CHA GREEN ASSESSMENT
LEED EBOM Compliance in Water Efficiency and Energy & Atmosphere

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LOCATION MAP: PATRICK SULLIVAN APARTMENTS
At A Glance

Property Name: Patrick Sullivan Apartments
AMP Number: IL002067
Property Type: Senior Housing / High-rise
PM Company: East Lake Management Group

Eligibility for LEED EBOM Certification: YES
Prerequisites: 9
Achievable (A): 7
Short-term (S): 2

Property Characteristics:
22 stories
482 units
3.5 acres

Unit Breakdown:
346 occupied
131 vacant
5 non-dwelling
7 down (mold)

Unit Types
200 one-bedroom (non-ADA)
40 one-bedroom (ADA)
160 studio (non-ADA)
80 efficiency (non-ADA)
2 two-bedroom, two bath (non-ADA)

Data Sources:
8 units visited
25 residents surveyed
(Sample size: 7%)
PM survey & follow-up interview

Quick Snapshot of Results:
Currently Compliant (C): 14 pts
Achievable (A): + 29 pts

LEED Certified Level Anticipated
Short-term credits (S): + 28 pts
Long-term credits (L): + 20 pts
Current Energy Reduction: 32%
Current Water Reduction: 17%
RESIDENT SURVEY RESPONSES

• 20 question resident survey

• 7 main topics covered:
  – Recycling
  – Transportation
  – Water
  – Energy
  – Lighting
  – Occupant Comfort
  – Indoor Environmental Quality
KEY SHEET

- Currently Compliant (C)
- Achievable (A)
- Short Term (S)
- Long Term (L)
- Not Achievable (N)

Credit Title

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<thead>
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<th>Status</th>
<th>CASLN</th>
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<tbody>
<tr>
<td>Points</td>
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</tbody>
</table>

**Intent**
Describes the objective of each prerequisite/credit per the LEED EBOM Reference Guide.

**Requirements**
Describes what must be done to earn each prerequisite or credit per the LEED EBOM Reference Guide.

**Alternative Compliance Path(s)**
Showcases the applicable alternative ways of achieving the prerequisite/credit, if/when applicable. Either identify and focus on the most suitable path, or provide recommendations on several applicable ones with their associated costs and savings to assist with an educated decision.

**Related Credits/Synergies**
Synergy refers to the interrelation between the different LEED EBOM prerequisites/credits.

**Implementation**
Details the specifics of how to achieve the prerequisite/credit for each applicable Compliance Path (or Option).

**Financial Impact**
As determined by CHA
- No cost
- Low Cost (under $25,000 to implement)
- Moderate Cost (between $25,000 and $100,000 to implement)
- High Cost (over $100,000 to implement)

**Comments**
Project specific observations, remarks, considerations, unique issues, exemplary performance and regional priority potential etc.

**Next Steps**
- Unique steps to meet credit intent
- References to applicable revised CHA PPMP Manual Chapters for policy/plan credits
- Performance Period tasks if applicable
- CHA Resident Involvement if applicable
LEED SCORE

• Complies with 7 of 9 Prerequisites
  – EAp1 & IEQp2 are slated for short term with high priority
WATER EFFICIENCY

- Monitor Water Consumption Performance
- Reduce Indoor Potable Water Consumption
- Reduce Water Consumption to Save Energy & Improve Environmental Well-Being
- Practice Water-Efficient Landscaping
# WATER EFFICIENCY CHECKLIST

**LEED EBOM 2009 Project Checklist**

<table>
<thead>
<tr>
<th>Water Efficiency</th>
<th>Currently Compliant</th>
<th>Achievable</th>
<th>Short-Term</th>
<th>Long-Term</th>
<th>Not Achievable</th>
<th>Total Possible Points</th>
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<td><strong>Total</strong></td>
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<td>5</td>
<td>2</td>
<td></td>
<td><strong>14 Points Possible</strong></td>
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</table>
WEp1 - Minimum Indoor Plumbing Fixture & Fitting Efficiency

**ACTION STEPS**

1. Write a policy that mandates economic assessment of conversion to high-performance plumbing fixtures and fittings as part of any future indoor plumbing renovations.

**REQUIRED**

Confirm that overall water usage via faucets and bathroom fixtures doesn't exceed LEED Baseline.

**BEFORE PERFORMANCE PERIOD**

- Demonstrate that the building earned a water reduction point under another LEED system.
- Document completion date of your building.
- Document when fixtures were upgraded.

**DURING**

- Inventory quantity, make, and flow/flush rates of all fixtures.
- Set up fixture groups in LEED Online.
- Input fixture and occupant data.
- If calculated water usage exceeds LEED baseline, identify fixtures and fitting upgrades and recalculate.

**IMPLEMENT**

- Implement a preventive maintenance program to inspect all fixtures and fittings and ensure ongoing performance levels.

