Building EQ Energy Audit Narrative Report

Instructions: *This report provides a template for a Level 1 Energy Audit that follows the information in Section 6 (Reporting), Annex C (Reporting Forms), and Annex D (Report Outlines) in ASHRAE/ANSI Standard 211 Standard for Commercial Building Energy Audits. The template provides recommended text and boiler plate language to assist the user in preparing a comprehensive report and is automatically populated with information collected and entered into the Building EQ Portal as part of the Building EQ In Operation assessment process. The recommended text can be edited as needed by the user. The audit specific information populated from the Building EQ Portal is shown in filled in tables in the report. Audit specific information required to meet the requirements of Standard 211 that is not collected as part of the Building EQ In Operation assessment is indicated via blue text and empty rows in the tables. This information can be filled in by the user to meet the audit requirements.*

The user should make whatever edits they deem appropriate and then either delete or fill in any missing information based on what they wish to include in their report. The report should then be finalized to provide a more professional looking product by eliminating the instruction boxes and by adding appropriate letterhead or logo.

Executive Summary/Introduction

Instructions: *This section should be written by the user as a general recap of the full report information that follows. The user may also wish to recap major recommendations and savings potential in this section.*

Facility Description/Site Information

Instructions: *The opening paragraph should be edited by the user to highlight any information included in the tabular information that follows.*

The facility information in this report is broken into contact information and characteristics/demographics. That information is detailed below.

Building Contact information

Building Name	ASHRAE HQ
Street	1791 Tullie Circle
City, State, Country, Postal Code	Atlanta, GA, United States of America, 30329

Building Owner	ASHRAE, Inc.
Client Name	
Key Contact	Mike Vaughn

Energy Auditor (name/company)	Commissioning and Green Building Solution, Inc.			
Assessment Date	2013-06-04			
Date(s) of site visit(s)				
Year(s) of Prior Energy Audit(s)				

Building Characteristics and Demographics

Building Description:

The ASHRAE headquarters is slab on grade one and two story steel frame structure. The two story portion of the building, orginal structure prior to renovation, has an exterior brick colums infilled with glass curtain wall system. The one story addition is also slab on grade with an insulated metal panel exterior. Both the first and second story roof systems are insulated with white TPO single membrane roofs. Green intensive plant modules overlayed roof of the main entrance vestibule and roof of the learning center, which constitutes the first floor addition of the Headquarters.

Description of Lighting Systems:

Open office areas on first and second floor are served by direct/indirect 32W T8 fluorescent fixtures. Main control of the lighting in the open offices is by momentary contact switches. Daylighting control along the exterior wall perimeter of the building can be controlled by the building automation system. This function has been disabled due to lack of dimming ballasts and accurate illumination level sensors by which to control the electrical in accordance with natural light. Light level measurements taken during the original commissioning effort indicate that the size of the existing building overhang prevents sufficient quantities of daylight to enter into the open office areas of the 2nd floor during sunny sky conditions. However, measurements on the 1st floor indicate presence of sufficient daylight on sunny days to allow daylight to offset electrical lighting contributions if dimmable ballasts and accurate sensors were installed. ASHRAE has obtained a donation from Lutron of dimmable ballasts and accurate Daylighting sensors but have not budgeted for their installation. Conference and learning center rooms have several lighting types including direct/indirect 32W T8 fluorescent lamps and recessed down lights. Each fixture type in the conference/learning center rooms is separately switched with dimming controls. Lighting controls in the learning center rooms also allow turning off lighting in the area of projector projection as necessary for presentations. All restroom lighting is 26 W recessed fluorescent fixtures controlled by passive dual technology occupancy sensors.

Description of HVAC Systems:

First floor is served by a variable refrigerant volume system utilizing multiple fan coil units to supply conditioned air to these spaces. Second floor is served by a ground loop heat pump system utilizing multiple heat pumps to supply conditioned air to these spaces. Outside air is delivered to the building by a dedicated outdoor air system which preconditions the air by heat and enthalpy exchange between buildings exhaust air and incoming outside air. The DOAS does not heat but does have 5 stages of direct expansion cooling. Outside air is delivered either directly to the fan coil unit/heat pump or directly to the space by a variable air volume terminal units.

