University of Maryland Center for Environmental Science
Agency Energy Plan (AEP)

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1. Executive Overview

A. Agency Information

UMCES has facilities throughout the state's regions: the Appalachian Laboratory (AL) in the mountains of western Maryland, the Chesapeake Biological Laboratory (CBL) at the mouth of the Patuxent River in Southern Maryland, the Horn Point Laboratory (HPL) on the Eastern Shore, the Institute of Marine and Environmental Technology on Baltimore's Inner Harbor, the Maryland Sea Grant College located in College Park and an Annapolis Office. These facilities allow UMCES to excel in bringing together interdisciplinary scientific studies in its pursuit of a greater understanding about ecosystems and the natural processes that unfold within them. Each laboratory is strategically focused on specific areas of research, education and scientific application, making UMCES among the few institutions in the world to examine a large ecosystem, the Chesapeake Bay and its watershed, in its entirety.

Figure 1 - UMCES Labs and Units Locations

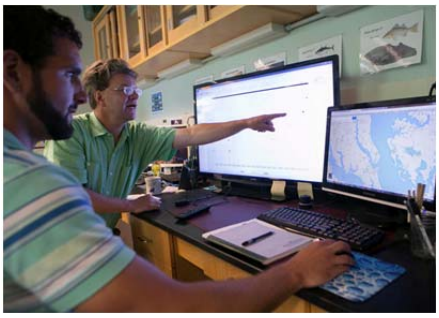
B. Energy Management

UMCES manages the facilities operations of its three labs: Appalachian Lab, Chesapeake Biological Lab and Horn Point Lab. The Institute of Marine and Environmental Technology (IMET) in Inner Harbor, Baltimore is managed by University of Maryland Baltimore County (UMBC) and Maryland Sea Grant is housed in a leased space in College Park, MD. The utilities consumption of each lab is primarily managed by the lab facilities personnel. The following lab sections will give further break down of the lab energy management team and energy consuming entities (ECEs).

C. Agency Energy Consumption Overview & Conservation Focus

As a Marine and Environmental Science Research Institution, UMCES labs consist of largely two building types; Laboratory buildings and Support buildings. The lab buildings are UMCESs' primary energy consuming entities (ECE) and also are vital instrument to achieve its institutional mission and mandates given by the State.






As an institution as a whole, nearly 85% of the energy cost is spent on purchased electricity. UMCES is continuously working towards energy efficiency. Currently, we are exploring a 2MWh on-site solar Power Purchase Agreement installation at Horn Point Laboratory to reduce our dependency on purchased electricity and its expected incremental cost increase. Energy consumption and conservation measures by each lab will be discussed in the following chapters.

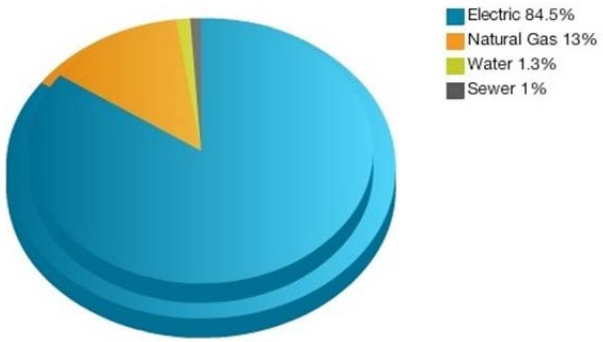


Figure 2 - UMCES - Agency Energy Cost Percentage

2. Appalachian Laboratory (AL)

A. Overview

The Appalachian Laboratory campus in Frostburg Maryland currently includes 4 buildings: The main laboratory/administration building (42,843 Gross Square Feet (GSF)); the greenhouse (4,266 GSF); a chemical storage building (363 GSF) and a garage (855 GSF), comprising 48,327 GSF of building space. The building was constructed in 1997 and is distributed over three floors – two floors in the lab side and two floors in the administrative side comprised of administrative office spaces, classrooms and laboratory spaces. The facility is relatively new and therefore employs many newer energy efficient technologies such as T8 lamps and electronic ballast's, variable flow fume hoods with occupancy sensors and integrated DDC controls on the Heating, Ventilating and Air Conditioning (HVAC) systems.

All buildings currently share the same utility meters numbers are provided on a campus wide scale. Without a separate meter on each building, it is not possible to break out the usage by individual buildings.

The main lab building is separated in to several specific use and occupancy sections. One wing of the building is used as administrative offices that are typically occupied Monday through Friday from 8AM to 5PM. The other section of the building is dedicated to laboratory spaces and classrooms. The laboratory spaces can be occupied anytime during the day or evenings since building occupants have access to the building after hours. However, according to the facility staff, classrooms and laboratories are occupied mostly during normal business hours on weekdays.

The AL facility staff is currently acting on the list of recommendations provided by the site audit completed in April 2009 as part of the Energy Performance Contract (EPC) with Constellation Energy.

B. Lab Management Team

Table 1. UMCES Appalachian Laboratory Energy Management Team

Name	Team Role	Phone	Email	Function
Barbara Jenkins	Lab Energy Coordinator (LEC)	301-689-7115	bjenkins@al.umces.edu	Manage and Lead Energy Team & Plan
Heather Johnson	Finance Agent	301-689-7111	hjohnson@al.umces.edu	Bills, Invoices, Project Costs
Cami Martin	Energy Agent	301-689-7106	cmartin@umces.edu	Assist AEC with data collection
John Piasecki	Facility Manager	301-689-7192	jpiasecki@al.umces.edu	Project manager, building procedures & facts

C. Lab Energy Consuming Entities (ECEs)

Table 2: Energy Consuming Entities								
ECE	**Location Site Description**	**Size Sq Feet**	**Occupancy Type/ People in Space per Day**	**ECE Age, Last Renov.**	**ECE Energy Usage / Annual amounts based on FY 2015 reads**			
					Electricity – kWh	**Natural Gas – MMBTUs**	**Water– Gallons**	**Fuel Oil - Gallons**
Main AL Building, Greenhouse Garage, and Chemical Storage	301 Braddock Road Frostburg MD	48327	Faculty, Staff and Students Approx: 30 per day	Constructed 1998 – never renovated	1240259	4196	156260	595 (this is an average based on full replacement)

D. Existing Conditions and Proposed Energy Conservation Measures (ECMs):

Specific preliminary energy conservation measures include:

ECM#1: Installation of Variable Frequency Drives (VFDs) on the central plant distribution Chilled Water (CW) and Hot Water (HW) pumps.
ECM#2: Installation of VFDs on the fume hood exhaust fan.
ECM#3: Air Balancing/Retro-Commissioning building Air Handling Units (AHUs).
ECM#4: Metasys (direct digital controls) DDC Control Retro-Commissioning – operation checks and control re-calibration due to age.
ECM#5: Retrofit lamps to 25 watt.
ECM#6: Retrofit Metal Halide Lamps to T5.
ECM#7: Building Envelope: Caulking and Sealing.
ECM#8: Insulation of brick wall that connects to lobby glass curtain walls.

All measures relate to the main facility only, there were no ECMs noted during the energy audit for the three out buildings that would make any difference in their energy use.

D.1 Central Heating Plant

The facility is served by a central chiller and boiler plant located within the lower level main mechanical room. Two Cleaverbrooks, Model# CB200-50 hot water boilers provide primary heating water during the winter months and reheat water during the summer months. Each boiler is rated at 2,095 MBH input. However, only one boiler is required to meet the peak heating demand during the winter months. Both boilers appear to be in good condition and contain standard Cleaverbrooks burners and fire controls. The boilers operate with natural gas and

have #2 fuel oil backup. Hot water is circulated from the central boiler plant to the building via a primary/secondary pumping arrangement. Primary heat pumps are rated at 7 ½ HP and operate at constant speed to circulate water through the main boiler plant. Re-heat pumps, rated at 10 HP, circulate hot water to the reheat coils throughout the building. The re-heat pumps operate at a constant speed with all re-heat coils containing 3-way control valves for recirculation of water. According to the Laboratory facility staff, the heating water distribution pipes utilize Victaulic piping within the mains. Branch piping connections utilize dielectric unions to transition from Victaulic piping to copper piping that is routed to each heating/re-heat coil throughout the building. Boilers are controlled by Facilities Explorer to run according to outside air temperature at set points designated by the facility manager.

D.2 Central Chiller Plant

Cooling during the summer months is provided by a central chilled water plant located on the mechanical pad adjacent to the mechanical room. Two Trane air-cooled chillers, Model# RTAA-125, provide chilled water for cooling at the main air handlers serving all wings of the building. The chillers can operate at any time during the year to provide cooling to the building as needed. The primary facilities system monitors operation of the chillers and provides staging automatically to meet the cooling demand of the building. According to the facility staff, only one chiller is needed to meet the maximum cooling demand during the summer months. Chilled water is distributed throughout the building to air handlers 1 and 2 by 20 HP constant volume pumps located within the main mechanical room. Overall, the chillers appear to be in good condition. Chillers are also controlled by Facilities Explorer to run according to outside air temperature at set points designated by the facility manager.

D.3 Central Plant Opportunities/Issues

D.3.a ECM-1: Variable Frequency Drives on pumps

Distribution pumps operate at a constant volume regardless of the cooling or heating load at the building. As the cooling, heating or reheat load is reduced, water flow requirements can also be reduced providing an opportunity for the installation of variable frequency drives on the distribution pumps. Many of the control valves within the building would need to be changed from 3-way valves to 2-way valves to permit variable flow operation. In 2016, all 6 pumps (2 heat, 2-reheat, and 2 chill) were replaced with newer, more efficient models. AL will investigate further on the installation of VFDs on these pumps.

D.4 Air Distribution and Ventilation Systems

Each section of the building is served by separate air handlers. The lab and classroom area is served by a large Governair 100% outside air unit (AHU #1) that provides make-up air to the laboratories. The supply air fan on the Governair unit utilizes a variable frequency drive to control the volume of airflow. The exhaust air from the fume hoods is controlled by an actuator that varies the flow based on the position of the fume hood sash. The main exhaust fan for the fume hood system uses a 40 HP motor. The fan system utilizes a by-pass to maintain flow through the fan while the VAV controllers modulate the flow through the hoods. The administration wing of the building is served by a Trane air handler (AHU #2), Model #MCCA017 that provides VAV operation with variable frequency drives (VFD). Heating is provided by hot water baseboard around the perimeter of the building in office and general use areas. Laboratories have VAVs to control heating.

The fume hood airflow is monitored and controlled by a TSI Smartflow control system. The TSI system uses occupancy sensors and sash opening sensors to determine the proper airflow to maintain air velocity at 110 feet per minute. Many of the existing laboratories within the building are currently non-working labs. Fume hoods in these labs are in set-back mode when not in use.

