University of Maryland Center for Environmental Science
Appalachian Laboratory

Campus Sustainability Report

Emissions Inventory & Comprehensive Climate Commitment:
Carbon and Resilience Commitments

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About this report…

The following report summarizes the UMCES Appalachian Laboratory greenhouse gas emissions for the three scopes defining emission sources, defines our plan of actions to reduce these emissions and outlines our plans to anticipate, survive and adapt to eminent climate changes.

Scope 1 – Direct sources. These are emissions from sources that are owned and operated by the institution such as on campus stationary sources of fuel combustion, produced electricity, heat and steam, direct transportation (i.e. fleet vehicles), fugitive emissions and agriculture.

Scope 2 – Indirect sources. These include emissions from off-campus sources that are neither owned nor operated by the institution but whose products are directly linked to on-campus energy consumption. These include purchased energy: electricity, steam and chilled water.

Scope 3 – Other Sources include emissions that are attributed to the institution but occur from sources neither owned nor controlled by the institution. These sources are normally directly financed by or directly linked to the institution such as outsourced transportation for business travel (air, rail, bus), faculty, staff and student commuting, solid waste disposal, wastewater, and electricity transportation and distribution losses, office paper and other paper purchases.

Offsets – Offsets are allocated RECs from the Renewable Portfolio Standard (RPS) and from the Purchase Power Agreements (PPAs) used to offset scope 2 emissions. Additional offset credits are earned by sequestration from forest preservation or planting of previously un-forested land.

The software used to compute carbon emissions is the Campus Carbon Calculator, v9.1 until FY 2017. With the discontinuation of the CCC, UMCES & AL moved to the SIMAP (Sustainability Indicator Management and Analysis Platform) Inventory Tool for FY2018 https://unhsimap.org/home Data is then transferred to the Second Nature Reporting site http://reporting.secondnature.org/ . See more at http://www.sustainableunh.unh.edu/calculator

The AL Carbon Emissions inventory team includes the following individuals:
Barbara Jenkins, Staff – *updated emissions inventory, compiled data, prepared the summary report*
Kristen Harper, Staff – provided *updated personnel, utility and travel data*
Cami Martin, Staff – *provided updated fleet use data and purchasing data*
Heather Johnson, Assistant Director - *provided operating and research budget data*
John Piasecki, Facility Manager – *provided facilities data*

The AL Environmental Sustainability Council consists of the following individuals:
Barbara Jenkins – Chair & Facility representative
Heather Johnson – Budget Office representative
Kristen Harper – Business Office representative
Cathlyn Stylinski – Faculty representative
Stephanie Siemek – Student representative
Jenna Linhardt – FRA representative

Ad hoc members include:
Katie Kline – Laboratory and Safety Manager
Cami Martin – Business Office, Purchaser and Fleet Manager
Eric Farris – IT Administrator
John Piasecki – Facility Manager

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Section I: History & Introduction

I.A. History

The Appalachian Laboratory (AL), located in the mountains of western Maryland, is an environmental research facility and is seen as a vital research component for understanding the Chesapeake Bay Watershed. AL is part of one of the world's leading coastal research institutions, the University of — Maryland Center for Environmental Science (UMCES). UMCES is the premier research institution aimed at advancing scientific knowledge of the environment; it is extensively involved in graduate education in the environmental science programs within the University System of Maryland (USM). UMCES faculty members advise, teach, and serve as mentors to many graduate students enrolled in joint degree programs with USM institutions, particularly through the System-wide graduate programs in Marine- Estuarine-Environmental Sciences (MEES), in which UMCES has a leading role. In addition, UMCES offers post-baccalaureate certificates in specialized areas for professional development. The sister units within UMCES are Horn Point Laboratory (HPL), on Maryland's Eastern Shore, the Chesapeake Biological Laboratory (CBL), at the mouth of Patuxent River in Southern Maryland, the Institute of Marine and Environmental Technology (IMET), located in the Columbus Center on Baltimore's Inner Harbor, Baltimore Maryland, and the Maryland Sea Grant College (MDSG) located in College Park.