**Prior LEED certification**

- Building Completed ≥1993
- All Fixtures Installed ≥1993
- Some or All Fixtures Installed before 1993
At A Glance
- Low Cost
- Property-specific
- Measurement & Verification

Credit Highlights
- All prerequisites must be met to qualify for any level of LEED certification
- All water fixtures have been replaced to levels that are equal to or below the International Plumbing Code 2006

**WEp1: Minimum Indoor Plumbing Fixture & Fitting Efficiency**

**Intent**
To reduce indoor fixture and fitting water use within buildings to reduce the burdens on potable water supply and wastewater systems

**Financial Impact**
LOW COST - due to the audit requirement during the performance period

**Comment**
- All prerequisites must be met to be qualified for any level of LEED certification.
- Of the 7% response rate to the Resident Survey, only 60% of those residents reported that the water pressure in the units is acceptable.
- The current washing machines in the laundry rooms are not Energy Star labeled.
- All water fixtures have been replaced to the levels that are equal to or below the International Plumbing Code (IPC) 2006 (see Recommended Resources section for details) flow rates.

**Next Steps**
- Investigate and correct the cause of the low water pressure cited by the residents in the survey.

**Performance Period**
- The current potable water usage is below the LEED EBOM baseline and meets the prerequisite.
- The calculation required for this prerequisite is also required for the WEd2, hence an audit in the performance period is required for a definitive determination on the achievability of these credits.
- The use of energy-star washing machines in the laundry rooms should help with reducing the burdens on potable water supply.
- Implement the Sustainable Purchasing Policy for indoor plumbing fixtures and fittings that can be found in the revised CHA PPMP Manual.
WEc1 - Water Performance Measurement: Whole Building Metering (Option 1 & Option 2)

**Action Steps**

**WEc1: Water Performance Measurement**

Evaluate the water metering scheme in the building to determine if the project can pursue Options 1 and 2.

**Option 1: Whole Building Metering (1 pt)**

- Identify all meters in building and grounds. Record their location, date of installation, and ownership entity.
- Determine if installed submeters provide adequate coverage.
- If necessary, install additional submeters to meet credit requirements.
- Implement a process to collect weekly water use data for building (Option 1) and subsystems (if pursuing Option 2), perform regular trend analysis, and compile monthly and annual summaries.
- Calibrate all building-owned meters per manufacturer recommendations and document calibration.

**Option 2: Submetering (Option 1 + 1pt)**

Permanently installed water metering for all potable water (1 pt) and one subsystem (+1 pt). 1 EP point for 2 subsystems.
At A Glance
- No Cost
- Property-specific
- Measurement & Verification

Credit Highlights
- Most single building developments have whole-building meters
  - Multiple building sites are sometimes “master metered”

### WEc1.1 Water Performance Measurement – Whole Building Metering (Option 1)

<table>
<thead>
<tr>
<th>Intent</th>
<th>To measure building and subsystem water performance over time to understand consumption patterns and identify opportunities for additional water savings.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Impact</td>
<td>NO COST</td>
</tr>
<tr>
<td>Comment</td>
<td>· Water consumption for the entire building is currently metered.</td>
</tr>
</tbody>
</table>
| Next Steps | · Intent of credit has been met.  
  · To ensure compliance, data must be recorded on a regular basis and compiled into monthly and annual summaries. |
At A Glance

- Low Cost
- Property-specific
- Measurement & Verification

Credit Highlights

- Meter either domestic hot water or irrigation for credit compliance
  - Sub-metering can identify potential system issues and/or inefficiencies
WEc2 - Additional Indoor Plumbing Fixture & Fitting Efficiency
At a Glance
- Moderate Cost
- Property-specific
- Measurement & Verification

Credit Highlights
- Fixture replacements can offer water & cost savings while achieving LEED points

WEc2 | Additional Indoor Plumbing Fixture & Fitting Efficiency

**Intent**
To maximize indoor plumbing fixture and fitting efficiency within buildings to reduce the use of potable water and consequent burden on municipal water supply and wastewater systems.

**Financial Impact**
MODERATE COST – depending on the number of fixtures that will need to be replaced.

**Comment**
- Of the 7% response rate, only 56% of those residents reported that leaks are fixed in a timely manner.
- Based on the site observations and preliminary calculations of water consumption, it is anticipated that 2 points (17% reduction) are achievable and 3 points are slated for the short term.
- Credit eligible for **exemplary performance** when 35% reduction is achieved relative to the LEED EBOM baseline.
- Credit eligible for **Regional Priority** (additional 1 point).

**Next Steps**
- Inform operations and maintenance personnel of the benefits and water savings associated with timely repair of any leaks.

**Performance Period**
- Implement an audit of plumbing fixture and fitting efficiency during the performance period for a definitive determination on the achievability of this credit.
- Points slated for the short term can be achieved by replacing or modifying water fixtures with flow rates exceeding International Plumbing Code (IPC) 2006 values to have a flow rate less than or equal to the IPC 2006 Values.

**CHA Resident Involvement**
- Inform residents of the benefits associated with timely reporting of leaks in their units.
WEc3 – Water Efficient Landscaping

Option 1: Compare metered data to LEED Baseline
- Calculate the LEED Baseline by determining how much water would be consumed by conventional irrigation methods in mid-summer.
- Meter potable water use.
- Determine the percent reduction.

Option 2: Theoretical calculations to estimate consumption
- Estimate mid-summer irrigation by assessing site area and vegetation types and using provided factors to quantify site characteristics.
- Use the estimated and baseline case to determine percent reduction.

Option 3: Perform irrigation assessment with independent tools
- Use irrigation performance and ranking tools based on local, regional, state or national sources to demonstrate reduction.