D.5 Air Distribution Opportunities/Issues

D.5.a ECM-2: Variable Frequency Drives on Exhaust Fans

In 2015, the upgrade of the VFDs on the exhaust fans was completed. The 2nd floor of the building contains two fume hoods and the 3rd floor contains eight fume hoods. These fume hoods are exhausted along with the main building and laboratories by these fans. The fumes hoods are controlled by individual actuators. The addition of these variable frequency drives to control the operation of the exhaust air fans will significantly reduce the electricity consumption.

D.5.b ECM-3: Air Balancing

We worked with HydraAir, TSI and OZ to complete a laboratory wing test and balance, which syncs all systems and reduce energy use. The laboratory wing of the building air balancing was completed December of 2015.

D.5.c ECM-4: Direct Digital Control Systems

The HVAC and exhaust systems are, as of 2015, controlled by a newly updated control system, the Johnson Controls Facility Explorer with supervisory controllers for system wide coordination of building operations and energy management on a Niagara platform. The HVAC systems are operated in the occupied mode 24 hours a day. While many of the lab spaces require continuous operation, the administration area and

some lab spaces no longer used as labs can be set back during unoccupied time periods. The Facility Explorer control is capable of performing multiple energy management functions such as AHU discharge air reset, heating water reset, night setback and optimum start/stop. All energy management functions appear to be operational.

D.6 Lighting Systems

Lighting within the building is energy efficient 32 watt, T8 lamps with energy saving electronic ballasts. The lobby area contains 150 watt metal halide light fixtures around the ceiling. However, ambient light through the large glass area reduces the need for lights during the day.
Only emergency lighting remains 24/7, other areas are lit as needed.

D.7 Lighting Opportunities/Issues

D.7.a ECM-5: Retrofit lamps to 25 watt

The existing 32 watt lamps can be replaced with newer 25 watt lamps with new super saver electronic ballasts to reduce electricity consumption. Reflectors can be added to fixtures where light levels are lower to improve foot-candles.

D.7.b ECM-6**:** Metal Halide to Fluorescent Retrofit

The existing 150 watt metal halides within the lobby area should be replaced with new T5 fluorescent fixtures to reduce the energy consumption of the high bay fixtures. The current recommendation includes a one for one replacement of the existing HID fixtures with new T5 fixtures. A current FY 2017 project request will replace the 12 metal halide bollard light fixtures at the main entrance with 4 new energy efficient LED models. Additionally, AL is looking at options to replace exiting metal halide parking lot lamps with energy efficient LED models.

D.8 Building Envelope

The building is approximately 18 years old and appears to be in good condition. Several issues with the building envelope were identified by the facility staff during the on-site audit. These are identified below under the respective Energy Conservation Measures (ECM's):

D.9 Building Envelope Opportunities/Issues

D.9.a ECM-7: Caulking/Sealing to Reduce Infiltration

The facility staff indicated that they have caulked or sealed many areas

after construction to reduce air infiltration. The building exterior has been thoroughly reviewed to determine the condition of the existing building seals and caulk. Seams and cracks around the exterior perimeter of the building are re-caulked as needed to reduce both air infiltration and the building heating load.

D.9.b. ECM-8: Insulation on Brick Wall
It is recommended that insulation panels be added along the edge of the windows on top of the brick wall to reduce heat losses. A two-foot insulation panel running vertically from the floor to the high bay ceiling will help reduce heat transfer along the brick wall and behind the window frame during the winter months.

D.10 Funding and Procurement Strategies

In November 2011, AL began an Energy Conservation Project to address these Energy Conservation Measures (ECMs). The installation of the VFD's on the exhaust fans was initiated as it was determined this would provide the most return in savings on both our budget and energy consumption and would be done in conjunction with our building controls upgrade. However, it was found during a building assessment that all but two actuators and most of the transducers were functioning improperly and needed to be replaced. So in order to reap the full benefits of the modification to the exhaust systems, a building wide update of the TSI actuators and transducers was completed in 2015. With these completed, a building wide test and balance was done to sync all systems. This completes energy conservation measures 2, 3 & 4.

D.11 Timeline

As of July 2016, the ECM 2, 3 and 4 are complete.

E. Energy Data

The following tables show energy use data since 2008. The fuel oil data is averaged over the past 16 year based on the total amount that has been purchased. The tank is not filled on an annual or even regular basis, it is only filled as needed.

Table 1: Electricity	
FY	**KWH**
FY08	1471911
FY09	1315555
FY10	1263923
FY11	1320272
FY12	1424627
FY13	1314924
FY14	1329311
FY15	1240259

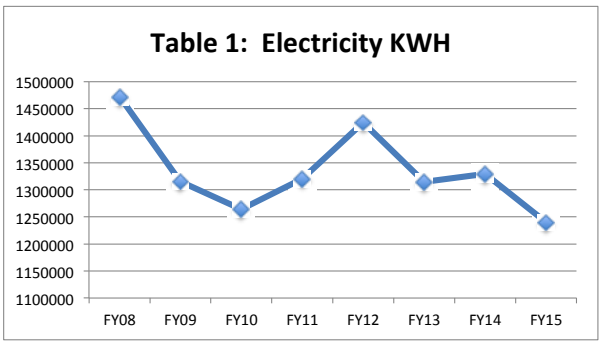


Table 2: Natural Gas	
FY	**MMBTUs**
FY08	6730.432
FY09	7376.119
FY10	6634.42
FY11	7145.353
FY12	6470.511
FY13	6477.905
FY14	6902.364
FY15	4196.425

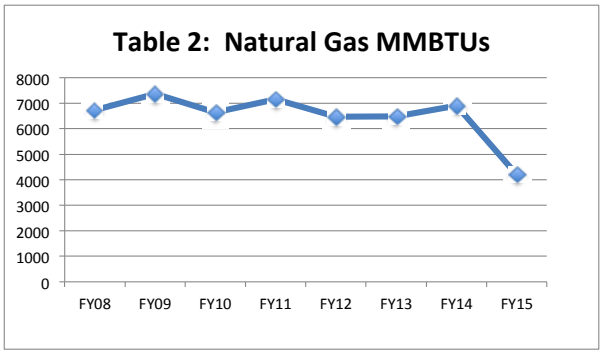


Table 3: Wastewater	
FY	**Gallons**
FY08	270300
FY09	187800
FY10	159200
FY11	374500
FY12	239810
FY13	332520
Fy14	203660
FY15	156260

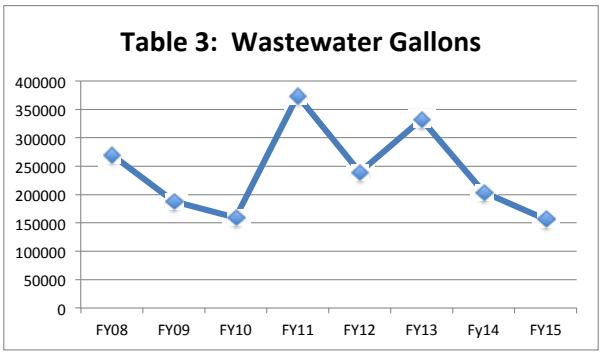
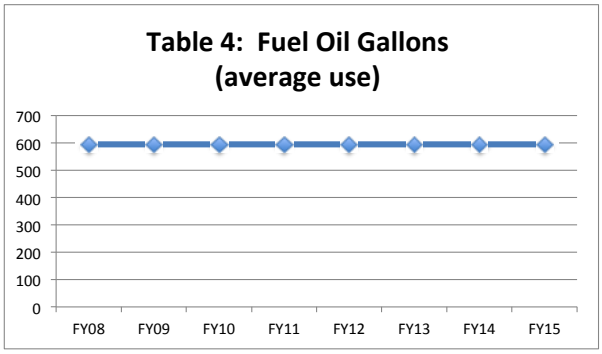


Table 4: Fuel Oil (avg)	
FY	**Gallons**
FY08	595
FY09	595
FY10	595
FY11	595
FY12	595
FY13	595
FY14	595
FY15	595



F. Current Energy Conservations Measures

In order to conserve energy, the following strategies have already been or are being implemented. As reflected in the previous tables, energy usage has fluctuated over the past 6 years, however there is a decrease in overall energy use at AL since 2008. These can be attributed to the adjustment and streamlining of facility practices. Areas such as increased recycling followed by a reduction in solid waste disposal, light, heating and cooling conservation both by building and individual offices, and increased use in video conferencing all contributed to a decrease in energy use.

F.1 Administrative Practices

Through our Capital Improvement Planning process, AL will ensure that all new buildings, renovations and additions are built to meet or exceed the LEED Silver Certification. New buildings, when construction is necessary, will employ the latest technologies and be designed with upfront commitment to energy efficiency that will reduce GHG emissions and lower operating costs.

Facilities Renewal projects will incorporate "green" upgrades and improvements into existing buildings in order to build a more sustainable campus.

To avoid increasing our energy use with new buildings, we will continue to maximize the use of existing spaces, and will investigate ways to renovate, modernize and retrofit unused or less desirable areas to meet new needs and avoid the necessity for additional construction.

F.2 Facilities Operations

Heating and cooling thermostats are programmed to operate in occupied mode 24 hours a day with minimum and maximum thresholds established for many building zones as most of the lab spaces require continuous operation. If necessary, when an area is unused for a longer stretch of time, the thermostats can be set back during this unoccupied time period for maximum efficiency. Additionally, all windows were re-caulked and sealed in March 2008 to prevent unnecessary heating and cooling losses.

Landscaping has been simplified to minimize maintenance, i.e. grass has been planted in previously mulched / bedded areas to decrease maintenance costs, both employee time and materials. Additionally, a natural species meadow has been planted on the grounds as a demonstration area and to reduce maintenance efforts.

AL's Recycling and waste minimization program makes provisions for recycling the required glass, plastic (1&2), aluminum and paper to be in compliance with Environment Article § 9-1706 (b) and (c) of the Annotated Code

of Maryland through the Allegany County Recycling program. Additionally our program also includes mixed cans, cardboard, batteries, lamps, books, toner, white goods, and electronics. Continued recycling efforts have enabled AL to keep our solid waste to a minimum since 2007, when the amount of solid waste was decreased from a dumpster pickup once a week to once every-other week.

AL maintenance staff has significantly increased preventative maintenance on aging equipment to gain as much energy efficiency as possible and we are replacing non-energy efficient equipment with newer Energy Star models when available and when replacement is necessary.

In areas that have been over-lit, extra lamps are removed. This is a simple, cost-less way to reduce electricity use. Almost all offices and labs have windows, so de-lamping in these areas goes mostly unnoticed.

F.3 Procurement Practices

AL will continue to augment the fleet with flex fuel, energy efficient vehicles when appropriate and fiscally possible.