Year of original construction	1965
Building Climate Zone	3A

Gross floor area	34,721	Total Number of Floors	2
Net floor area	34,721	Conditioned Floors Above grade	2
Total conditioned area	31,196	Conditioned Floors Below grade	0
Conditioned area (heated only)	0		
Conditioned area (cooled only)	0		

Primary Building use type	Other office

Multi-Use Building space types	Floor Area	Percentage

Space excluded from gross floor area	Floor Area	Percentage

Description of Major Renovations	Year
Renovations include complete remodel of interior spacing.	2008
Complete change out of HVAC and eletrical systems.	2008
Addition of single story learning center area.	2008
Reroofing of buildling also included in renovations	2008

Systems Commissioned	Year
Building Envelope (roof, walls, window systems)	2009
All Mechanical Systems including Controls	2009
All Plumbing Systems	2009
All Electrical Systems (power, lighting)	2009

Energy Efficiency Improvements since Construction	Year
Correction of HVAC operation issues	2009

Typical occupancy (low/average/continuous)	Average
Typical occupancy (hours/week)	60
Typical occupancy (weeks/year)	52
Typical number of occupants (during occupied hours)	100
% of Building owned	100%
% of Building leased (rented)	0%
Number of Dwelling Units in Building (Multifamily Only)	
% of Dwelling Units currently Occupied (Multifamily Only)	

Space Function Breakdown

Space ID	#1	#2	#3	#4
Function/Use				
Original Intended Use				
Gross Floor Area (per space)				
Conditioned Area (%)				
Number Occupants				
Estimated Plug Loads (W/ft^2 or W/m^2)				
Use (hours/week)				
Use (weeks/year)				
Principal HVAC type				
Principal Lighting Type				

Notable Conditions Observed

Instructions: *The opening paragraph should be edited by the user to highlight any information included in the tabular information that follows.*

The following notable conditions have been observed during the facility walk-through. Specific data as noted during the facility walk-through follows in tabular format.

Historical landmark status? (Y/N)	N

Health Concerns and IEQ Deficiencies

Example Text:

- *Biological growth was observed at the piping connections of AHU-08HC.*
- *Ductwork exposed to ambient conditions is of construction and insulation that is improper for this location; the insulation is saturated with moisture. Biological growth was observed at the exterior ductwork penetrations on both sides of the corridor.*
- *Room 105 is being renovated. Some of the ductwork insulation is marked as containing asbestos.*

Opportunities to Improve Maintenance Practices

Example Text:

- *Many of the mechanical deficiencies observed during the walkthrough were immediately reported to maintenance for work order issuance so further actions should be coordinated with maintenance staff. For example, AHU-AS3-3HC has a dirty OA plenum and dirty filters.*
- *Tenant ice-machine condensing units are in very poor condition and are likely contributing to a nearly continuous electrical load. Tenant equipment should be included in a maintenance contract or the tenant should provide proof of a regularly scheduled maintenance contract.*
- *The 15 HP water circulation pump serving the decorative pond sounds like the bearings may be failing. The pump should be serviced.*

Conditions Causing Unusual Operating Costs

Example Text:

- *The level of BAS infrastructure is substantial and could benefit from the addition of a Fault Detection and Diagnostics (FDD) platform to enhance the ability to act on the significant volume of information available in the BAS and electrical switchgear systems.*
- *Electrical and IT room lighting operates 24/7. While occupancy sensors are installed in the majority of these rooms, when tested for operation most (>75%) appear to have been bypassed as they did not modulate lights on/off under manual control.*
- *Most of the AHUs have large electric resistance heating coils installed. These coils are disabled when the OA temperature is >55F but are likely contributing to winter season demand charges.*

Information Recorded during Facility Walk-through

Issues/Resolutions Log – Recurring and/or unresolved issues:

Observed Thermal Comfort Issues:

Thermostat bodies observed to be 2 degrees higher than ambient conditions, occupant noted diffuser blowing directly on them in office. No personal fans our personal electric heaters were observed.