Points: 1-5
Reduce the consumption of potable water for irrigation by 50%-100%
At A Glance
- Low Cost
- Property-specific

Credit Highlights
- Large turf grass area & lack of irrigation system presents challenge

<table>
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<tr>
<th>Site Size</th>
<th>LEED Points</th>
<th>Requirements</th>
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<td>S</td>
<td>L</td>
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<tr>
<td>Urban</td>
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<tr>
<td>Planters (≤ 5%)</td>
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<tr>
<td>Planters (&gt; 5%)</td>
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<tr>
<td>Small (&lt; 1 acre)</td>
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<tr>
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<td>Hose Bibs</td>
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<tr>
<td>Large (3+ acres)</td>
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<tr>
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<tr>
<td>Hose Bibs</td>
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</tr>
</tbody>
</table>

WEc3 Water Efficient Landscaping

Intent
To limit or eliminate the use of potable water or other natural surface or subsurface resources available on or near the project site for landscape irrigation.

Financial Impact
LOW COST

Comments
- Site is watered by hand with hose bibs.
- The current site area is approximately 3.5 acres.
- The large area of turf grass presents a challenge for the achievability of the credit.
- Without the ability to implement moisture sensors, the achievability of this credit will require replanting 50-65% of the site with native species, slating 5 points for the long term.
- Rainwater collection from the roof will provide irrigation for all months for up to 10 times the area of the roof. Therefore, all irrigation loads can be met with rainwater collection, though this strategy is more feasible in the long term due to higher costs.

Next Steps
- Install weather data-based controllers or moisture sensors to reduce consumption and increase efficiency.
- Perform regular maintenance to the irrigation system to ensure the performance quality and plant recommended water efficient plantings as described in the Landscape Management Plan in the revised CHA PPMP Manual.
- If CHA decides to purchase Geosyntec Consultants' rainwater collection system for all its properties, using the captured rainwater for irrigation will increase possible points that can be achieved for this credit.
WEc4 – Cooling Tower Water Management

**Action Steps**

**WEc4: Cooling Tower Water Management**

**Option 1: Chemical Management Plan (1 pt.)**
- Implement a water management plan addressing chemical treatment, bleed-off, biological control, and staff training.
- Install and maintain a conductivity meter and controls to automatically adjust bleed-off rates.

**Option 2: Non-Potable Water Use (1 pt.)**
- Retrofit and/or maintain onsite cooling towers to use at least 50% non-potable water in makeup water.
- Install and/or maintain sub-meters to track potable and non-potable water for cooling tower makeup.

**Option 3: Follow both Option 1 and 2 (2 pts.)**
- Reduce potable water consumption for cooling towers.

**Points: 1–2**
At A Glance

- Property-specific

Credit Highlights

- Patrick Sullivan does not have a cooling tower & therefore cannot comply
- This credit information is from Britton I Budd Apartments which does have a cooling tower
- Half of credit is achieved through the existing cooling tower water management plan
- Other point requires non-potable water collection system
ENERGY & ATMOSPHERE

- Monitor & Improve Building Energy Performance
- Eliminate CFCs
- Utilize Renewable Energy
## ENERGY + ATMOSPHERE CHECKLIST

### LEED EBOM 2009 Project Checklist

<table>
<thead>
<tr>
<th>Energy &amp; Atmosphere</th>
<th>Currently Compliant</th>
<th>Achievable</th>
<th>Short-Term</th>
<th>Long-Term</th>
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<th>Total Possible Points</th>
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**Total 35 Points Possible**
At A Glance
- Low Cost
- Property-specific

Credit Highlights
- ASHRAE Level I Energy Audit may be performed in-house
  - Identifies no/low cost upgrades

- Need to formally document:
  - Systems Narrative
  - Building Operating Plan
  - Preventative Maintenance Plan
  - Sequence of Operation


Intent
To promote continuity of information to ensure that energy-efficient operating strategies are maintained and provide a foundation for training and system analysis.

Financial Impact
LOW COST - associated with ASHRAE (see Recommended Resources section for details) Level I Energy Audit which is generally performed by a 3rd party. Costs can be reduced or eliminated if the walkthrough is conducted by a member of the building operations staff.

Comment
- All prerequisites must be met to be qualified for any level of LEED certification.
- An ASHRAE Level I Energy Audit has not been completed for the management office or residential buildings.
- A Systems Narrative, Building Operating Plan, Preventative Maintenance Plan, and Sequence of Operation are not currently documented.

Next Steps
- Conduct an ASHRAE Level I Energy Audit
- To ensure eligibility, document the following:
  - a Systems Narrative which describes the heating, cooling, ventilation, domestic water heating, humidification, dehumidification, and lighting,
  - a Building Operating Plan that defines the delivered conditions required by building management and occupants for each space in order to successfully operate the building. This is also called the owner’s project requirements,
  - a Preventative Maintenance Plan that describes each preventative maintenance measure and the scheduled frequency of activity,
  - a Sequence of Operation that defines what operational states are desired under what conditions in the building and should include specific information on operating phases, setpoints and controls, and feedback systems to monitor performance.
EAp2 – Minimum Energy Efficiency Performance

ACTION STEPS

1. Enter last 12 months utility data in Energy Star Portfolio Manager.
2. Does building qualify for an Energy Star rating based on type, size, or operating hours?