AL paper purchases will, at a minimum, contain 30% post-consumer recycled paper. In October 2009 we moved to 100% post-consumer recycled paper. Other recycled office products & food service items will be purchased when available.

The University System of Maryland is committed to purchasing energy efficient and environmentally friendly products and provides tools and quick tip sheets to help locate and purchase these environmentally friendly products. Both of the approved USM Master Contracts for office supplies now include an extensive selection of green products.

F.4 Technology Practices

New IT purchases look to computer systems that support video and sound so that meetings can be held for small groups over web based conferencing software. This software is normally open source or fairly inexpensive, simple to use and has helped eliminate the need for faculty and staff to travel in order to keep research collaborations and business communications open.

AL's IT administrator is moving toward virtualization, one path on the rapidly growing Green IT road. Virtual machines have allowed the power down of 12+ servers without affecting applications or users. This is a significant decrease in energy consumption and cost without a decrease in the service

provided to the AL community. Virtualization has eliminated wasteful network equipment and has reduced energy consumption and floor space requirements.

Many office users are opting for laptop computers instead of traditional desktop computers. In addition to providing portability, these machines can use as little as 25% of the electricity of a standard desktop computer and monitor.

Over long breaks and holidays, only the main critical systems in the computer center remain powered on, all other systems are powered off.

As stated earlier, all obsolete or damaged IT equipment is cannibalized and then e-cycled through the county recycling program. As newer equipment is purchased based on computational need, older viable equipment is re-deployed to areas with less demand.

F.5 Transportation Practices

AL fleet manager will continue to assign fleet vehicles based on needs and fuel efficiency. The large 4WD vehicles are not assigned for single person trips or used for non-field related travel except when absolutely necessary.

Due to our remote location, public transportation does not play a major role in our transportation practices and policies. However, The Bayrunner shuttle is now available daily for trips to and from the BWI airport from Frostburg. Additionally, many faculty and staff live locally, so biking and walking to work are often standard practice and have been encouraged by providing safe, dry, inside storage areas for bicycles.

AL and UMCES have evaluated the location and distances traveled to frequent administrative meetings, revising schedules and, when appropriate, substituting the Interactive Video Network, or web based conferencing programs such as Polycom PVX and Skype desktop solutions, in lieu of face-to-face meetings.

3. Chesapeake Biological Laboratory (CBL)

A. Overview

The Chesapeake Biological Laboratory (CBL) campus in Solomons, Maryland is a marine research facility of the University of Maryland Center for Environmental Sciences (UMCES).

The Chesapeake Biological Laboratory was founded in 1925 and is home to approximately 120 scientists, graduate students and staff. CBL has a long history of excellence in fisheries science and environmental chemistry. The CBL campus is located at the mouth of the Patuxent River 60 miles SSE of Washington, D.C.

The campus consists of 20 buildings consisting primarily of laboratories, offices and general occupancy areas.

The CBL facility staff recently completed the list of recommendations provided by the site audit performed in July 2008 as part of the Energy Performance Contract (EPC) with Constellation Energy. Additionally, the CBL facility staff continues to identify energy improvements and act upon them as feasibly possible.

B. Lab Management Team

Table 1. UMCES Chesapeake Biological Laboratory Energy Management Team				
Name	**Team Role**	**Phone**	**Email**	**Function**
Stacy Maffei	Associate Director, Administration	41-325-7364	maffei@umces.edu	Manage and Lead Energy Team & Plan
Brian Duke	Manager, Facilities	410-326-7352	duke@umces.edu	Project and implementation Lead
Kenny Rager	Lead HVAC	410-326-7352	krager@umces.edu	Implementation Lead

C. Lab Energy Consuming Entities (ECEs)

Table 2: Energy Consuming Entities								
ECE	**Location Site Description**	**Size Sq Feet**	**Occupancy Type/ People in Space per Day**	**ECE Age, Last Renov.**	**ECE Energy Usage / Annual amounts based on FY 2015 reads**			
					Electricity – kWh	**Natural Gas Therms**	**Water – Gallons**	**Fuel Oil - Gallons**
Beaven Hall	150 Farren Ave	9280	Admin Offices, Library, faculty and Students	Constructed 1932	51,760	N/A	18,790	

			Approx: 30 per day					
Becker House	145 Charles St	2417	Teaching lab, apartments	Constructed 1920	12,194	493.5	8,900	
Carey House	148 Charles St	1100	Faculty housing	Constructed 1930	5,684	923.1	19,450	
Chemical Storage	132 Williams St	3,000	Scientific equipment & sample storage	Constructed 1993	56,870	5,658.7	3,000	
Coastal Technologies Lab	144 Charles St	4,500	Faculty and research	Constructed 1982	62,880	N/A	n/a	
Bernie Fowler Laboratory	142 Williams St	25,860	Faculty offices and research laboratories	Constructed 1994	1,604,640	158,986.70	116,5600	85
Cory Hall And Nice Hall	125 Williams St	5,104	Faculty offices and research laboratories	Constructed 1961	174,180	n/a	n/a	
Kopp House	160 Farren Ave	2,245	Faculty offices and apartment	Constructed 1940	30,390	n/a	19,790	
Maintenance	100 Williams St	4,412	Offices and maintenance facility	Constructed 1952	42,720	n/a	32,720	
Mansueti Lab	146 Williams St	10,176	Faculty offices and research laboratories	Constructed 1980	269,520	58.5	n/a	7400
Nice Hall	121 Williams St	7,200	IT Department, dormitories, meeting space	Constructed 1938	w/Cory 1 acct.	n/a	216,400	
Northam House	170 Farren Ave	1,440	Offices & Storage	Constructed 1960	10,329	n/a	10,470	
Parish House & Garage	180 Farren Ave	2,241	Offices & Storage	Constructed 1960	42,720	560.4	17,240	
Seawater Pump House	n/a	433	Seawater pump equipment	Replaced 2013	n/a	395.8	n/a	
RV Truitt Lab	129 Williams St	13,911	Facility closed	Scheduled for demolition in 2014	25,320	n/a	n/a	139
RV Truitt Extension (Cronin)	129 Williams St	12,157	Faculty offices and research laboratories	Constructed 2007	n/a	n/a	n/a	
Saunders House	140 Charles St	2,570	Faculty Offices, conference rooms	Constructed 1920	27,276	n/a	20,980	
Solomons House	200 Farren Ave	2,210	Visitor Center	Constructed 1880	24,653	n/a	67,320	
Swift House	136 Williams St	4,244	Faculty and Student offices	Constructed 1930	19,883	n/a	13,900	128

Chiller	Truitt & Truitt Extension	n/a	n/a	n/a	185,520	n/a	n/a	

D. Existing Conditions and Proposed Energy Conservation Measures (ECMs):

Specific preliminary energy conservation measures include:

ECM#1: All-Campus energy efficient lighting and control upgrade.
ECM#2: BFL Building – Lab hood controls – centralized exhaust – heat recovery
ECM#3: Building Envelope Improvements
ECM#4: Sea Water Pump Building – Install 20 HP VFD on sea water pump
ECM#5: Update Honeywell Control System Software
ECM#6: Nice Hall and Beaven Hall Window Replacement
ECM#7: Storage Building HVAC System Replacement
ECM#8: Comprehensive Window Replacement at Beaven Hall
ECM#9: HVAC Split-System Replacement at Coastal Technologies Building
ECM#10: Emergency Lighting and Exit Fixture Replacement

D.1 Existing Systems and Campus Equipment

The primary energy users in each building are lighting systems, HVAC systems and various laboratory equipment. The boilers located in the Bernie Fowler Laboratory and Mansueti Laboratory supply steam to seven core buildings through an underground loop. There are two 125 HP steam boilers in the BFL and two 100 HP steam boilers in the Mansueti Laboratory. The boilers in each building run as a dedicated boiler plant. These boiler plants cannot operate together as they share a common feed water and condensate return system.

The boilers in the BFL building fire on natural gas as the boilers in the Mansueti Building fire on #2 fuel oil. The university runs the boilers in the BFL building during the core winter months. The boilers in the Mansueti Building run during the summer months when oil tends to be cheaper than natural gas. The seven buildings that receive central steam are the BFL, Mansueti, Truitt Laboratory, Cory Hall, Beaven Hall, Nice Hall and the Cronin Complex.

The campus receives cooling from dedicated cooling units throughout the campus. The Truitt Building and the Cronin Complex have one chiller that serves both buildings. The campus operates on the EMS Honeywell Excel 5000 control system installed with the SynnetrE front end software package with graphic interface. The Honeywell system controls most of the major HVAC equipment throughout the campus. The Honeywell system does not control any laboratory equipment and there are no controls on the boilers in the Mansueti Building.

D.2 Control Opportunities/Issues & Solutions

D.2.a ECM #5: The control system has become outdated, although upgraded only seven years ago. In conjunction with the replacement of the R.V. Truitt Building, the entire campus will updated to the newest version of the Honeywell Control systems software. This upgrade will be completed by October of 2015.

D.3 HVAC Opportunities/Issues & Solutions

D.3.a ECM #5: During 2011 all stand-alone individual building heat pumps were replaced in an effort to increase efficiency and reduce energy consumption. In total, 22 units were replaced with higher-efficiency, EnergyStar units.

D.4 HVAC Opportunities/Issues & Solutions

D.4.a ECM #9: The Coastal Technologies Building at CBL has two (2) 5-ton split system units providing heating and air conditioning to the building. The units were original to the construction of the building (early 1980's), were not efficient in their delivery of conditioned air, exceeded their life expectancy and were not EnergyStar compliant. New units were installed in 2013 utilizing funding provided by Facilities Renewal.

D.5 HVAC Opportunities/Issues & Solutions

D.5.a ECM #7: The Chemical Storage Building HVAC system was identified in the Constellation comprehensive energy review as a project that needed attention. The Storage Building, used to store all of the laboratory chemicals and other general chemicals and samples, had poor ventilation and temperature controls. Proper storage and ventilation within this building is critical so that chemicals do not spoil, samples don't mold and life safety issues do not arise. The complete replacement of the system occurred in 2011. Although a reduction in energy was not realized, the system in place maintains the proper levels of humidity control and temperature control necessary for the conditions of the building.

D.6 Lighting Systems

During the campus walk-through in 2008 it was noted that lighting within the buildings on campus were a mixture of T8 and T12 linear fluorescent technologies. These fixtures are the main source of light in areas such as offices, labs, halls as well as utility and storage spaces. The T8 fixtures were found to have standard T8 ballasts and house 32 watt T8 lamps while the T12 fixtures

utilize standard T12 ballasts and 34 watt T12 lamps. Another major fixture type found in use is 2x2 troffer fixtures. On campus as a whole, more than 1,100 lighting fixtures exist.