Space by Space Measurements

Location	Space Type	Air T	RH	T FLR	Vert dT
1st floor Member Services Offices (140)	Open Office (cubicles)	75.2	45	0	0
1st Floor West Side	Open Office (cubicles)	75.1	45	0	0
1st Floor South Side	Open Office (cubicles)	76.2	45	0	0
2nd Floor North Side	Open Office (cubicles)	75.4	45	0	0
2nd Floor East Side	Private Office	78	45	0	0
2nd Floor Conference Room	Conference Room	68.3	45	0	0
2nd Floor South Side	Open Office (cubicles)	76.2	45	0	0

Location	Space Type	dBA	FPM Air	CO_2	ABS psi
1st floor Member Services Offices (140)	Open Office (cubicles)	0	0	0	0
1st Floor West Side	Open Office (cubicles)	0	0	0	0
1st Floor South Side	Open Office (cubicles)	0	0	0	0
2nd Floor North Side	Open Office (cubicles)	0	0	0	0
2nd Floor East Side	Private Office	0	0	0	0
2nd Floor Conference Room	Conference Room	0	0	0	0
2nd Floor South Side	Open Office (cubicles)	0	0	0	0

Observed Lighting Issues:

none reported

Occupant Reported Lighting Issues:

Hoteling room lighting is provided by recessed fluorescent fixtures which when initially energized were observed having low lumen output which over a period of approximately ten minutes increased in foot-candle levels. Complaints from occupants identified the hoteling areas as under lite primarily due to the short duration of use combined with time period for fluorescent lamps to reach full output levels. (6 respondants out of 79 surveyed expressed this concern). Other areas occupants identified as having low levels of lighting included several corridors. Lighting measurements in these areas indicated that the lighting levels were adequate for the task of egress/ingress to the various spaces. However, some of these corridors which are formed between the open office cubicles and office counter tops and cabinets were tasks are performed do not have sufficient light to support these tasks. It is recommended that under cabinet lights be added to provide sufficient light associated with the tasks that occur in these

areas. Occupants in the cubicles that are adjacent to the corridors between the cubicles and the interior core wall have lover light levels which some occupants find insufficient. (5 respondents out of 79 surveyed expressed this concern). ASHRAE management has issued task lighting to those individuals who have indicated they need more light.

Lighting Measurements

Location	Space Type	Lighting issue or condition	FC
Corridor outside single story learning center	Corridor	Low lighting levels	24
Corridor between interior learning center roo	Corridor	Low lighting levels	8
Hallway main entrance corridor and open offic	Corridor	Low lighting levels	10
1st Floor South Side	Open Office (Cubicles)	Insufficient lighting levels	57
1st floor North Side	Open Office (Cubicles)	Insufficient lighting levels	53
1st floor Hoteling Rooms	Private rooms	Insufficient lighting levels	6
2nd Floor South Side	Open Office (Cubicles)	Insufficient lighting levels	52
2nd floor North Side	Open Office (Cubicles)	Insufficient lighting levels	41
2nd Floor Hoteling Rooms (East side of buildi	Private rooms	Insufficient lighting levels	10
2nd Floor Hoteling Rooms (West side of buildi	Private rooms	Insufficient lighting levels	22

Building automation system? (Y/N)	Yes
Building CO Monitoring System? (Y/N)	No
Other Toxic Gas Monitoring? (Y/N)	No
CO Level (ppm) in vicinity of Combustion Equipment?	
Outdoor CO_2 Measurement	500

Representative Flow Rate Measurements

Outdoor Air (OA) Intake Location	Flow Rate
NA	4159

Observed Air Distribution System Issues:

System Identifier	Scheduled Operation (hrs/wk)	Distribution System	Control of Outside Air
Variable Refrigerant Volume Fan Coil Unit	6 am - 7 pm M-F	Supply ductwork from unit to conditioned spaces	delivered to return air ductwork
Dedicated Outside Air Unit	6 am - 7 pm M-F	Outside air delivered either directly to spaces by ductowrk or to return ductowrk on units via VAV b	Outside air delivered either directly to spaces by ductowrk or to return ductowrk on units via VAV b
Ground Loop Heat Pump Unit	6 am - 7 pm M-F	Supply ductwork from unit to conditioned spaces	delivered to return air ductwork

System Identifier	OA Damper Operation	Condition of Mechanical Room	Drain Pan Drainage
Variable Refrigerant Volume Fan Coil Unit	manual damper set at required CFM	Units located above ceiling	no blockages observed
Dedicated Outside Air Unit	modulates as necessary to provide required outside air	clean	no blockages observed
Ground Loop Heat Pump Unit	manual damper set at required CFM	Units located above ceiling	no blockages observed