Case 1: Eligible for Energy Star
   - Use the Portfolio Manager benchmarking tools to generate a score.

Case 2: Not eligible for Energy Star
   - Use the USGBC’s “Option B&G Calculator” using building Energy Utilization Index (EUI) data generated in Portfolio Manager.

Review output

Meets Requirement? Improvement Needed?

Submit documentation describing level of energy performance.
Conduct energy audit and identify incentives available to determine best opportunities for improvement.

REQUIRED

Requirements: Building has an Energy Star rating ≥69 or energy efficiency ≥19% better than national average.

Implement energy efficiency measures.
At A Glance
- No Cost
- Property-specific
- Measurement & Verification

Credit Highlights
- Document energy use for 12 months
- Resident responses help to determine energy use awareness
- 64% of residents reported knowledge of their monthly electricity bill
- Baseline EUI: 170 kbtu/sf
- Property EUI: 94.9 kbtu/sf
- 32% better than average

Credit Details
- Document energy use for 12 months
- Resident responses help to determine energy use awareness
- 64% of residents reported knowledge of their monthly electricity bill
- Baseline EUI: 170 kbtu/sf
- Property EUI: 94.9 kbtu/sf
- 32% better than average

Next Steps
- The current score meets the prerequisite.
- See EAc1 - Optimize Energy Performance for details.

CHA Resident Involvement
- Educate the residents on the benefits of tracking energy use and simple methods to reduce usage.
EAp3 – Fundamental Refrigerant Management

EAp3: Fundamental Refrigerant Management

ACTION STEPS

1. Record product information on all refrigerants used in base building systems in LEED Online credit form.

REQUIRED

Requirements: Zero use of CFC-based refrigerants OR phase-out plan OR 3rd-party audit showing replacement or conversion is not feasible.

Before Performance Period

1. Does equipment use CFC-based refrigerants?
   - No: Complete LEED-OnSite credit form.
   - Yes: Work with qualified third party to determine whether system replacement or conversion is economically feasible.

During Performance Period

1. Feasible?
   - Yes: Develop comprehensive plan to phase out CFCs within 5 years of the end of the performance period.
   - No: Prepare relevant building personnel to initiate CFC phase-out plan within 5 years of the end of the performance period.

2. Minimize annual refrigerant leakage to 5% or less and total leakage over remaining life of unit to less than 30% of charge.
At A Glance
- No Cost

Credit Highlights
- No CFCs on site

### EAp3 | Fundamental Refrigerant Management

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intent</strong></td>
<td>To reduce stratospheric ozone depletion</td>
</tr>
<tr>
<td><strong>Financial Impact</strong></td>
<td>NO COST</td>
</tr>
<tr>
<td><strong>Comment</strong></td>
<td>- No CFCs were observed on site. All air conditioning units utilized R-22 as a refrigerant. R-22 is not a CFC based refrigerant and is therefore compliant with the prerequisite.</td>
</tr>
<tr>
<td><strong>Next Steps</strong></td>
<td>- Intent of prerequisite has been met.</td>
</tr>
</tbody>
</table>
EAc1 – Optimize Energy Efficiency Performance

**ACTION STEPS**

**EAc1: Optimize Energy Performance**

Enter last 12 months utility data in Energy Star Portfolio Manager.

Does building quality for an Energy Star rating based on type, size, or operating hours?

**Case 1:** Eligible for Energy Star

Use the Portfolio Manager benchmarking tools to generate a score.

**Case 2:** Not eligible for Energy Star

Use the USGBC’s “Option B & Calculator” using building Energy Utilization Index (EUI) data generated in Portfolio Manager.

Review output and resulting LEED points.

Satisfied?

Submit documentation describing level of energy performance.

Room for Improvement?

Revisit ASHRAE Level I Walkthrough completed for EAp1 and expand energy auditing if necessary.

Implement energy efficiency measures.

Requirements: Building has an Energy Star rating ≥71 or energy efficiency ≥21% better than national average.
At A Glance

- Property-specific
- Measurement & Verification

Credit Highlights

- Relatively new & efficient boilers
- Opportunity to further support CFL bulb integration in residences
- Residents reported less than satisfactory lighting levels
  - Will be taken into consideration during future building upgrades

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**EAc1. Optimize Energy Efficiency Performance**

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<th>Status</th>
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<td>A</td>
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<td>C</td>
<td>2</td>
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<tr>
<td>S</td>
<td>2</td>
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<tr>
<td>L</td>
<td>3</td>
</tr>
</tbody>
</table>

**Intent**

To achieve an increased level of operating energy efficiency performance relative to typical buildings of similar type to reduce environmental impacts associated with excessive energy use.

**Financial Impact**

See ECMs below

**Comments**

- The current score demonstrates the property’s energy efficiency being 32% better than the average for typical buildings of similar type, achieving 11 points out of a total of 18 points available for this credit. The annual weather-normalized Source Energy Use Intensity is 94.9 kBtu/sf.

- According to the Resident Survey:
  - Of the 7% response rate, only 64% of those residents reported feeling comfortable with the quality of the interior lighting.
  - Full integration of CFL bulbs is not yet complete for all units.
  - Of the 7% response rate, only 56% of those residents reported feeling comfortable with the quality of the exterior lighting.