D.7 Lighting Opportunities/Issues & Solutions

D.7.a ECM #1: In an effort to achieve energy savings all lighting fixtures have been upgraded and/or converted to T8, T5 or LED on the CBL campus. As funding becomes available, and lighting systems fail, the CBL campus will transition to an entirely LED campus environment.

D.7.b ECM #1: Additional efforts to improve efficiency and energy consumption, occupancy controls have been added to areas where the fixture density and ease of installation are present. Infrared occupancy sensors turn off the lights in the installed area after a set period of inactivity. Inhibitive photocell sensors keep lights off when ambient light levels are high enough to provide adequate lighting. These sensors have been installed in offices, labs, bathrooms and other common areas.

D.7.c ECM #10: Emergency lighting and Exit Signage throughout campus consisted of standard fixtures in full-mode operation 24/7. A comprehensive replacement of all exit fixtures and lighting occurred in 2013 which included LED emergency lighting that is self-testing and ambient light censored. The new fixtures reduced electricity consumption and do not require a full test mode monthly by staff, saving energy and staff resources. The project was possible utilizing Facility Renewal Funding.

D.8 BFL Building – Lab hood controls – centralized exhaust – heat recovery

The BFL Lab provides over 25,000 square feet of research laboratories for environmental chemistry, organic and trace metal geochemistry, biogeochemistry and microbial ecology. The building is made up of two floors with the center of the building dedicated to the laboratory rooms and the east and west wings dedicated to office space.

Each lab room utilizes one or more fume hoods as a means of protection from harmful vapors. The dedicated exhaust fan for the respective lab hood runs continuously at a constant volume 24 hours a day, seven days a week. Air Handlers #2 and #3 utilize 100% outdoor air to provide make-up air to the laboratories. There were no controls on the lab hoods and or the make-up air system. There are no controls to maintain building pressure. This had become a major problem for CBL if an exhaust fan should fail. The current HVAC system for this building operated inefficiently.

As a part of the Constellation Energy Audit the proposed modifications

included installing variable volume controls on the supply and exhaust air systems to reduce airflow as required to meet the immediate demands of each lab. Fume hoods were outfitted with occupancy sensors that reduce air flow from maximum to minimum air volume based on occupant presence at the hood. Fume hood were also outfitted with monitors to ensure adequate airflow is available and a safe working environment exists. Monitors provide proper alarming to bring the existing hoods to current code compliancy.

The existing utility-set exhaust fans were removed from the roof and exhaust ducts were tied together via a common exhaust manifold. Variable speed drives and associated controls were installed on the laboratory supply and exhaust fans to accommodate the variable flow of the proposed system. The VAV units installed control and maintain a positive and/or negative air charge by tracking and summing the CFM;s that are being exhausted by the hoods and the supply air required to condition the space.

Additionally a run-around heat recovery glycol loop was installed. The run-around system is a simply piping loop, containing a circulator pump. The warm exhaust air heats the circulating glycol loop and is then used to warm up the cool make-up air. The heat recovery system typically operates to preheat outdoor make-up air but also to pre-cool the make-up air when the exhaust air stream is cooler than the outdoor make-up air.

D.9 Fume Hood Opportunities/Issues & Solutions

D.9.a ECM#2: The identified project was set into place utilizing funding available through the State of Maryland SALP payback program as well as the SMECO Business Solutions Rebate Program. The benefits and energy savings from this project have been tremendous. CBL began seeing significant reduction in electrical usage within 6 months of the start of the project. Within those six months CBL decreased energy demand by 106,000 kilowatt-hours, which represents a 27% decrease in electricity consumption.

D.10 Window Replacement Opportunities/Issues & Solutions

D.10.a ECM#6: The CBL Campus consists of a wide variety of building types, including laboratories, residential structures and historic administrative buildings. Identified in the Constellation Energy Audit was the need for window replacements at Nice Hall and Beaven Hall. Nice Hall, built in 1938 and Beaven Hall, built in 1933 currently house administrative offices, dormitories, kitchen facilities for the campus and a lounge area. The windows in Nice Hall were original to the construction and Beaven Hall windows were replaced in 1995, however the replacement was with a low quality, non-efficient window. Both building have recently received full window replacements. The occupant comfort

level has significantly improved.

D.11 Building Envelope Opportunities/Issues & Solutions

D.11.a ECM#3: CBL is dedicated to improving the building envelope for all campus buildings. Several improvement projects have occurred since 2011 to ensure the comfort of staff within building and decrease draft and air exchange. These projects include door replacements at several campus building, new insulation within crawl spaces and attics, ductwork re-configuration to increase airflow and return as well as new window shades to divert direct sunlight in summer months.

E. Energy Data

The following tables show energy use data since 2010.

Table 1: Electricity	
FY	kWh
FY10	4,295,399
FY11	4,289,630
FY12	3,571,431
FY13	3,344,673
FY14	3,499,355
FY15	3,271,964

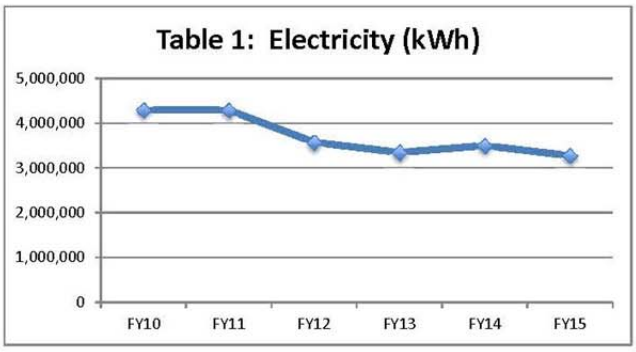


Table 2: Natural Gas	
FY	Therms
FY10	120,456
FY11	139,743
FY12	102,857
FY13	156,833
FY14	156,334
FY15	173,636

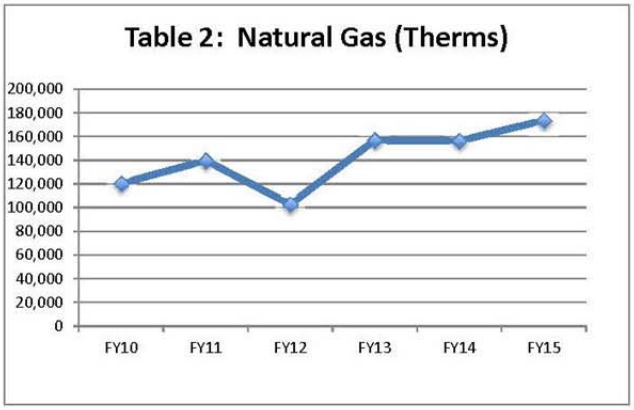


Table 3: Water	
FY	Gallons
FY10	1,278,924
FY11	1,302,046
FY12	1,243,776
FY13	1,304,090
FY14	1,051,580
FY15	1,634,860

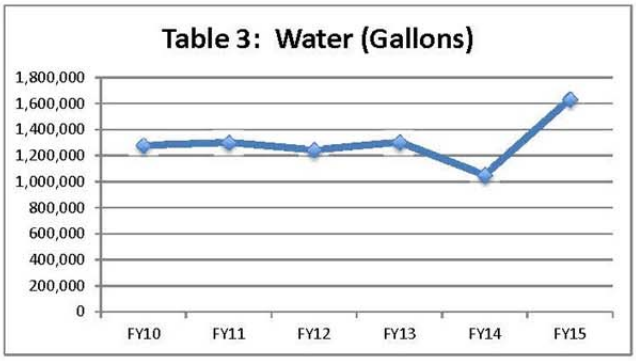
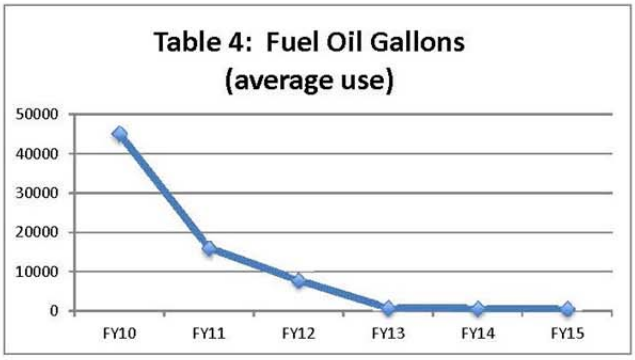


Table 4: Fuel Oil (avg)	
FY	Gallons
FY10	45175
FY11	16048
FY12	7841
FY13	800
FY14	700
FY15	546



F. Current Energy Conservations Measures

In order to conserve energy, the CBL campus is dedicated to implementing strategies that encourage energy conservation. Areas of concentration include things such as increased recycling followed by a reduction in solid waste disposal, lighting, heating and cooling conservation both by building and individual offices, and increased use in video conferencing.

F.1 Administrative Practices

Through our Capital Improvement Planning process, CBL will ensure that all new buildings, renovations and additions are built to meet or exceed the LEED Silver Certification. The current RV Truitt Replacement Project is in line to reach LEED Gold certification. New buildings will employ the latest technologies and be designed with upfront commitment to energy efficiency that will reduce GHG emissions and lower operating costs.

Facilities Renewal projects will incorporate green upgrades and improvements into existing buildings in order to build a more sustainable campus.

F.2 Facilities Operations

Heating and cooling thermostats are programmed to operate in occupied mode 24 hours a day with minimum and maximum thresholds established for laboratory buildings as these buildings are occupied or require consistent temperatures. Administrative buildings are set to set-back temperatures during off-hours.

CBL's recycling and waste minimization program makes provisions for recycling the required glass, plastic, aluminum and paper to be in compliance with Environment Article § 9-1706 (b) and (c) of the Annotated Code of Maryland through the Calvert County Recycling program. Additionally our program also includes mixed cans, cardboard, batteries, lamps, books, toner, white goods, and electronics.

In 2011 CBL Maintenance staff implemented a preventative maintenance plan utilizing our work order and scheduling software. Keeping equipment in tip-top running order keeps aging equipment operating at peak performance and allows for as much energy efficiency as possible. All new equipment purchased meets EnergyStar ratings.

F.3 Procurement Practices

CBL will continue to augment the fleet with flex fuel, energy efficient vehicles when appropriate and fiscally possible. CBL's paper purchases will, at a minimum, contain 30% post-consumer recycled paper.

The University System of Maryland is committed to purchasing energy efficient and environmentally friendly products and provides tools and quick tip sheets to help locate and purchase these environmentally friendly products. Both of the approved USM Master Contracts for office supplies now include an extensive selection of green products.

F.4 Technology Practices

New IT purchases include systems that support video and sound so that meetings can be held for small groups over web based conferencing software. Many office users are opting for laptop computers instead of traditional desktop computers. In addition to providing portability, these machines can use as little as 25% of the electricity of a standard desktop computer and monitor.

