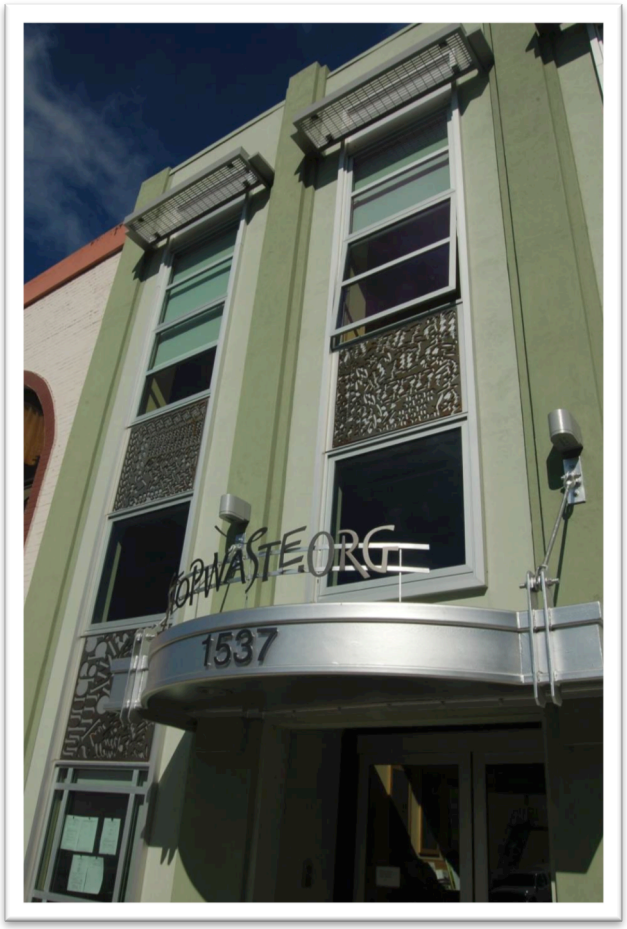

Ongoing Commissioning Plan

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Ongoing Commissioning Program

Introduction

Property Management has completed the implementation of outlined low cost and no cost energy efficiency improvements identified in the ASHRAE Level II study by Enovity, Inc, at StopWaste of Alameda County, located at 1537 Webster St. located in Oakland, Ca. The resulting efficiency improvements reflect an annual utility cost savings of approximately $2,137or %10.6 of total utility costs.

Ongoing Commissioning Plan (OCP)

The following is intended to identify steps that should be taken periodically by the facility manager and building technicians to ensure the implemented ASHRAE Level II measures and associated energy savings persist over time. These steps include:

1. **ASHRAE Level II Results:** The plan summarizes the measures implemented as a result of the ASHRAE Level II process including specifically what changes were made.

2. **Building Maintenance Plan:** The plan includes a description of what facility staff should do to ensure optimized system operation persists over time.

3. **Tracking Building Energy Performance:** The plan includes a description of what facility staff should do to track and verify optimized system operation persists over time. This includes benchmarking and energy use analysis.

4. **Reviewing Training Needs:** The plan outlines the training that has been provided as part of the ASHRAE Level II process along with recommendations for future training and education for both building management and facility operators.

The following documents are available to assist the building staff in carrying out O&M activities that ensure the ASHRAE Level II benefits last.

Overview of Facility

The following ongoing commissioning program includes StopWaste.org and all building systems listed in this program. All new systems added to the building, will also be added to this commissioning program.

Ongoing Commissioning Team

The management staff at StopWaste.org at 1537 Webster St. will be responsible for completing the ongoing commissioning program every 24 months. They will also coordinate and organize any vendors and/or specialists needed to complete the commissioning process. The engineering and management staff will also be responsible for providing training to all employees and vendors involved in the commissioning process. The responsible party will be the individual responsible for the commissioning process. (See

Appendix A)

Ongoing Commissioning Goals and Scope

The primary goals of this commissioning program are to identify cost-effective reductions in energy consumption as well as improve the environment for building occupants working environment. The scope consists of all systems in the building. An energy use breakdown will also be performed during each commissioning cycle.

Building Systems Included in the Program

All building systems included in the program can be found on the document titled "*Building Systems Narrative*". This list will be updated as new building systems are installed or updated. For further description of each system, please refer to the document titled Building Systems Narrative. All procedures and operational practices can be found within the document titled "Preventative Maintenance Plan". For all information regarding mechanical drawings, equipment specifications, and operations and maintenance manuals, please contact the Chief Engineer. For all information regarding utility bills and operating documents, please contact the Senior Property Manager.