- The ASHRAE Level I Energy audit required under EAp1 may also identify opportunities to improve energy performance.

- The building central heating hot water system recently went through a major renovation within the last 2 years. Five (5) new Thermal Solutions “Evolution” type boilers were installed. Each boiler has a capacity of 258,000 BTU/h and each has its own recirculation pump. System operates by demand and not by outside air temperature. Boilers provide building heat by feeding two (2) heat exchangers, one heat exchanger serves the north zone and the second heat exchanger serves the south zone of the building. Hot water is distributed by two main building pumps.

- Building domestic hot water is provided by two (2) Burkay Genesis, AO Smith Space Saver series gas boilers. Both boilers have capacities of 1,250,000 BTUs. Boilers appear to have been installed in 2002. According to the building engineer, the boilers are reportedly slated to be replaced with new high efficient boilers in the near future.
Credit Highlights

- Relatively low energy rates affect Energy Conservation Measure (ECM) payback
  - CHA was the first PHA to negotiate a special electric rate for all uses

- Add Photocell Control to Exterior Lighting
  - Estimated Cost: $5,300
  - Annual savings: 3,552 kWh, $234

EAc1 | Optimize Energy Efficiency Performance

**Next Steps**

- Consider increasing the wattage and altering the color spectrum of interior and exterior lamps in response to lighting quality concerns from the resident survey.

- The following Energy Conservation Measures (ECM) would increase the energy efficiency of the buildings. In all the ECMs below, the cost savings was projected using a blended electricity cost of $0.0659 and blended natural gas rate of $0.54/therm, based on Excel sheets provided by CHA.

**ECM 1 - Add Photocell Control to Exterior Lighting**

During the site walkthrough, the project team noted that all exterior lighting fixtures are controlled by a time clock. Building personnel reported that electric lighting is often on during daylight hours and off during non-daylight hours because of needed time clock adjustment. Additional energy savings for the site could be realized if the pole mounted exterior lighting schedule were adjusted to better match non-daylight hours. In order to do this, the project team recommends installing photocells to control all exterior lighting fixtures ensuring that the electric lighting is on only during non-daylight hours. In addition, adding photocells will enhance security of the site because the exterior lighting fixtures will be on during all non-daylight hours. Photocell control will also decrease the number of hours per day that the exterior light fixtures are in operation which will also increase lamp life resulting in reduced maintenance costs.

The project team noted that each of the exterior lighting fixtures serving the parking lot contain (1) 250 W Metal Halide lamp and each of the exterior lighting fixtures serving the building perimeter contain (1) 75 W Metal Halide lamp. Exterior lighting fixtures serving the courtyard each contain (1) 75 W Metal Halide lamp. Exterior walkway ceiling light fixtures each contain (1) 13 W CFL lamps. Currently, the timelock is set to turn on the exterior lighting fixtures each evening at 5:00pm and turn off the exterior lighting fixtures each morning at 8:00am. No adjustments are made to the timelock to match seasonal sunlight variation. It is estimated that an energy savings of 3552 kWh and a cost savings of $234 could be realized each year if photocell control of the exterior lighting fixtures is installed. The estimated cost of installation is $5,300 yielding an estimated payback of 23 years.
Credit Highlights

- Replace AC units with Energy Star rated units
  - Estimated Cost: $117,000
  - Annual savings:
    - 0.35 kW/unit
    - 29,593 kWh
    - $1,950

EAc1 | Optimize Energy Efficiency Performance

Next Steps

ECM 2 - Replace All Apartment Air Conditioning (AC) Units with Energy Star Rated AC Units

During the apartment walk through, the project team noted that all apartment vertical-wall AC units are sized at 12,000 Btu/h and had an unknown SEER rating, assumed at 8.2 SEER. In addition, many units were over 10 years old and were noted to have damaged condenser coils. A new AC unit with a high SEER rating is more efficient than an older, damaged AC unit with a low SEER rating. Also, the current unit use HCFC-22 refrigerant, which has a high ozone depletion potential and global warming potential. If replacing units, consider purchasing ones using a more environmentally preferable refrigerant such as HFC-410a.

By replacing all existing inefficient and/or damaged AC units with efficient 10.8 SEER AC units that meet current Energy Star requirements, each unit would save 0.35 kW per AC unit. Assuming 12 full load hours of operation, 7 days a week for 5 months, 29,593 kWh and $1,950 will be saved per year. The estimated cost of installation is $117,000, which produces an estimated payback of 60 years. Given that the payback period is greater than the life of the AC unit, it is therefore recommended that AC units only be replaced on an as needed basis.

Performance Period
- Track the building's total energy meter output on a regular basis, over 1 year.

CHA Resident Involvement
- Educate residents on the financial and environmental benefits of using CFL bulbs.
EAc2.1 - Existing Building Commissioning: Investigation & Analysis
At A Glance
- Low Cost
- Portfolio-wide
- Measurement & Verification

Credit Highlights
- Retro-commissioning plan:
  - Site assessment
  - Energy use breakdown
  - Diagnostic monitoring
  - Functioning testing

- Pursuing this credit can help maximize energy efficiency of existing systems

- Allows pursuit of EAc2.2 & 2.3

EAc2.1 | Existing Building Commissioning: Investigation & Analysis

**Intent**
Through a systematic process, to develop an understanding of the operation of the building’s major energy-using systems, options for optimizing energy performance and a plan to achieve energy savings.