Over long breaks and holidays, only the main critical systems in the computer center remain powered on, all other systems are powered off. As stated earlier, all obsolete or damaged IT equipment is cannibalized and then e-cycled through the county recycling program.

F.5 Transportation Practices

CBL assigns fleet vehicles based on needs and fuel efficiency. The large 4WD vehicles are not assigned for single person trips or used for non-field related travel except when absolutely necessary.

Due to our location, public transportation does not play a major role in our transportation practices and policies. However, many faculty and staff live locally, so biking and walking to work are often standard practice and have been encouraged by providing safe areas for bicycle storage at every building. Designated parking locations are reserved throughout campus for car-pooling and alternative fuel vehicles.

4. Horn Point Laboratory (HPL)

A. Overview

The Horn Point campus includes 39 buildings spread across 850 acres of land. We are an environmental education and research facility. A large part of our utility demand is created from research projects and aquaculture processes. While mechanical and electrical upgrades will increase efficiency, many worthwhile advances can be made through increased integration and the eventual modification of research processes and procedures. We have made great strides in both of these areas and with continued effort and support from both faculty and staff we should be poised to exceed our goal of energy reduction.

B. Lab Management Team

Table 1. UMCES Horn Point Laboratory Energy Management Team

Name	Team Role	Phone	Email	Function
Jeffrey Miley	Assistant Director for Facilities	410-221-8464	jmiley@umces.edu	Manage and Lead Energy Team & Plan
Curtis Henry	Assistant Director for Finance	410-221-8417	chenry@umces.edu	Bills, Invoices, Project Costs

C. Inventory of Buildings and Energy Consuming Entities (ECEs)

The Horn Point campus located in Cambridge Maryland currently includes 39 structures including the UMCES Center Administration Building which total more than 214,000 GSF. These structures, along with other Energy Consuming Entities (ECE) are outlined in the table below.

		Section 1: ECE Data									
#	ECE Name	Address	Size (square feet)	Property Rights (Owned, Leased w/ Utilities or Leased w/o Utilities)	Occupancy			Date ECE Was Originally Built (Month-Year)	Date of Last Major Renovation (Month-Year)	Unoccupied Conditioned Space (square feet)	Shared Utility Account ? (Y/N)
					ECE Use	# Visitors/ Clients per day	# Staff per day				
1	Ambient Water Filtration	2020 Horns Point Road, Cambridge, MD 21613	672	Owned	Storage	5	0	?-1992		0	Y
2	Ambient Water Pump Station	2020 Horns Point Road, Cambridge, MD 21613	983	Owned	Mechanical Equipment Room	2	0	?-1992		983	Y
3	AREL Ozone Generator Shed	2020 Horns Point Road, Cambridge, MD 21613	192	Owned	Mechanical Equipment Room	1	0	?-2005		0	Y
4	AREL Research Laboratory	2020 Horns Point Road, Cambridge, MD 21613	65,600	Owned	Research Facility	10	45	?-2003		10,480	Y
5	UMCES Administration Well House	2020 Horns Point Road, Cambridge, MD 21613	225	Owned	Mechanical Equipment Room	0	0	?-1950		225	Y
6	UMCES Administration Building	2020 Horns Point Road, Cambridge, MD 21613	10,369	Owned	Office Space	4	15	?-1950	?-1978	4,800	Y

Section 1: ECE Data											
#	ECE Name	Address	Size (square feet)	Property Rights (Owned, Leased w/ Utilities or Leased w/o Utilities)	Occupancy			Date ECE Was Originally Built (Month-Year)	Date of Last Major Renovation (Month-Year)	Unoccupied Conditioned Space (square feet)	Shared Utility Account ? (Y/N)
					ECE Use	# Visitors/ Clients per day	# Staff per day				
7	Chemical Storage	2020 Horns Point Road, Cambridge, MD 21613	395	Owned	Storage	0	0	?-2002		395	Y
8	Coastal Science lab	2020 Horns Point Road, Cambridge, MD 21613	25,760	Owned	Office and Lab Space	10	40	?-1980	?-2010	2,332	Y
9	Coastal Science Well House	2020 Horns Point Road, Cambridge, MD 21613	240	Owned	Mechanical Equipment Room	0	0	?-1981	?-2010	240	Y
10	Compressed Gas Storage	2020 Horns Point Road, Cambridge, MD 21613	160	Owned	Storage	0	0	?-2005		0	Y
11	Dive Locker	2020 Horns Point Road, Cambridge, MD 21613	160	No Utilities							
12	IAN Facility	2020 Horns Point Road, Cambridge, MD 21613	1,584	Owned	Office Space	1	5	?-1925	?-2005	332	Y

Section 1: ECE Data											
#	ECE Name	Address	Size (square feet)	Property Rights (Owned, Leased w/ Utilities or Leased w/o Utilities)	Occupancy			Date ECE Was Originally Built (Month-Year)	Date of Last Major Renovation (Month-Year)	Unoccupied Conditioned Space (square feet)	Shared Utility Account ? (Y/N)
					ECE Use	# Visitors/ Clients per day	# Staff per day				
13	Environmental Education Canoe Shed	2020 Horns Point Road, Cambridge, MD 21613	720	No Utilities							
14	Environmental Education Activities Building	2020 Horns Point Road, Cambridge, MD 21613	7,165	Owned	Environmental Education Building	5	1	?-1993		189	Y
15	Environmental Education Residential Building -	2020 Horns Point Road, Cambridge, MD 21613	1,627	Owned	Dormitory	2	1	?-1993		0	Y
16	Environmental Education Residentail Building -	2020 Horns Point Road, Cambridge, MD 21613	1,627	Owned	Dormitory	2	1	?-1993		0	Y
17	Environmental Information Center	2020 Horns Point Road, Cambridge, MD 21613	3,523	Owned	Office Space	2	5	?-2011			Y
~~18~~	Fiber Optic Building	2020 Horns Point Road, Cambridge, MD 21613	~~108~~	~~Owned~~	Phone Equipment	~~0~~	~~0~~	~~?-2003~~		~~0~~	~~Y~~

		Section 1: ECE Data									
#	ECE Name	Address	Size (square feet)	Property Rights (Owned, Leased w/ Utilities or Leased w/o Utilities)	Occupancy			Date ECE Was Originally Built (Month-Year)	Date of Last Major Renovation (Month-Year)	Unoccupied Conditioned Space (square feet)	Shared Utility Account ? (Y/N)
					ECE Use	# Visitors/ Clients per day	# Staff per day				
19	Fish Systematics Lab	2020 Horns Point Road, Cambridge, MD 21613	672	Owned	Storage	0	0	?-1992		0	Y
20	Forest Classroom	2020 Horns Point Road, Cambridge, MD 21613	379	No Utilities							
21	Generator Building	2020 Horns Point Road, Cambridge, MD 21613	560	No Utilities							
22	Maintenance Complex	5745 Lovers Lane, Cambridge, MD 21613	12,800	Owned	Office and Shop Space	5	6	?-1982		2,700	Y
23	Maintenance Well House	5745 Lovers Lane, Cambridge, MD 21613	310	Owned	Mechanical Equipment Room	0	0	?-1982		310	Y
24	Visiting Faculty Residence	2020 Horns Point Road, Cambridge, MD 21613	1,503	Owned	Dormitory	0	3	?-1948	?-2002		Y

		Section 1: ECE Data									
#	ECE Name	Address	Size (square feet)	Property Rights (Owned, Leased w/ Utilities or Leased w/o Utilities)	Occupancy			Date ECE Was Originally Built (Month-Year)	Date of Last Major Renovation (Month-Year)	Unoccupied Conditioned Space (square feet)	Shared Utility Account ? (Y/N)
					ECE Use	# Visitors/ Clients per day	# Staff per day				
25	Morris Marine Well House	2020 Horns Point Road, Cambridge, MD 21613	300	Owned	Mechanical Equipment Room	0	0	?-1989	?-2010	300	Y
26	Morris Marine Lab	2020 Horns Point Road, Cambridge, MD 21613	26,500	Owned	Research Facility	5	10	?-1989	?-2010	4,161	Y
27	Museum Cottage	2020 Horns Point Road, Cambridge, MD 21613	1,005	No Utilities							
28	Museum Hanger	2020 Horns Point Road, Cambridge, MD 21613	2,458	No Utilities							
29	Oyster Cultch Facility	2020 Horns Point Road, Cambridge, MD 21613	2,200	Owned	Aquaculture Facility	1	4	?-2001		0	Y
30	Oyster Setting Facility	2020 Horns Point Road, Cambridge, MD 21613	21,000	Owned	Aquaculture Facility	4	4	?-2010		2,090	Y

Section 1: ECE Data											
#	ECE Name	Address	Size (square feet)	Property Rights (Owned, Leased w/ Utilities or Leased w/o Utilities)	Occupancy			Date ECE Was Originally Built (Month-Year)	Date of Last Major Renovation (Month-Year)	Unoccupied Conditioned Space (square feet)	Shared Utility Account ? (Y/N)
					ECE Use	# Visitors/ Clients per day	# Staff per day				
31	SAV Laboratory	2020 Horns Point Road, Cambridge, MD 21613	2,228	Owned	Research Facility	1	2	?-1986	?-2010		Y
32	Visitor Student Housing	2020 Horns Point Road, Cambridge, MD 21613	7,700	Owned	Dormitory	15	0	?-1989			Y
33	Warehouse #1 (BSL-2)	2020 Horns Point Road, Cambridge, MD 21613	3,000	Owned	Research Facility	0	1	?-1992	?-2011	1,378	Y
34	Research Support Maintenance	5745 Lovers Lane, Cambridge, MD 21613	3,710	Owned	Machine Shop	2	3	?-1988		0	Y
35	Wdigeon Pavilion Restroom	2020 Horns Point Road, Cambridge, MD 21613	148	Owned	Restroom	2	0	?-1992	?-2010	0	Y
36	Widgeon Pavilion	2020 Horns Point Road, Cambridge, MD 21613	3,200	Owned	Outdoor Pavilion	3	0	?-1990		0	Y