Ongoing Commissioning Cycle and Schedule

A commissioning report will be completed on a reoccurring 24-month basis at which time all no cost/low cost items identified will be completed within 60 days of the report. In addition, half of the scope of improvements identified in the commissioning report must be completed during each commissioning cycle. The commissioning cycle will take place during the first quarter, every 2 years. The following steps will be followed:

1. Make any necessary changes to this plan regarding new responsible parties, upgraded equipment, etc.
2. Plan a time for commissioning agent to come on-site to perform audit
3. Within 60 days, complete all recommended low and no cost efficiency measures.
4. Within 6 months, complete 50% of recommended capital intensive items. Within 2 years, complete all financially feasible capital-intensive items.

Commissioning Cycle Budget & Capital Plan

The cost of this commissioning process will be negligible. All items that cannot be completed in-house will be completed through a third party auditor. Using the previous commissioning cycle costs will be a basis for the next commissioning cycle budget. The budget for the next commissioning cycle is $17,500. This includes all consulting costs as well as recommendation implementations.

Monitoring, testing, and performance verification plan

Responsible Party: Nathan Greene, Facility Manager, StopWaste

The building uses a standard procedure for monitoring testing and performance verification. All operating levels for building systems can be found in the preventive maintenance program as well as the building equipment list in this program. Monitoring

and Testing of the BAS trend logs and portable data loggers will continue to take place as frequently as recommended by the manufacturer of such systems. The responsible party will be responsible for ensuring these trend logs are kept. Reports will be created to help disseminate the information to appropriate staffing members and corrective action will take place.

Sensors and Test Equipment Calibration

All sensors and test equipment will be calibrated by the manufacturer's recommended intervals. The responsible party will be responsible for ensuring proper calibration.

Issue Identification and Response Protocols

Issue identification and response will be dealt in order of importance, deemed by the building engineer. No cost and low cost issues will be addressed immediately while more capital intensive issues will be addressed depending on their economical feasibility.

Ongoing Commissioning Action Plan

Please see the ASHRAE Level II Report for all program costs, savings, and payback periods related to the current commissioning cycle. A plan has been created to complete the remaining capital-intensive upgrades.

Preventative Maintenance Plan
Responsible Party: Nathan Greene, Facility Manager, StopWaste
This document outlines the updated sequence of operations for all HVAC and lighting control systems, as well as integration of the fire/life safety and HVAC systems.

ASHRAE Level II Report
Responsible Party: Henry Summers, Project Manager, Enovity, Inc.
This document provides a list of low cost, no cost and capital-intensive measures recommended for implementation.

Building Operating Plan
Responsible Party: Nathan Greene, Facility Manager, StopWaste
This document describes which sensors should be calibrated, how frequently they need to be checked, and the acceptable measurement range between the sensor and a hand-held calibrated device. Please see the attached Systems Narrative for a complete list of all equipment utilized on the project site.

Investigation and Analysis

Objective
The primary objective of ASHRAE Level II at this facility was to identify deficiencies in the operation of a facility's mechanical equipment, lighting, and related controls, and determine opportunities for corrective action and other operational and maintenance improvements that reduce energy consumption and demand.

Implementation
To perform the investigation, Henry Summers from Enovity, Inc. assessed the facility's equipment and operations. Functional performance testing was used to verify the intended operation of individual components and systems under various conditions and modes of operation, and analysis of system data occurred as follows:

- Functional testing procedures were performed for
    - Thermafusers
    - actuators and OSA dampers
    - all system sensors
- General operational testing was provided for the package units
- Full assessment of the calibration requirements of sensor and communicative BAS devices

Procedures not completed as part of this ASHRAE L2 investigation and analysis phase and will need to be conducted at least quarterly over the following 12 month period:

- BAS Alarm Testing
- BAS Point trending

Results

As a result of the ASHRAE Level II process, 7 measures were implemented:

1. EEM 1 – Reduce AC RTU Operating Schedules
2. EEM 2 – Reduce lighting runtime
3. EEM 3 – Repair and re-enable economizers
4. EEM 5 – Lower lights and runtime schedules
5. WCM 1 - Install low flow aerators on restroom faucets
6. O&M 1 – Calibrate Thermafuser VAV boxes
7. O&M 2 – Install filters upstream of OA sensors

Measures Considered but deemed inappropriate:

1. EEM 4 – New Premium efficiency rooftop units
2. SGM 1 – Install 7.7 kW DC solar PV array

The following table outlines all of the recommended measures as a result of the current commissioning cycle:

Measure Number	Measure Description	Annual Resource and Cost Savings					Payback with Incentive					
		Peak Demand Savings (kW)	Electricity Savings (kWh)	Gas/Fuel Savings (therms)	Water Savings (kGal)	Total Cost Savings	Measure Cost	Potential Utility Incentive	Measure Life (years)	Net Measure Cost	NPV*	Simple Payback (yr)
EEM 1	Reduce AC RTU operating schedules	0.0	3,100	60	0	$636	$200	$100	5	$100	$3,000	0.2
EEM 2	Reduce lighting run time	0.0	2,664	0	0	$501	$200	$100	5	$100	$2,343	0.2
EEM 3	Repair and re-enable economizers	0.0	2,100	410	0	$756	$5,800	$168	10	$5,632	$1,874	7.5
EEM 4	New Premium Efficiency Roof Top Units	0.0	3,900	0		$733	$32,800	$873	20	$31,927	($16,822)	43.6
EEM 5	Lower lights and install individual fixture Occ. Sensors	0.7	1,300	0	0	$244	$10,700	$105	10	$10,595	($8,167)	43.4
SGM 1	Install 7.7 kW DC Solar PV Array	7.7	10,200	0	0	$1,918	$28,500	$1,540	25	$26,960	$12,556	14.1
WCM 1	Install low flow aerators on restoom faucets	0.0	0	0	0.4	$7	$100	$0	20	$100	$43	14.4
O&M 1	Calibrate Therma Fuser VAV boxes	-	-	-	0	-	$2,700	-	-	$2,700	-	
O&M 2	Install filters upstream of OA sensors	-	-	-	0	-	$700	-	-	$700	-	
TOTALS		**8.4**	**23,264.0**	**470.0**	**0.4**	**4,794.0**	**81,700.0**	**2,886.0**		**$78,814**	**($5,216)**	**16.4**

Maintenance

This section of the Ongoing Commissioning Plan includes a description of maintenance procedures that should be performed by facility operators, including sensor calibration and updating sequence of operations as changes are made to ensure all documentation is accurate.

Measurement Requirements

Sensor Calibration

Calibrated sensors are key to proper ongoing operation of a system. This section describes techniques for calibration and general guidance for replacement of faulty sensors.

The two types of applicable sensor calibration are as follows:

Single Point Calibration

For most applications, single-point calibration is accurate enough for sensors that will typically only sense at one point or a relatively close range. For example, a cold-deck AHU discharge air temperature sensor can be calibrated at only one point since the control range is typically only about 15°F.

Multi-Point Calibration

Calibration should only be performed when accuracy over a range of values is important. For example, the secondary hot water supply temperature is often reset between 120°F and 180°F. To ensure the sensor is measuring accurately across the entire range, verify temperature readings at both the high and low end of the reset. Other sensors that may see wide variations in conditions are the outdoor air temperature and relative humidity sensors. It is recommended that a multi-point calibration be performed on these sensors as well.

Calibration/Replacement Methods

A typical method for temperature sensor calibration is to compare the control system display to a measurement from a calibrated instrument. The calibration should be made at a typical value for each sensor, by an instrument at least as accurate as the sensor that is being calibrated. Note that calibrating water flow meters is difficult, since it is not always practical to use a calibration flow meter at the same location. One possibility is to use a portable, strap-on meter in series with the permanent meter to verify flow. Another option is to measure differential pressure across a known device like a pump or triple duty valve. Use the pump or valve performance curves to estimate system flow based on measured pressure drop and compare this value to the installed flow meter reading.

Eventually a sensor will need to be replaced because either the sensor has failed or it cannot be calibrated accurately. If a sensor must be replaced, a field calibration check on the new sensor must also be conducted to ensure that the proper offset for the new sensor is programmed into the EMCS.

Calibration Plan Recommendations

The following list outlines recommendations related to sensor calibration:

- Sensors that are used directly in a control loop (drive the control loop) should be at minimum calibrated annually. Because the outside air sensor is often widely used in control loop applications (and is subject to more abuse than most sensors), it should be calibrated at least twice per year if not more often. Sensors should be calibrated when problems are found while monitoring VAV box operation. Space temperature sensors can also be calibrated whenever there is a trouble call or comfort call for a particular space in the building.

- The points used for troubleshooting and evaluating system operation/performance such as mixed air temperature sensors can be calibrated less frequently.

- Sensor calibration should be added to any existing preventive maintenance program. This way, a work order will be issued to calibrate various sensors throughout the year, which ensures that all sensors eventually get calibrated within the recommended frequency

- In addition, any hand-held measurement device used to calibrate sensors should be recalibrated per the manufacturer's recommended interval. The instrument calibration should be added to the PM program to remind the facility staff when it's time to send the instruments in for calibration.