**Financial Impact**
LOW COST – due to a third party commissioning fee

**Comment**
- No previous ASHRAE energy audits or retro-commissioning activities have been completed for the site.
- Pursuing the Commissioning Process in Option 1 allows for more possible points in EAc2.3.

**Next Steps**
- Engage a commissioning agent to develop a commissioning plan, complete a site assessment, energy use breakdown, diagnostic monitoring and functional testing, and master list of findings.
EAc2.2 – Existing Building Commissioning: Implementation

**ACTION STEPS**

1. **Determine possible energy conservation measures through EAc2.1, commissioning or energy audit**
2. **Implement all low-cost or no-cost measures**
3. **Provide training for building staff**
4. **Develop the following documentation**
   - Table listing all no- or low-cost operational improvements and/or minor repairs implemented
   - Summary of significant updates or revisions to the Building Operating Plan
   - Summary of management staff training program used to build skills and awareness in a broad range of sustainability topics

**DURING PERFORMANCE PERIOD**

**POINTS: 2**

- Implement low-cost improvements and provide training for staff
At A Glance
- Low Cost
- Property-specific
- Measurement & Verification

Credit Highlights
- Requires implementation of no/low cost items identified in EAp1

### EAc2.2 | Existing Building Commissioning: Implementation

**Intent**
To implement minor improvements and identify planned capital projects to ensure that the building’s major energy-using systems are repaired, operated, and maintained effectively to optimize energy performance.

**Financial Impact**
LOW COST – associated with the implementation of low/no cost recommendations identified in previous prerequisites/credits.

**Comments**
- No previous energy audits or retro-commissioning activities have been completed for the site.
- EAc2.2 cannot be achieved unless EAc2.1 has been achieved.
- Compliance with this credit may not be determined until the ASHRAE Level I Energy Audit conducted in EAp1 is completed during the performance period.

**Next Steps**
- Demonstrate the financial costs and benefits of measures that have been implemented.
- Update the Building Operating Plan as necessary.
- Provide training for staff on sustainable building operations topics.
- Create a plan for capital improvements based on higher cost items identified during the ASHRAE Level I Energy Audit.

**Performance Period**
- Implement all no/low cost energy efficiency improvements identified during the ASHRAE Level I Energy Audit.
EAc2.3 – Existing Building Commissioning: Ongoing Commissioning

**ACTION STEPS**

**EAc2.3: Existing Building Commissioning — Ongoing Commissioning**

1. **Start Commissioning – EAc2.1**
   - Determine possible energy conservation measures through commissioning

2. **Implement Results – EAc2.2**
   - Implement all low-cost or no-cost measures
   - Provide training for building staff

3. **Repeat – EAc2.3**
   - Develop the final report
   - Compile a systems manual
   - Develop an ongoing commissioning plan

4. **Repeat system testing and evaluation over 2 year cycle**

5. **Complete 1/2 scope of work prior to date of LEED application**

6. **POINTS: 2**
   - Implement ongoing commissioning program, with written plan, and complete at least half of first commissioning cycle prior to LEED application date
At A Glance
- Moderate Cost
- Property-specific
- Measurement & Verification

Credit Highlights
- Ongoing Commissioning Plan:
  - Building equipment list with performance measurement frequency
  - Estimated **24-month** commissioning cycle budget
  - Complete **50%** of scope of first commissioning cycle

EAc2.3 | Existing Building Commissioning: Ongoing Commissioning

| Intent | To use commissioning, address changes in facility occupancy, usage, maintenance, and repair. Make periodic adjustments and reviews of building operating systems and procedures essential for optimal energy efficiency and service provision |
| Financial Impact | MODERATE COST - due to the cost of performing at least half (with respect to total budget) of the necessary operational and equipment upgrades or maintenance during the first commissioning cycle (24 months) and the third party commissioning fees |
| Comment | • No previous energy audits or retro-commissioning activities have been completed for the site. |
| Next Steps | • Engage a commissioning agent to develop an ongoing commissioning plan that includes a commissioning cycle frequency of no more than 24 months and implement at least half of the scope of work in the first cycle. • Create a building equipment list outlined by system or component type, and include performance measurement frequency for each component type and procedures for responding to deviations from expected parameters. • Provide an estimated budget for completion of the overall commissioning cycle with a breakdown of costs for complete of each major task within the cycle. • Provide a table summarizing all tasks related to the commissioning program that have occurred in the past two years. Include the cost of each task, the date each task was undertaken/completed, and the total cost of the completed work. Include a summary that shows at least 50% of the scope was completed in the first commissioning cycle/prior to LEED EBOM application. • Update the Building Operating Plan and/or Systems Narrative as necessary |
EAc3.1 - Performance Measurement: Building Automation System

- Have a computer-based Building Automation System (BAS) for major building systems—HVAC and lighting at minimum.

**Minimum BAS Functions—HVAC**
- Monitoring the status of sensors and controlled devices.
- Scheduling equipment off when not in use.
- Scheduling setpoints and setbacks.
- Trending equipment status.

