy Efficiency Opportunities

The following section lists energy efficiency measures that were considered and analyzed, but not included in this report. These opportunities were not included for a variety of reasons including lack of data, design analysis time constraints or preliminary unfavorable economics.

System	Measure	Electric Energy Savings (kWh)	Peak Electric Demand Savings (kW)	Heating Energy Savings (Therm)	Savings (\$)	Incentive (\$)	Net Cost (\$)
AHU	Duct Static Pressure Reset	55,523	0.0	-12	\$5,623	\$200	\$600
AHU	Supply Air Temp Control and Reset	-85,801	0.0	16,266	\$2,429	\$450	\$550
AHU	Demand Control Ventilation	4,180	23.8	44	\$454	\$2,000	\$6,400
AHU	Improve AHU Scheduling	37,203	0.0	23,615	\$19,933	\$400	\$800
Infiltration	Improve Building Infiltration	-973	0.0	768	\$427	\$550	\$13,450
Walls	Improve Wall Characteristics	-304	0.0	241	\$134	-	-
Roof	Improve Roof Characteristics	-20	0.0	16	\$9	\$500	\$9,500
Appliances	Improve Appliances	7,402	0.8	0	\$751	\$2,000	\$37,580
Computers	Computer Power Management	9,541	0.0	0	\$968	-	-