- A list of points, acceptable ranges, and frequency of calibration has been compiled for each major HVAC system.

Calibration/Replacement Tracking

Instrument Type	Make	Model	MFG recommended Calibration Interval
CO2 Sensor	Veris	CW Series	5 years
Temperature Sensor	Veris	TDDAM11	No calibration required
Thermally Powered VAV Diffuser	Thermafuser	ST-HC 24”x24”	Annual (Per Cx recommendation)
Thermally Powered VAV Diffuser	Thermafuser	TK-HC 12”x12”	Annual (Per Cx recommendation)
Thermally Powered VAV Diffuser	Thermafuser	TLW-CW	Annual (Per Cx recommendation)
Daylight Photosensor	Wattstopper Lightsaver	LS-290C	5 years
Outside air flow Transmitter	TBD	TBD	Annual

Update Sequence of Operations

Any programming or setpoint changes made to the building automation system over the course of time to meet the changing needs of the building should be fully documented in both the **Building Systems Sequence of Operations** and **Building Operating Plan** as applicable. This will ensure that accurate as-operated documentation is always available for facility operators. If a work order system is used to address trouble calls, place a check box or reminder to document any changes made on the Systems Sequence of Operations and Building Operating Plan on the work order form. *(Note that it may be necessary to update the as- built control drawings as well if significant modifications or additions are made to the control system.)*

Tracking Building Energy Performance Over Time

ENERGY STAR Benchmarking

ENERGY STAR's Portfolio Manager tool is used to benchmark whole building energy performance at the beginning and end of the ASHRAE Level II process (post-implementation) to provide a baseline for building performance. To fully capture the effect of ASHRAE Level II on the energy benchmark, it is necessary to re-benchmark one year post-implementation. The following table presents baseline benchmarks of the building's energy performance:

Table 3: Whole Building Energy Performance Benchmarks (From ENERGY STAR)

Period Ending	Site Intensity (kBTU/SF/yr)	Source Intensity (kBTU/SF/yr)
February 2013	475,901.5	1,156,896.3

Table 4: Comparison with National Average for Similar Buildings

Period Ending	Site EUI	Source EUI
February 2013	1,015,000.0	2,466,800.0

Energy Star's Portfolio Manager tool is updated on a monthly basis to ensure that the post-implementation benchmark is maintained or is improving over time.

Energy Use Analysis

Energy use tracking and analysis should be done at least monthly to help determine building-system performance deficiencies. Tracking monthly energy bills and making comparisons to the baseline data can help reveal possible energy use problems. For performing energy use tracking building engineering staff will evaluate energy consumption via Energy Star's Portfolio Manager. Please see the ASHRAE Level II report completed in November 2013 for the most recent analysis.

Review Training Needs

The following section outlines the training that should be provided to building management and facility operators to help ensure that the benefits of Ongoing Commissioning are long lasting.

Facility Management

- The primary method for tracking energy use over time is ENERGY STAR's Portfolio Manager. Management staff will receive training updates on the use of Portfolio Manager on an annual basis.

Facility Operators

- Review of all the identified and implemented ASHRAE Level II measures
- Review of the as-operated sequence of operations for all affected controls and equipment
- Instruction on how to implement the Calibration Plan into existing preventive maintenance program

Signed

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Nathan Greene, Facility Manager
StopWaste.org

Referenced Documents (See Appendix B):

- Building Systems Narrative
- Building Operating Plan
- Preventive Maintenance Plan
- ASHRAE Level II Audit report

Appendix A

Roles and Responsibilities

Table 1 - Contact Information

Contanct Information	Responsibility
Wes Sullens, Project StopWaste.org 510.891.6511 wsullens@stopwaste.org	• Owners representative and Project manager • Efficiency implementation assessment • Oversees and delegates action items associated with ongoing commissioning
Nathan Greene, Facility Manager Stopwaste.org ngreene@stopwaste.org	• Facility/Property Manager • Coordiantes and works with contractors on the implementation of all action items and efficiency measures
Levi Jimenez, Project Manager BuildingWise 831.920.8490 levi@buildingwise.net	• LEED Consultants • Provides guidance as ongoing commissioning pertains to LEED throughout initial certification and recertification • Plan development and
Henry Summers, Project Manager Enovity, Inc hsumers@enovity.com	• HVAC and General Engineering contractor • Commissioning Agent

Appendix B

Referenced Documents Attached

Building Systems Narrative

Building Operating Plan

ASHRAE Level II Report Summary