**Minimum BAS Functions—Lighting**
- Scheduling lights off during unoccupied times.

**Credit Requirements**
- Have a preventative maintenance program in place for the BAS.
- Demonstrate the BAS is being used to inform decisions.
At A Glance
- High Cost
- Property-specific

Credit Highlights
- Local control of most resident systems prevents BAS installation
- CHA has automation systems for its central boilers

EAc3.1 Performance Measurement: Building Automation System

<table>
<thead>
<tr>
<th>Intent</th>
<th>To provide information to support the ongoing accountability and optimization of building energy performance and identify opportunities for additional energy saving investments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Impact</td>
<td>HIGH COST - due to installation of BAS</td>
</tr>
<tr>
<td>Comments</td>
<td>• Boilers and domestic water heaters have own controls system and have the capacity for remote control.</td>
</tr>
<tr>
<td></td>
<td>• Remaining systems and spaces are not connected to a Building Automation System (BAS). The domestic water pumps, AC units and lighting are controlled locally. In addition, the AC units are through-the-wall type and are plugged into a receptacle, therefore it is unlikely these units can be controlled or monitored via a BAS.</td>
</tr>
<tr>
<td>Next Steps</td>
<td>• Currently slated as a not achievable credit. CHA may reconsider pending a major rehabilitation decision and installation of BAS.</td>
</tr>
</tbody>
</table>
EAc3.2 – Performance Measurement: System-Level Metering

ACTION STEPS

1. Assess the current level of submetering and the feasibility of adding more if needed.
2. Record a breakdown of the building's significant end-use energy applications using results from the ASHRAE Level I energy audit completed for EAp1.
3. For each major end use, compile the expected annual energy consumption, percentage of total annual energy use, and percentage of submetered energy consumption.
4. If necessary, install additional submeters to meet the credit requirements.
5. Employ system-level metering covering 40% or 80% of the total expected annual energy use.
6. Calibrate meters and establish procedures for reviewing and using metered data to improve system performance.

POINTS: 1-2

Employ system-level metering covering 40% or 80% of total expected annual energy consumption and 80% of the largest energy use categories.
At A Glance
- High Cost
- Property-specific
- Calculation
- Measurement & Verification

Credit Highlights
- Local control of resident systems (AC, cooking gas) prevents system level metering
- Domestic hot water & heating is a central system that can be sub-metered
  - Natural gas consumption accounts for 89% of total energy consumption

EAc3.2 Performance Measurement: System-Level Metering

<table>
<thead>
<tr>
<th>Status</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Intent
To provide accurate energy use information to support energy management and identify opportunities for additional energy-saving improvements.

Financial Impact
HIGH COST - due to the need for system-level metering

Comments
- All tenants pay for their individual electric utility bills.
- Cooling, receptacle loads, and lighting systems serving both the management offices and the residential units are not sub-metered. Cooling for the 1st floor management offices and social/common room is accomplished through four (4) split system AC units. Cooling for the residential units is accomplished through window AC units plugged into receptacles. Sub-metering for cooling, receptacle loads, and lighting will be difficult and expensive because of the number of separate systems serving the site.
- Domestic hot water is a central system and can be separately metered. It is expected that the natural gas used for domestic hot water is below the 40% needed to earn this credit.
- Gas for cooking can be separately metered in each entire building. It is expected that the natural gas used for cooking is below the 40% needed to earn this credit.
- Heating is accomplished through central hot water boilers feeding heat exchangers serving radiant floor heating. The central heating system is not separately metered and likely accounts for at least 40% of the building's total expected annual energy consumption. The combined natural gas consumption is 89% of the total energy consumption. Heating is likely a majority of this portion and domestic hot water is likely the second largest.

Next Steps
- Install sub-metering for central heating system and verify that the heating end-use consumption accounts for 40% or greater of the total annual energy consumption. Install sub-metering for the domestic hot water system and verify that the heating and domestic hot water end-use consumption together account for 80% or greater of the total annual energy consumption.
- Maintain documentation of the system-level metering operation and function, per the manufacturer's recommended interval. Maintain a written record of preventative maintenance practices relating to the system-level metering.
EAc4 – On-Site & Off-Site Renewable Energy
At A Glance
- Low Cost
- Portfolio-wide
- Calculation

Credit Highlights
- Purchase off-site renewable energy and carbon offsets only if in need of “buffer points”

**EAc4 | On-Site & Off-Site Renewable Energy**

**Intent**
To encourage and recognize increasing levels of on-site and off-site renewable energy to reduce environmental impacts associated with fossil fuel energy use.

**Financial Impact**
LOW COST - for Option 2, due to REC and carbon credits.

**Comment**
- Green-e certified Renewable Energy Certificates can be purchased for approximately $0.87/MWh at the time this report was written.
- Certified Emission Reductions (CERs) can be purchased for approximately $2.50/tCO₂ at the time this report was written.
- On-site renewable energy, Option 1, is a high initial cost creating a high payback period. If funds can be secured through grants, federal tax incentives, and utility programs, the following on-site renewable energy may be applicable to this site: Photo-Voltaic Panels, Solar Thermal Hot Water Heating, and Geothermal.
- Credit eligible for **exemplary performance** by meeting the next threshold of credit achievement, which could mean 13.5% on-site renewable energy, or the equivalent calculated combination of on-site and off-site renewable energy, provided the percentage sum of off-site and on-site renewable energy is 100% or less.