The Appalachian Laboratory, established in 1961 as a field station of the Inland Resources Division of the University of Maryland's Natural Resources Institute, consisted of portions of two rented buildings and a storage facility along Route 40 in LaVale, a suburb of Cumberland, Maryland. In 1973, the Institute became part of the University of Maryland's new Center for Environmental and Estuarine Studies (CEES) and the Inland Resources Division in College Park was abandoned, its positions divided among the three Laboratories.

To provide more adequate facilities and encourage cooperative relationships with other institutions in western Maryland, the Laboratory was relocated to Gunter Hall, a converted dining hall and kitchen, on the Frostburg State University (FSU) Campus, in the fall of 1975. Its current location is within a three county region (Garrett, Allegany, and Washington) that provides direct access to several state parks, forests, and wildlife management area.

In 1996, UMCES negotiated the transfer of 10.59 acres at the south end of Frostburg State University campus near the corner of University Drive and Braddock Road and constructed a new facility that was occupied in December of 1998. The new physical plant consists of 4 structures totaling 48,327 GSF. With increased development at the Allegany County Business Park situated just above the AL campus, and the requirements for storm water management these facilities, it became necessary to adjust the boundary lines from the original ground lease to UMCES. In 2015, this section of land, approximately 2.12 acres on the west side of the AL property, was transferred to Frostburg State University for the maintenance of the storm water ponds and has been designated a no-build area. With this land transfer, the Appalachian Laboratory Campus covers approximately 8.47 acres.

AL seeks to understand the consequences of land use change on terrestrial and freshwater ecosystems dynamics, with special focus on the impacts within the Chesapeake Bay watershed. AL researchers pursue this goal by designing and executing studies of the effects of natural and human-induced changes on organisms, landscapes, and biogeochemical and hydrological cycles. Scientific results from these studies reveal the consequences of environmental change across scales of organization and inform the management of natural resources, the restoration of ecosystems, and the fostering of environmental awareness. The research conducted at AL is notably diverse and inter-disciplinary and spans scales from genes to landscapes and watersheds, and encompasses terrestrial, wetland, and aquatic ecosystems. This breadth of scientific enquiry, coupled with a strongly collaborative faculty, has enabled us to address a variety of research needs within the state, the country, and throughout the world.

Historically, AL had its roots in fisheries, wildlife, and conservation ecology. Faculty members have a strong record of assisting the state in addressing problems concerning the population status of terrestrial and aquatic organisms. Studies often aimed to link local processes to regional or global phenomena, with many studies relying on extensive, long-term (sometimes spanning more than 20 years) data sets derived from detailed field measurements as well as field and laboratory analyses of water, soil, atmospheric, and plant samples using high quality analytical techniques.

In the early 1990's AL began building strengths in ecosystem ecology with a particular focus on spatial scales of the entire Potomac landscape and its sub-watersheds. This initiative established a new and broader role for AL within UMCES that complemented the more estuarine and marine focus of the other laboratories, and extended the overall breadth of UMCES by integrating the Chesapeake Bay and its watershed into a central "mountains to sea" vision. Ecosystem ecology is a natural entry point for studies on global change, and consequently the research at AL has increasingly focused on revealing the varied effects of anthropogenic disturbance and climate variability on organismal responses, community biodiversity, and the functioning of terrestrial and aquatic ecosystems. Some of these environmental threats have been known for some time, such as habitat fragmentation, urban runoff and estuarine eutrophication, while other threats like climate change, sea level rise, large-scale energy development (e.g., wind farms, natural gas fracking), and the spread of invasive pests and pathogens recently have emerged as causes of concern.

AL researchers are dedicated to staying at the forefront of the approaches needed to address the most pressing environmental problems. Faculty appointments in recent years have greatly expanded AL's research breadth with new expertise focused on remote sensing, geospatial modeling, stable isotopes, and molecular ecology and genomics. These new research areas address questions across a wide variety of spatial scales (local populations, communities, landscapes), habitat types (terrestrial, aquatic), and taxonomic groups (animals, plants, microbes), thereby providing enormous collaborative potential not only within AL but also across UMCES labs, jointly contributing to the growth of the Center and the Appalachian Laboratory.