System Identifier	Coil Cleanliness	Duct Liner	Return Air Plenum	MERV Filter Level
Variable Refrigerant Volume Fan Coil Unit	coils observed to be clean	Duct insulated on exterior, in good shape	Clear	
Dedicated Outside Air Unit	coils observed to be clean	Duct insulated on exterior, in good shape	exhuast air from building delivered to unit by ductwork	
Ground Loop Heat Pump Unit	coils observed to be clean	Duct insulated on exterior, in good shape	Clear	

Historical Utility Data

Instructions: *The opening paragraph should be edited by the user to highlight any information included in the tabular information that follows.*

Metered energy data was collected during the audit for the facility and is documented below, aggregated by fuel type and/or utility. Additional utility data and energy end use data is also documented in this section. Notes on use patterns and/or other issues observed in the data are also included.

Metered Data

Utility #1 - Electricity

Start Date	End Date	Days	Energy Use	Cost	Use/Day
2012-12-04	2013-01-04	31	26,880	3,508	867.1
2012-11-02	2012-12-04	32	26,882	3,468	840.1
2012-10-04	2012-11-02	29	28,322	3,520	976.6
2012-09-04	2012-10-04	30	30,360	3,629	1,012.0
2012-08-04	2012-09-04	31	35,763	4,066	1,153.6
2012-07-04	2012-08-03	30	36,120	4,191	1,204.0
2012-06-03	2012-07-04	31	33,842	3,810	1,091.7
2012-05-02	2012-06-03	32	31,920	3,698	997.5
2012-04-02	2012-05-02	30	29,643	3,627	988.1
2012-03-05	2012-04-02	28	29,640	3,588	1,058.6
2012-02-03	2012-03-05	31	27,963	3,542	902.0
2012-01-05	2012-02-03	29	28,320	3,597	976.6
2012-12-04	**2012-02-03**	**364**	**365,655**	**44,243.2**	

Utility #2 – Natural Gas

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #3 – LPG

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #4 – Steam

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #5 – Hot Water

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #6 – Chilled Water

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #7 – Wood / Biomass

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #8 – Fuel Oil

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #9 – Additional Fuel Type 1

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #10 – Additional Fuel Type 2

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility #11 – Additional Fuel Type 3

Start Date	End Date	Days	Energy Use	Cost	Use/Day

Utility/Use Information

Total kWH Used in Peak Month	36,120	Number Days in Billing Cycle	30
Peak Electric Demand	120	Month of Peak	July
Peak Month Billing Hours	720	Electric Load Factor	0.4

Electricity Notes:

Natural Gas Notes:

Other Fuel Notes:

Energy Rate Information

Fuel	Annual Cost		Purchase Agreement / Tariff Identifier	Tariff Type	Alternative	Supplier
Electricity	0.121	$/kWh	Power and light Medium Commerical Rate	Consumption		
Natural Gas						
Fuel Oil						
LPG						
Steam						
Hot Water						
Chilled Water						
Wood						
Coal Coke						
Other						

Energy End Use Breakdown

End Use	Energy Use	Color
Lighting	266806	
Plug Loads	166313	
Service Water Heating	30065	
Exterior Lighting	27360	
Heat Reject	176814	
	0	
	0	
HVAC VRF	141147	
Data Center	175499	

Benchmarking

Instructions: *The opening paragraph describes the Building EQ process as required in Standard 211. The user should add any additional details that are appropriate for this section.*

This audit utilizes the Building EQ In Operation Performance Score to benchmark the performance of the facility. This score compares the candidate building's metered energy use to a baseline EUI that is based on the CBECS median for that building type and is corrected for location and hours of operation. EUIs are calculated for source energy using U.S. national site-to-source ratios. Because the same site-source multipliers are used in the calculation of the median/baseline EUI as are used for the candidate building, the effect of the multipliers is diminished and the Building EQ Performance Score can be used for all locations.

The Building EQ Performance Score is calculated as follows: $(EUI_{metered} / EUI_{baseline}) \times 100$

The Building EQ Performance Score is shown on a barometer scale that illustrates that building's performance as compared to other similar buildings. The score ranges from zero (zero net energy) and goes to 200 or beyond. The baseline value of 100 represents the median (similar to mid-point or average) energy use intensity for existing buildings of that building type.