Section 1: ECE Data											
#	ECE Name	Address	Size (square feet)	Property Rights (Owned, Leased w/ Utilities or Leased w/o Utilities)	Occupancy			Date ECE Was Originally Built (Month-Year)	Date of Last Major Renovation (Month-Year)	Unoccupied Conditioned Space (square feet)	Shared Utility Account ? (Y/N)
					ECE Use	# Visitors/ Clients per day	# Staff per day				
37	Microsia Filter Building	2020 Horns Point Road, Cambridge, MD 21613	160	Owned	Mechanical Equipment Room	0	0	?-2006		0	Y
38	Oyster Cultch Facility - 2	2020 Horns Point Road, Cambridge, MD 21613	3,072	Owned	Aquaculture Facility	2	8	?-2006			Y
39	Main Gate	2020 Horns Point Road, Cambridge, MD 21613	0	Owned	Main Campus Electric Entrance	25	160	?-2008			N
40	Lined Fish Ponds	2020 Horns Point Road, Cambridge, MD 21613	0	Owned	Aquaculture Ponds	0	1	?-1990		0	N
41	Earthen Ponds	2020 Horns Point Road, Cambridge, MD 21613	0	Owned	Aquaculture Ponds	0	1	?-1984		0	N
42	Main Pump Station	2020 Horns Point Road, Cambridge, MD 21613	0	Owned	Sewage Pump Station	0	0	?-1996		0	N

Section 1:		Section 2: Utility Data					
#	ECE Name	**Electricity** (kWh)		**Fuel Oil #2**(Gallons)		**Propane** (Gallons)	
1	Ambient Water Filtration	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
2	Ambient Water Pump Station	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
3	AREL Ozone Generator Shed	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
4	AREL Research Laboratory	Vendor	DP&L	Vendor	Griffith Energy	Vendor	N/A
		Account #	5501-0844-029	Account #	1215004	Account #	N/A
		Meter #	KZD357605676	Meter #	None	Meter #	N/A
		Quantity	6982185	Quantity	125429	Quantity	N/A
5	UMCES Administration Well House	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
6	UMCES Administration Building	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A

Section 1:		Section 2: Utility Data					
#	ECE Name	**Electricity** (kWh)		**Fuel Oil #2**(Gallons)		**Propane** (Gallons)	
7	Chemical Storage	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
8	Coastal Science lab	Vendor	DP&L	Vendor	Griffith Energy	Vendor	N/A
		Account #	5501-0844-029	Account #	1215012	Account #	N/A
		Meter #	KZD357605676	Meter #	None	Meter #	N/A
		Quantity		Quantity	13470	Quantity	N/A
9	Coastal Science Well House	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
10	Compressed Gas Storage	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
11	Dive Locker	Vendor		Vendor	N/A	Vendor	N/A
		Account #		Account #	N/A	Account #	N/A
		Meter #		Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
12	IAN Facility	Vendor	DP&L	Vendor	N/A	Vendor	Tri-Gas
		Account #	5501-0844-029	Account #	N/A	Account #	744904587
		Meter #	KZD357605676	Meter #	N/A	Meter #	None
		Quantity		Quantity	N/A	Quantity	Not Available

Section 1:		Section 2: Utility Data					
#	ECE Name	Electricity (kWh)		Fuel Oil #2(Gallons)		Propane (Gallons)	
13	Environmental Education Canoe Shed	Vendor		Vendor	N/A	Vendor	N/A
		Account #		Account #	N/A	Account #	N/A
		Meter #		Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
14	Environmental Education Activities Building	Vendor	DP&L	Vendor	N/A	Vendor	Tri-Gas
		Account #	5500-8373-767	Account #	N/A	Account #	744904555
		Meter #	X9D358102224	Meter #	N/A	Meter #	None
		Quantity	74800	Quantity	N/A	Quantity	2543
15	Environmental Education Residential Building -	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5500-8373-767	Account #	N/A	Account #	N/A
		Meter #	X9D358102224	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
16	Environmental Education Residentail Building -	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5500-8373-767	Account #	N/A	Account #	N/A
		Meter #	X9D358102224	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
17	Environmental Information Center	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
18	Fiber Optic Building	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A

Section 1:		Section 2: Utility Data					
#	ECE Name	**Electricity** (kWh)		**Fuel Oil #2**(Gallons)		**Propane** (Gallons)	
19	Fish Systematics Lab	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
20	Forest Classroom	Vendor		Vendor	N/A	Vendor	N/A
		Account #		Account #	N/A	Account #	N/A
		Meter #		Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
21	Generator Building	Vendor		Vendor	N/A	Vendor	N/A
		Account #		Account #	N/A	Account #	N/A
		Meter #		Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
22	Maintenance Complex	Vendor	DP&L	Vendor	Griffith Energy	Vendor	N/A
		Account #	5500-0676-191	Account #	1215020	Account #	N/A
		Meter #	X8D357604109	Meter #	None	Meter #	N/A
		Quantity	81120	Quantity	4087	Quantity	N/A
23	Maintenance Well House	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5500-0676-191	Account #	N/A	Account #	N/A
		Meter #	X8D357604109	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
24	Visiting Faculty Residence	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A

Section 1:		Section 2: Utility Data					
#	ECE Name	**Electricity** (kWh)		**Fuel Oil #2**(Gallons)		**Propane** (Gallons)	
25	Morris Marine Well House	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
26	Morris Marine Lab	Vendor	DP&L	Vendor	Griffith Energy	Vendor	Tri-Gas
		Account #	5501-0844-029	Account #	1214999	Account #	744904555
		Meter #	KZD357605676	Meter #	None	Meter #	None
		Quantity		Quantity	0	Quantity	16600
27	Museum Cottage	Vendor		Vendor	N/A	Vendor	N/A
		Account #		Account #	N/A	Account #	N/A
		Meter #		Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
28	Museum Hanger	Vendor		Vendor	N/A	Vendor	N/A
		Account #		Account #	N/A	Account #	N/A
		Meter #		Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
29	Oyster Cultch Facility	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
30	Oyster Setting Facility	Vendor	DP&L	Vendor	Griffith Energy	Vendor	N/A
		Account #	5501-0844-029	Account #	1972331	Account #	N/A
		Meter #	KZD357605676	Meter #	None	Meter #	N/A
		Quantity		Quantity	2145	Quantity	N/A

Section 1:		Section 2: Utility Data					
#	ECE Name	**Electricity** (kWh)		**Fuel Oil #2**(Gallons)		**Propane** (Gallons)	
31	SAV Laboratory	Vendor	DP&L	Vendor	N/A	Vendor	Tri-Gas
		Account #	5501-0844-029	Account #	N/A	Account #	744904587
		Meter #	KZD357605676	Meter #	N/A	Meter #	None
		Quantity		Quantity	N/A	Quantity	0
32	Visitor Student Housing	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
33	Warehouse #1 (BSL-2)	Vendor	DP&L	Vendor	N/A	Vendor	Tri-Gas
		Account #	5501-0844-029	Account #	N/A	Account #	744904555
		Meter #	KZD357605676	Meter #	N/A	Meter #	None
		Quantity		Quantity	N/A	Quantity	250
34	Research Support Maintenance	Vendor	DP&L	Vendor	N/A	Vendor	Tri-Gas
		Account #	5500-5626-035	Account #	N/A	Account #	744904555
		Meter #	B4A119775223	Meter #	N/A	Meter #	None
		Quantity	12207	Quantity	N/A	Quantity	4506
35	Wdigeon Pavilion Restroom	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
36	Widgeon Pavilion	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A

Section 1:		Section 2: Utility Data					
#	ECE Name	**Electricity** (kWh)		**Fuel Oil #2**(Gallons)		**Propane** (Gallons)	
37	Microsia Filter Building	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
38	Oyster Cultch Facility - 2	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0844-029	Account #	N/A	Account #	N/A
		Meter #	KZD357605676	Meter #	N/A	Meter #	N/A
		Quantity		Quantity	N/A	Quantity	N/A
39	Main Gate	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0843-765	Account #	N/A	Account #	N/A
		Meter #	NYA123334915	Meter #	N/A	Meter #	N/A
		Quantity	263	Quantity	N/A	Quantity	N/A
40	Lined Fish Ponds	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5500-8849-626	Account #	N/A	Account #	N/A
		Meter #	1ND358807104	Meter #	N/A	Meter #	N/A
		Quantity	14416	Quantity	N/A	Quantity	N/A
41	Earthen Ponds	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5500-8870-119	Account #	N/A	Account #	N/A
		Meter #	NYA123334736	Meter #	N/A	Meter #	N/A
		Quantity	7577	Quantity	N/A	Quantity	N/A
42	Main Pump Station	Vendor	DP&L	Vendor	N/A	Vendor	N/A
		Account #	5501-0331-852	Account #	N/A	Account #	N/A
		Meter #	TED3576852225	Meter #	N/A	Meter #	N/A
		Quantity	10559	Quantity	N/A	Quantity	N/A

The Horn Point Laboratory is comprised of the above structures which are in various conditions mechanically, structurally and with regard to efficiencies. The campus has been subjected to an Energy Performance Contract (EPC) by Constellation Energy which addressed many energy usage issues but there is much left to do. A Metasys Energy Management System (EMS) platform is being utilized as provided by Johnson Controls. Numerous lighting and HVAC upgrades have taken place throughout the campus and many VFD's have been installed on both pumps and AHU drives. Night setbacks are used on many systems and these are now being modified to allow for increased setbacks during times when the recovery period is decreased because of moderate temperatures. Outside air intake is minimized during recovery times prior to occupancy to prevent having to condition raw outside air during unoccupied periods.

Most of the buildings on campus are on a single electric meter which does not allow us to monitor the usage of individual buildings. While the primary metering does provide a better utility rate, the losses within the distribution network and transformers

add to our consumption and the cost of this electrical infrastructure is financially cumbersome. Oil and propane consumption is more easily monitored as each building has a separate supply and corresponding separate numbered account.

One of the difficult factors to separate from normal energy usage is the amount of energy spent for aquaculture purposes. We have four very large pumps for circulation of river water and, though controlled by VFD's; they do consume large amounts of energy. In addition, it is often necessary to cool or heat the river water for the constantly varying aquaculture needs. This is most often accomplished through heat exchangers but at other times by electric immersion heaters. The exact amount of energy used for these purposes is not known but it is very significant and needs to be more clearly identified.

D. Existing Conditions and Proposed Energy Conservation Measures (ECMs):

With such a varied array of buildings and usage, specific energy conservation methods will be identified by building then general energy conservation methods will be identified and implemented to all buildings.

Specific energy conservation measures include:

D.1 Ambient Water Filtration **–** As this building has been relegated to storage, we have discontinued heating the space entirely and interior lighting has been left in the normally-off position. Energy consumption is near zero. An additional conservation action would be to replace the single exit light with a more efficient LED light. We plan on including this as part of a campus wide lighting upgrade as funding becomes available.

D.2 Ambient Water Pump Station – This building houses the seawater pumps which pump water from the Choptank River for aquaculture purposes. We have installed VFD's on the pumps to reduce electrical consumption and the aging diesel backup pump has been eliminated which eliminated the diesel fuel and fuel storage tank. A future ECM would be the replacement of existing lighting with more efficient LED lighting. This can be part of a campus wide project.