Appalachian Laboratory is the headquarters and administrative lead of the Chesapeake Watershed Cooperative Ecosystem Studies Unit (CW CESU), a partnership among 46 universities and research institutions, and 9 federal agencies whose members strive to understand and protect the natural and cultural resources of the region. The CW CESU is part of the CESU national network of 17 similar partnerships. The primary objective of the network is to foster stewardship of the environment through collaborative research, technical assistance and education that support integrated ecosystem management.

I.B. Introduction

On December 18, 2007, UMCES President, Dr. Donald Boesch, signed the American College & University Presidents Climate Commitment (ACUPCC) with an effective date of January 15, 2008. The Environmental Sustainability Council (ESC) was created to provide leadership, advice, and assistance in implementing practices that enhance the environmental sustainability of the operations of the University of Maryland Center for Environmental Science (UMCES). The UMCES ESC functions as a task group and advisory body to the President and Administrative Council. Members are appointed by the President from among the faculty, staff and students at the Center's four laboratories, Center Administration and the Maryland Sea Grant College Program.

The Appalachian Laboratory Environmental Sustainability Council (AL ESC) serves as the laboratory/campus level advisory council and has worked with the Administration to complete a comprehensive inventory of greenhouse gas emissions and will continue to work with the Administration to complete an institutional action plan to work toward obtaining climate neutrality.

Additionally, as a provision to the University System of Maryland (USM) Sustainability Initiative, institutions are required to make a serious environmental commitment to the concept of reducing greenhouse gas emissions and combating climate change when preparing Facilities Master Plans (FMP) for campus development, utilities, infrastructure, new building and renovations.

A greenhouse gas inventory estimates the amount of carbon-based gases emitted into the atmosphere as a result of an institution's activities. The Appalachian Laboratory's inventory will help evaluate energy use as the first step toward reducing our greenhouse gas (carbon) emissions and overall climate footprint. The AL building construction was not completed and ready for occupancy until December 1998. We use data from a ten-year time period to complete our annual inventories to provide a living and current document to track our progress and goals.

University of Maryland Center for Environmental Science completed and submitted our initial Climate Action Plan to the ACUPCC in May of 2010 completing the initial requirements as a signatory to the President's Climate Commitment. The plan is available on the UMCES sustainability webpage as at http://www.umces.edu/sustainability as well as the UMCES AL sustainability webpage at http://www.umces.edu/al-environmental-sustainability-initiative .

In October 2015, this ACUPCC initiative was rebranded the Climate Commitment with major changes that introduced concepts of resilience. Building on the history of the ACUPCC and completing a strategic planning process with extensive feedback and input from signatories and partners, Second Nature is maturing the ACUPCC and the Alliance for Resilient Campuses (ARC) by integrating and rebranding them as Second Nature's Climate Leadership Commitments.

On October 5, 2015, Dr. Boesch signed the new, updated Climate Leadership Commitment. The Climate Commitment integrates carbon neutrality with climate resilience and provides a systems approach to mitigating and adapting to a changing climate. The Resilience Commitment is focused on climate resiliency and community capacity-building to deal with a changing climate and resulting extremes while the he Carbon Commitment is focused on reducing Greenhouse Gas emissions and achieving carbon neutrality as soon as possible.

In 2017, Dr. Peter Goodwin joined University of Maryland Center For Environmental Science as the new President and also serves as Vice Chancellor for Environmental Sustainability for the University System of Maryland, leading the Environmental Sustainability Initiative for USM's 12 institutions.

Section II: Operational Boundaries, Data Collection & Emission Sources

II.A. Operational Boundaries

AL's inventory included the following sources of emissions (Table 1): ***Scope 1:*** direct sources include heating, emergency generator use, fleet transportation and fugitive emissions; ***Scope 2:*** indirect sources including purchased electricity; ***Scope 3:*** other sources including employee business travel, solid waste disposal, wastewater, electric transportation and distribution (T&D) losses, employee commuter miles, and paper purchases. ***Offsets***: RECs allocated o from the Renewable Portfolio Standard (RPS) and Purchase Power Agreements (PPAs). The last PPA SREC allocation was used in FY15. ***DeMinimus:*** Although several of the sources may qualify as *De Minimus Emissions* sources, (less than 5%) they have been included to establish a baseline and to maintain consistency with the other UMCES laboratories.