- An average building will fall near the median value of 100.
- An Inefficient building has a score greater than 100 (above average energy use = high energy use)
- An efficient building has a score less than 100 (low energy use = energy use approaching zero net energy use).
- A zero net energy building will have a score less than or equal to zero (zero net energy use)

Other Performance credentials are also shown below as documented during the assessment process.

Total Building Energy Use

	Site Energy (k/Btu)	Site-Source Ratio	Source Energy (k/Btu)
Total Building Energy Use	1,247,980.5		3,918,658.8
Qualified Renewable Energy	16,255.0	3.14	51,040.7
Net Energy Use	1,231,725.5		3,867,618.1

Metered Building Site EUI (kBtu/ft^2-yr)	35.5
Metered Building Source EUI (kBtu/ft^2-yr)	111.4
Energy Cost Index	1.27

Building EQ Performance Score

Building EQ Median EUI (kBtu/ft^2-yr)	146
Building EQ Performance Score	76

[Insert Barometer illustration here]

Other Building Performance Credentials

Performance Rating Awarded	Description	Score	Year

EUI Target and Estimated Savings

Instructions: *The assessor will need to establish EUI or ECI Target for the facility in consultation with the building owner and estimate the annual energy and cost savings that would arise if the target is met. How the energy target was established should be explained (how and by whom). Information describing the process and results should be added to the opening paragraph.*

The EUI target and estimated savings expected when that target is reached are detailed below along with an explanation of how and by whom that information was determined.

Targeted Building Site EUI (kBtu/ft^2-yr)	
Targeted Building Source EUI (kBtu/ft^2-yr)	
Targeted Energy Cost Index	

Estimated Energy Savings by achieving Target	
Estimated Cost Savings by achieving Target	

Energy Saving Opportunities

Instructions: *The assessor will need to indicate whether or not the listed EEMs are capital measures (non-capital projects are assumed to be no-cost/low-cost measures) and sort them from lowest cost/highest priority to highest cost/lowest priority. Impacts on occupant comfort, IEQ, and other non-energy impacts will need to be added below each system section. The opening paragraph should be edited as needed to include any additional information that needs to be emphasized.*

Recommended energy efficiency measures (EEMs) fall into two different categories: no-cost/low-cost measures and capital measures. The EEMs are ranked by lowest cost/highest priority to highest cost/lowest priority. The recommendation EEMs have also been divided into categories by system as noted. The recommended EEMs should be reviewed to determine the priority of measures to be taken to improve the energy utilization at the facility.

Building Envelope Suggestions

Description	Low cost	High cost	Payback	Priority	Capital Y/N

Impacts on occupant comfort, IEQ, and non-energy impacts:

Lighting/Daylighting Suggestions

Description	Low cost	High cost	Payback	Priority	Capital Y/N
Replace installed daylighting controls with better daylighting system with dimming ballast for 1st floor along exterior wall areas	3600	4000	1-4 yrs		

Impacts on occupant comfort, IEQ, and non-energy impacts:

HVAC System Suggestions

Description	Low cost	High cost	Payback	Priority	Capital Y/N
Implement ongoing monitoring based commissioning to identify operational issues for correction to improve building overall energy performance	5000	5000	< 1 yr		

Impacts on occupant comfort, IEQ, and non-energy impacts:

Refrigeration System Suggestions

Description	Low cost	High cost	Payback	Priority	Capital Y/N

Impacts on occupant comfort, IEQ, and non-energy impacts:

Energy Generation Suggestions

Description	Low cost	High cost	Payback	Priority	Capital Y/N

Impacts on occupant comfort, IEQ, and non-energy impacts:

Other EEM Suggestions

Description	Low cost	High cost	Payback	Priority	Capital Y/N
Replace photovoltic inverters and install metal shield to protect from overheating and repeative replacements costs	0	0	1-4 yrs		

Impacts on occupant comfort, IEQ, and non-energy impacts:

Attachments

Instructions: *Select, delete, and/or modify the information below to reflect the actual attachments to be included with the report.*

Photographs and other attachments that support the information in this audit report are shown below.

Facility Photographs

Photo	Description	Type

Facility Attachments

Attachment	Description	Type