D.3 AREL Ozone Shed – This small portable building houses the Ozone Generator used for aquaculture purposes. There is no heat in the building and the only electrical draw is the ozone generator and a single light fixture. Other than replacing the fixture, which is not cost effective due to the minimal usage, there is little that can be done in this building to conserve energy.

D.4 AREL Research Lab – Having undergone an EPC recently with Constellation Energy many of the inefficiencies have been addressed including the installation of many VFD's on pumps and AHU equipment. The building is controlled and monitored by a Metasys EMS system.

D.4.a Completed ECM: A grossly oversized, 250 KVA UPS system was replaced with a high efficiency 40 KVA UPS system. In addition to eliminating the large amounts of energy wasted by the existing system, the new system produces far less excess heat which had to be counteracted by energy consuming cooling equipment. The savings will be two fold and the entire system will pay for itself within three years. The funding was provided by a SALP loan from MEA.

D.4.b Completed ECM: Night setback times have been adjusted be reducing the recovery times during moderate temperatures and eliminating outside air intake during recovery times which are unoccupied times thus eliminating the need to condition raw air. This was implemented by Johnson Controls as part of their existing EMS support contract so the cost was minimal.

D.4.c Completed ECM: Excess heat from the algae greenhouse, which is detrimental to algae production, has been exhausted into the Mass Larvae Room where additional heat was needed for oyster larvae production. This eliminated the need to simultaneously heat and cool two adjacent rooms.

D.4.d Completed ECM: A percentage of cooling tower water is recirculated through a partially closed loop to reduce the water consumption of the tower.

D.4.e Completed ECM: A small ductless mini-split system cooling unit was added in the algae lab. This lab has a significant heat load due to the many lights needed for algae growth. The heat load had been counteracted by cooling from the main building chillers. Often, the massive chillers were run only for cooling this one room as the heat load was excessive and existed almost year round. By using the small, high efficiency unit, the load has been eliminated from the main chillers and energy is conserved and the lab temperature is more easily controlled leading to better algae growth. This project was funded by the oyster program as it benefited their research by proving better results in the algae lab though better and more consistent temperature control.

D.4.f Current ECM: We are reducing the non-potable fresh water demand by changing the way certain finfish aquaculture programs are operated. The electrical savings and well maintenance costs will be substantial.

D.4.g Future ECM: Install occupancy sensors on lighting in infrequently occupied areas such as stair towers and mechanical spaces.

D.4.h Future ECM: Replace existing small independent cooling units which reply on R-22 refrigerant with new higher efficiency units which

use less harmful and less costly refrigerant. This is being targeted with Facilities Renewal funding.

D.4.i Future ECM: Install high efficiency LED lighting on both interior and exterior spaces. While costly, the savings in electrical and maintenance costs would easily justify the project. A possible source of funding would be an MEA loan. This is a long term goal and could be part of a campus wide lighting retrofit.

D.5 UMCES Administration Well House – This aging structure was constructed in 1950 and currently houses an electric UV water sterilization system, water piping and the diaphragm tanks for the well. As part of a current project we are installing a new water main which will eliminate the need for having any water within this building by switching the building water supply to the central campus water system. Once the water is eliminated, there will not be a need for the UV sterilization system or the electric heat. The electrical consumption of the building will be reduced by 90 to 95%. The remaining sources of electrical consumption would be the interior building lighting, which would be rarely used as the need to enter the building for maintenance of equipment would be eliminated and a single exterior wall pack used for nighttime illumination. The wall pack could be replaced with a high efficiency LED lighting fixture as part of a larger campus lighting upgrade.

D.6 UMCES Central Administration Building - Although constructed in 1950 the building has been upgraded several times including the addition of a ground source heat pump system.

D.6.a Completed ECM: Caulking/Sealing to reduce air infiltration. The main porch which serves as a meeting/conference room is surrounded by windows on three sides. The windows have been thoroughly re-caulked and sealed to reduce air infiltration, water infiltration and reduce the building heating load.

D.6.b Future ECM: There are seven HVAC units which use R-22 refrigerant which is being phased out due to environmental concerns. These units should be replaced with new higher efficiency units which use alternative refrigerants and provide more reliability, reduced maintenance and lower operating costs. This project is being targeted with future Facilities Renewal funding. An alternative funding source would be a SALP loan from MEA which is designated for energy efficiency improvements.

D.6.c Future ECM: Lighting improvements are always a possibility. LED fixtures should be considered as a long term goal.

D.6.d Future ECM: Replace windows with those offering better thermal resistance and low-e glass. Gable windows are in need of replacement and would be a good first step. The main windows could occur later as funding and future needs dictate.

D.7 Chemical Storage – The chemical storage shed has minimal heat to prevent freezing and basic lighting which is only used when occupied. The fixtures could be re-lamped but, with minimal usage, the payback would be very long term.

D.8 Coastal Science Building - Having undergone an EPC recently with Constellation Energy, many of this building's inefficiencies have been addressed. Boiler burners have recently been replaced. The building is controlled and monitored by a Metasys EMS system.

D.8.a Completed ECM: Night setback times have been increased during periods with moderate exterior temperatures and outside air intake has been eliminated during recovery periods thus eliminating the need to condition raw air. This has been implemented by Johnson Controls as part of their existing EMS support contract so the cost was minimal.

D.8.b Future ECM: Replace the aging oil fired boilers with higher efficiency gas units. Possible source of funding would be through an energy loan or grant.

D.8.c Future ECM: Replace existing laboratory fume hoods which exhaust 100% of laboratory air to ones which supply their own make-up air which would reduce the need to fully condition the hood air. This could be completed as a phased approach whenever a laboratory space is renovated.

D.8.d Future ECM: Replace existing lighting with LED lighting and investigate whether de-lamping some areas with excess lighting could be accomplished.

D.9 Coastal Science Well House – This structure has only minimal heat and lighting. It is currently insulated to minimize heat loss. With its minimal use there is little that can be done to reduce the utility demand. Water conservation would reduce well run times and save electric but this would need to be part of larger building and plumbing fixture upgrade projects.

D.10 Compressed Gas Storage – This structure has only minimal lighting and no other utility load. The lighting is only used during times when the building is occupied so very little can be saved from any upgrade.

D.11 Dive Locker – No utilities.

D.12 IAN Facility – This building is primarily office space. There is an existing central AC unit which utilizes R-22 refrigerant. A future ECM would be to replace this aging unit with a high efficiency unit which uses an alternative refrigerant. Facilities renewal funding has been requested to fund this project.

D.13 IAN Facility Pump House – Although not identified as a separate structure, the existing well pump house is highly inefficient. The building and adjacent valve pit are not insulated but are heated to prevent freezing of the pipe and valves. As part of a current project, a new water main will eliminate the need for this structure. All electricity will be permanently disconnected and the structure will be removed.

D.14 Environmental Education Canoe Shed – No utilities.

D.15 Environmental Education Building and Residential Buildings - These 1993 structures were previously heated by suspended propane gas unit heaters and cooled by air-to-air AC units.

> D.15.a Completed ECM: The 20+ year old, AC units were replaced with high efficiency heat pumps which now provide both heating and cooling. The gas unit heaters were eliminated. The functionality of the space was increased by reducing the unacceptable noise level of the unit heaters with the much quieter heat pumps. Funding was provided by rent paid by outside groups who utilize the facility and a grant from a generous patron.
>
> D.15.b Future ECM: Replace six remaining HVAC units containing R-22 refrigerant with higher efficiency units containing an alternative refrigerant. Funding has been requested on the basis of eliminating the R-22 which is being phased out due to environmental concerns. The added efficiency and reduced operating costs will be added benefits.

D.16 Environmental Information Center – This building was constructed in 2011 therefore most equipment is early in its life cycle and efficiencies are pretty high. The building envelope is well insulated and the windows are tight and efficient.

> D.16.a Future ECM: Identify and reduce electrical consumption by computers and computer servers which are housed in this building. These account for a large part of the electrical usage and are therefore a potential source of savings. Reducing the use of non-critical equipment during off hours could provide some savings. This could be part of a larger campus wide effort to reduce ghost electrical loads by identifying the sources and then guiding faculty and staff toward ways of reducing them.

D.17 Fiber Optic Building – This small shed serves as a junction point for campus phone and data wiring. Other than minimal lighting, there is no other utility load and little savings to be found.

D.18 Fish Systematics Lab (AKA Hoke Hall) – This building is currently used for storage so water service has been stopped and heating and cooling temporarily turned off. Lighting is used only when occupied so the energy demand has been reduced to minimal levels.

D.19 Forrest Classroom – No utilities

D.20 Generator Building – No utilities

D.21 Maintenance Complex - Having undergone an EPC recently with Constellation Energy many of the inefficiencies have been addressed. Lighting upgrades have been made throughout.

> D.21.a Completed ECM: Replace the R-22 AC unit, which serves the administration area, with a new high efficiency unit.
>
> D.21.b Future ECM: Add smart programmable thermostats. Although temperatures are strictly controlled to save on heating and cooling costs there are no pre-set night or weekend setbacks.
>
> D.21.c Future ECM: Replace aging AC unit in administration area which contains R-22 refrigerant with new high efficiency unit. Funding has been request from facilities renewal to complete this project.

D.22 Maintenance Well House – The building contains minimal heat to prevent freezing and a single light fixture. No identifiable efficiency increases are found.

D.23 Visiting Faculty Residence (AKA Marsh House) – This single story residential dwelling was constructed in 1948 but has been upgraded to include modern windows and adequate insulation.

> D.23.a Completed ECM: Replace oil fired furnace and electric AC unit with high efficiency heat pump. The funding was provided from the dorm rental fees. No other obvious inefficiencies exist so there are no future ECM's planned at this time.

D.24 Morris Marine Well House – There is minimal heat and lighting so there are few ways to provide savings. No projects are planned for this building at this time.

D.25 Morris Marine Laboratory - Having undergone an EPC recently with Constellation Energy, much inefficiency has been addressed but there is still room for significant improvement.

D.25.a Future ECM: As part of a planned phased renovation, all building systems will be improved or replaced. A central RO/DI system will be installed to reduce operating costs associated with multiple existing water treatment systems. The existing chiller and boilers will be replaced with a Variable Refrigerant Flow (VRF) system to gain better building efficiency and reduced O&M costs. Lighting will be upgraded as part of the renovation as will the increased use of natural light. Many of the uninsulated overhead doors will be removed and replaced with windows to improve aesthetics and increase natural lighting. Funding for the project will be from multiple sources including facilities renewal and HPL operating budget.

D.26 Museum Cottage – This antiquated structure is currently unused and is deemed unsafe for occupation due to asbestos contamination.

D.26.a Completed ECM: The influent line to sewer pump station was capped and the pump station was shut down. This saved the cost of pumping infiltrating ground water from the pump station and the coat of treatment for the discharge. There was virtually no cost for this initiative.