**Next Steps**
- Purchase RECs and/or carbon offsets for a minimum of 25% of electricity, purchased steam, natural gas, propane and fuel oil from a Green-e certified or equivalent provider*. A two year contract is required.

* Although included in the assessment, this compliance path does not provide any environmental, social or financial return on investment and thus, is not recommended unless the property is in need of buffer points.
EAc5 – Refrigerant Management

ACTION STEPS

EAc5: Enhanced Refrigerant Management

POUNTS: 1
Base building HVAC&R total refrigerant impact per ton < 100; Fire suppression system free of ODPs.

Option 1: No refrigerant use

Verify that fire suppression systems do not use halons, CFCs, or HCFCs

No calculations are needed for naturally ventilated buildings

Option 2: Minimize emissions

Verify that credit achievement is likely—the building uses efficient centralized equipment with low-impact refrigerants

Record product information on all refrigerants used in base building systems in LEED Online credit form

Calculate Annual Leakage Rate (Lr) for each piece of equipment

Complete Refrigerant Impact Calculations to determine Total Refrigerant Impact per Ton

BEFORE PERFORMANCE PERIOD

DURING PERFORMANCE PERIOD
At A Glance
- High Cost
- Property-specific
- Calculation
- Measurement & Verification

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Patrick Sullivan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerant</td>
<td>HCFC-22</td>
</tr>
<tr>
<td>Unit Type</td>
<td>Room or Window</td>
</tr>
<tr>
<td></td>
<td>AC Unit</td>
</tr>
<tr>
<td></td>
<td>Unitary, Split</td>
</tr>
<tr>
<td></td>
<td>Packaged AC</td>
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<tr>
<td>ODP</td>
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<tr>
<td>GWP</td>
<td>1780</td>
</tr>
<tr>
<td>Lr</td>
<td>0.02</td>
</tr>
<tr>
<td>Mr</td>
<td>0.1</td>
</tr>
<tr>
<td>Rc (lbs)</td>
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<tr>
<td>Life</td>
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</tr>
<tr>
<td>Tons</td>
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</tr>
<tr>
<td># of Units</td>
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<tr>
<td>LCODP</td>
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<tr>
<td>LCGWP</td>
<td>63.413</td>
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<td>Baseline</td>
<td>100</td>
</tr>
<tr>
<td>Property Average</td>
<td>224</td>
</tr>
</tbody>
</table>

EAc5 Refrigerant Management

Intent
To reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming.

Financial Impact
HIGH COST - due to replacement of AC units.

 Comment
- Existing AC units all utilize R-22, an HCFC, which means the project is required to pursue Option 2.
- If information was unavailable on site, a default value from LEED was used for the refrigerant charge per ton. Typical values for refrigerant leakage rate and end of life refrigerant loss were obtained from the LEED Reference Manual as well.
- For the preliminary analysis, the following units were observed:
  - Apartment AC units: Approximately one (1) ton, 1.18 lbs of refrigerant.
  - Social/Common Room: Two (2) split systems, 10 and 12.5 tons, containing 1.4 and 19 lbs of refrigerant, respectively.
  - 1st floor management offices: Two (2) split systems, 5 tons each, 13 lbs of refrigerant.
- Based on preliminary calculations, the combined global warming and ozone depletion potential of all AC units within the building is 224. Because this score is greater than 100, the property is anticipated to achieve 1 point in the long term.

Next Steps
- This preliminary analysis need to be expanded for the entire building by collecting the necessary data for each HVAC equipment piece containing greater than 0.5 lbs of refrigerant.
- In this preliminary investigation, replacing only the 4 split systems with units using HFC-410a will not achieve a score below 100. Consider replacing all apartment AC units with equipment using a more environmentally preferable refrigerant such as HFC-410a. Also, consider using equipment with lower refrigerant charge (pounds of refrigerant per ton of cooling).
EAc6 – Emission Reduction Reporting

**ACTION STEPS**

1. Track utility data related to onsite fuel use and electricity consumption.
2. Calculate associated emissions using third-party voluntary reporting programs.
3. Produce documentation of participation in a third-party reporting program.
4. Provide a summary of actions relating to energy efficiency, renewable energy, and other building energy emissions reductions, including renewable energy credits, and estimate the relative contribution of each action.

**POINTS: 1**

Identify, track, and record energy-related emissions reductions and report to a formal tracking program.
At A Glance

- Moderate Cost
- Portfolio-wide
- Calculation
- Measurement & Verification

Credit Highlights

- Utilizing data tracking system (YARDI) will help to lower documentation & calculation costs
- Benchmarking each property gives CHA accurate emissions profile

### EAc6 | Emission Reduction Reporting

<table>
<thead>
<tr>
<th>Intent</th>
<th>To document the emissions reduction benefits of building efficiency measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Impact</td>
<td>MODERATE COST - due to emissions study</td>
</tr>
<tr>
<td>Comment</td>
<td>• Currently no system in place for tracking and reporting emissions.</td>
</tr>
</tbody>
</table>
| Next Steps | Performance Period
• Establish a baseline for the building and report the reduction in greenhouse gas emissions using a third party voluntary reporting or certification program during the performance period.

• Provide a summary of renewable energy sources, efficiency measures, etc. outlining how greenhouse gas emissions were reduced.

• Complete a Carbon Footprint report for the site. |
THANK YOU

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