D.26.b Completed ECM: Disconnect the electric service. This eliminated the monthly usage and service fees. The risk of fire to this aging structure was reduced. There was no cost for this initiative.

D.27 Museum Hangar - This antiquated structure is currently unused and is deemed unsafe for occupation due to asbestos contamination.

D.27.a Completed ECM: Disconnect the electric service. This eliminated the monthly usage and service fees. The risk of fire to this aging structure was reduced. There was no cost for this initiative.

D.28 Oyster Cultch Facility – This building houses equipment used for oyster aquaculture.

D.28.a Completed ECM: The volume of water used for the aquaculture operation has been reduced which reduces the electrical consumption. As the seawater is normally only required for approximately 6 hours per day and only 4 or 5 days per week, the seawater pump is shut down during times when it is not need to reduce wear on the pump and to further reduce the electrical need.

D.28.b Future ECM: Replace existing R-22 HVAC system with high efficiency system using alternative refrigerant. Funding is to be provided by the Oyster Recovery Partnership, who operates the facility.

D.29 Oyster Setting Facility – This is comprised of a concrete pier, mechanical room and lab area used for oyster aquaculture.

D.29.a Future ECM: Work in conjunction with leaders of the oyster program in an effort to reduce the amount of heated river water required. Funding cannot be identified until it is determined what measures must be taken to make this happen or it is even possible. While a worthy goal, it will be a difficult job to accomplish.

D.29.b Future ECM: Change exterior lighting to LED and reduce the amount of exterior illumination.

D.30 SAV Laboratory – This is a single story word frame structure that supports Submerged Aquatic Vegetation research.

D.30.a Future ECM: Replace existing R-22 HVAC systems with high efficiency heat pumps. Funding has been requested from facilities renewal for this purpose.

D.31 Visiting Student Housing – This is a two story wooden structure used to house visiting faculty or students.

D.31.a Completed ECM: The existing 8 SEER, air to air, heat pumps were replaced with high efficiency 16 SEER heat pumps. The simple payback will only be three years with a life span of 15 years or more. Funding was provided by an SALP Loan from MEA.

D.32 Warehouse #1 (AKA BSL-2) – This building was recently renovated and displays no obvious needs for improvement.

D.33 Research Support Maintenance – This is home of the HPL machine shop with some office space for a few maintenance personnel.

D.33.a Future ECM: Replace existing R-22 AC unit for office area with a new high efficiency unit. Facilities renewal funding has been requested.

D.34 Widgeon Pavilion Restroom – This is a small stand-alone restroom used in conjunction with the adjacent pavilion. There is no heat and only minimal lighting. There are no practical energy saving measures to be undertaken.

D.35 Widgeon Pavilion – This is an open pavilion used or occasional functions. There is no heat and only a few lights. There are no practical energy saving measures to be undertaken.

D.36 Microsia Filter Building – This is a portable wooden structure which houses filter equipment used for aquaculture research. There is no heat and only minimal lighting. No upgrades are planned for this building.

D.37 Oyster Cultch Facility 2 – This is an expansion of the aquaculture facility used by Oyster Recovery Partnership. There are no improvements planned for this building.

D.38 Main Gate **–** The main gate has an electric operator and security camera. Electrical consumption is minimal. The gate is left open during normal business hours to minimize wear and reduce electrical usage.

D.39 Lined Fish Ponds and Earthen Ponds – These ponds are used for aquaculture. The electrical use is limited to aerators and site lighting. A future ECM could include LED site lighting. This would need to be part of a larger campus lighting project.

D.40 Main Pump Station – This is the pump station which is used to move effluent waste from the campus to the City of Cambridge waste water treatment plant. While there is no direct way to reduce the electrical consumption of the station, reductions in water use by the campus through conservation methods and fixture upgrades will have a positive effect on the operating cost of the pump station and cost of treating the wastewater which we are charged for.

Campus wide ECM's include the following:

- Use required temperature settings for heat and cooling.
- Cooling being unavailable except during the correct season as determine by the lab director.
- Continuous monitoring of all systems and preventative maintenance to maintain optimum efficiency.
- Correct replacement lamps and ballasts to maintain efficiency.
- The use of IVN system to eliminate the need for commuting.
- Monitoring of EPC by DGS to provide measurement and verification of savings.
- Installation of high efficiency LED lighting for both interior and exterior applications.
- Increase the use of occupancy sensing light switches to reduce electrical consumption in minimally used areas.

D.41 Timeline

All future ECM's are worthy goals but their implementation will be dependent upon funding and time constraints. Constant increases in efficiency are gained through routine equipment replacement and with planned renovations.

E. Energy Data

The following table shows electrical, propane and fuel oil use since 2008.

Table 1: Electricity	
FY	**KWH**
FY08	7707068
FY09	6904373
FY10	6580222
FY11	6775398
FY12	7036925
FY13	6704181
FY14	7166853
FY15	7183134

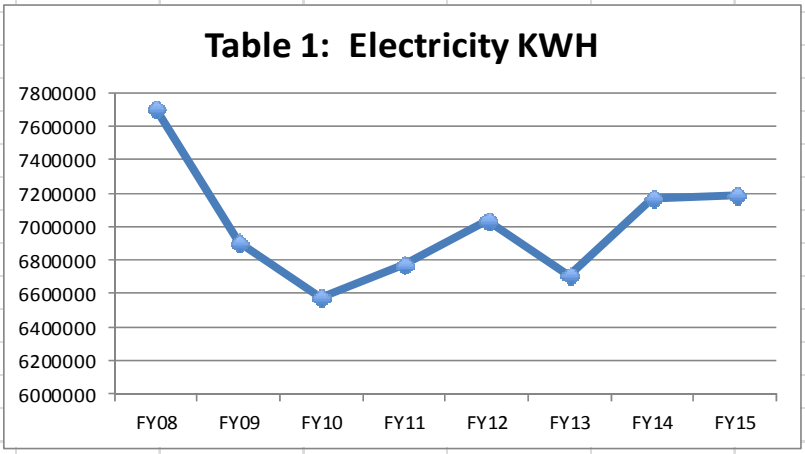


Table 2: Propane	
FY	**Gallons**
FY08	Not Available
FY09	264.8
FY10	Not Available
FY11	14110
FY12	11672
FY13	19003
FY14	24266
FY15	20321

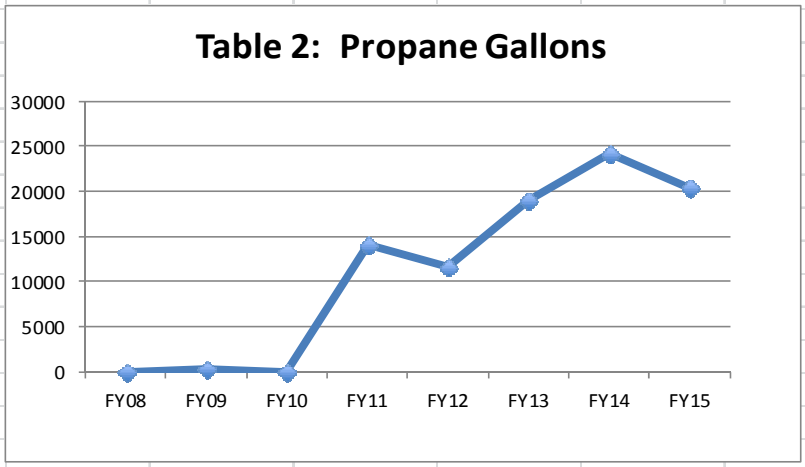
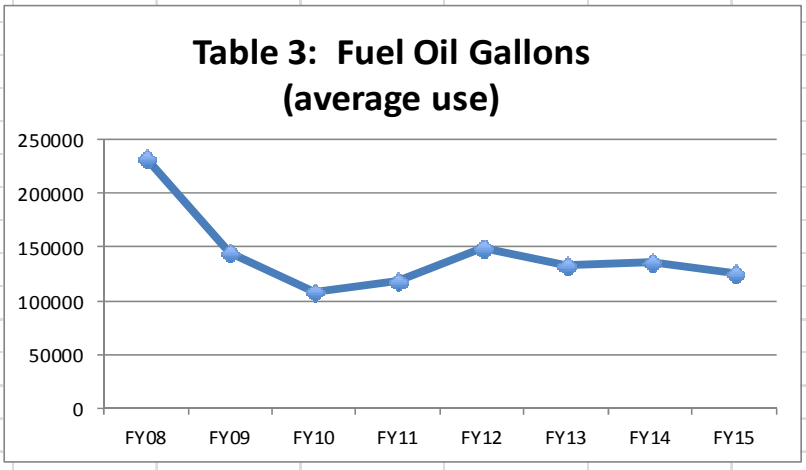


Table 3: Fuel Oil (avg)	
FY	**Gallons**
FY08	232192
FY09	144344
FY10	107759
FY11	117831
FY12	149179
FY13	133697
FY14	135453
FY15	125403



F. Current Energy Conservations Measures

F.1 Administrative Practices

All new buildings, renovations and additions will be built to meet or exceed the LEED Silver Certification. New buildings, when construction is necessary, will employ the latest technologies and be designed with upfront commitment to energy efficiency that will reduce GHG emissions and lower operating costs.

Facilities Renewal projects will incorporate "green" upgrades and improvements into existing buildings in order to build a more sustainable campus.

To avoid increasing our energy use with new buildings, we will continue to maximize the use of existing spaces, and will investigate ways to renovate, modernize and retrofit unused or less desirable areas to meet new needs and avoid the necessity for additional construction.

F.2 Facilities Operations

Landscaping has been simplified to minimize maintenance costs. Native species occupy the few landscaped areas with the remainder being either grass or in most cases the areas have been allowed to return to nature. These natural areas are maintenance free and provide habitat for a multitude of species of wildlife.

Horn points recycling program has reduced our solid waste disposal costs, minimized the dispersal to landfills and prevented many possible contaminants from reaching the environment.

F.3 Procurement Practices

HPL will continue to augment the fleet with flex fuel, energy efficient vehicles when appropriate and fiscally possible. The University System of Maryland is committed to purchasing energy efficient and environmentally friendly products and provides tools and quick tip sheets to help locate and purchase these environmentally friendly products. Both of the approved USM Master Contracts for office supplies now include an extensive selection of green products.

F.4 Transportation Practices

More fuel efficient vehicles are being incorporated into the campus fleet including several hybrid vehicles. Some golf carts have been used in place of

larger trucks for on-campus transportation. Vehicle rental rates have been increased to more accurately reflect the true cost of maintaining the vehicles and to possibly discourage nonessential use of state vehicles. HPL and UMCES have attempted to limit travel to only when appropriate and by substituting the Interactive Video Network, or web based conferencing programs in lieu of face-to-face meetings.