Table 1: Emission Sources & Offsets

Scope 1 - Direct Emissions	Scope 2 – Indirect Emissions	Scope 3 – Other Emissions	Offsets
On Campus Stationary Source 1 (OCSS1) - Natural Gas	Purchased Electricity	Air, Rail, Bus Transportation	RPS-RECs
On Campus Stationary Source 2 (OCSS2) - Fuel Oil #2		Solid Waste	PPA-SREC
Fugitive Emissions: Refrigerants & Other Chemicals		Wastewater	
University Owned Fleet		Commuter Miles	
		Electric T&D Losses	
		Paper Purchases	

II.B. Data Collection

This report is updated annually to cover a ten fiscal-year period. This study period covers FY09 – FY18. USM fiscal year runs from July 1 – June 30. Raw data are continually gathered from actual utility bills to extend the study period and keep the GHG inventory current. Data collected were entered into the Campus Carbon Calculator, v9.1 (CCC) to obtain the Metric Tons Carbon Dioxide equivalent (MT CO_2e) emissions for each source through 2017. With the discontinuation of the CCC, UMCES & AL moved to the SIMAP (Sustainability Indicator Management and Analysis Platform) Inventory Tool for FY 2018. There are several gases that contribute to global warming and these gases contribute to varying degrees. Global warming potential (GWP) is a relative measure of how much heat a greenhouse gas traps in the atmosphere. Carbon dioxide, the most prevalent greenhouse gas, is the proxy that greenhouse gas emissions are measured by. For the purpose of having a standard measure for carbon footprints, the GWP of a gas is referenced in carbon dioxide (CO_2) equivalency, or CO_2e, since the GWP for CO_2 is standardize to 1. By expressing the impact of each different greenhouse gas in terms of the amount of CO_2 that would create the same amount of warming, a carbon footprint consisting of many of different greenhouse gases can be expressed as a single number.

II.C. Emission Sources

II.C.1. Scope 1: Direct Sources of Emissions

Scope 1 or Direct Sources of emissions include those emissions from sources that are owned or controlled by the institution. Currently, direct sources at AL include on campus stationary sources (OCSS) for heating and emergency generator use, direct transportation services (fleet transportation) and fugitive emissions.

On-Campus Stationary Source 1: Natural Gas

The first source of on-campus stationary emissions is from natural gas (Table 2). Natural gas is used to heat the building by the use of two Clever Brooks boilers, one serves as a backup system. Natural gas is also used to heat domestic hot water. Usage amounts were compiled from Columbia Gas bills and cubic feet (CF) were converted to Million Metric British Thermal Units (MMBTUs) for purposes of this inventory. Over the 10-year study period, 3391.60 MT CO_2e were emitted due to the burning of natural gas. This equates to 23.51% of our total emissions making it our second largest contributor of carbon emissions.

Table 2: Natural Gas			
FY	**CF**	**MMBTUs**	**MT CO_2e emissions**
FY09 (7/08 – 6/09)	7182200	7376.119	**392.39**
FY10 (7/09 – 6/10)	6460000	6634.420	**381.34**
FY11 (7/10 – 6/11)	6957500	7145.353	**379.99**
FY12 (7/11 – 6/12)	6300400	6470.511	**344.04**
FY13 (7/12 – 6/13)	6307600	6477.905	**344.41**
FY14 (7/13 – 6/14)	6720900	6902.364	**366.98**
FY15 (7/14 – 6/15)	4086100	4196.425	**223.11**
FY16 (7/15 – 6/16)	5581000	5731.687	**304.74**
FY17 (7/16 – 6/17)	4884000	5015.868	**266.70**
FY18 (7/17 – 6/18)	6290000	6459.83	**387.90**

On-Campus Stationary Source 2: Fuel Oil #2

The second on-campus stationary source is fuel oil #2. Fuel oil is used to supply the emergency generator and is also used as a backup supply for the boilers. There are two above ground oil tanks – a 3,000 tank and 2,000-gallon tank. Both tanks were filled in 1998 with the construction of the new facility. However, the generator is, as stated, only used as an emergency power source and the boilers normally operate on natural gas, so the use of fuel oil is very minimal. The tanks have only been topped off twice during the 10-year Study period, and once in FY10 (2,786.70 gallons) and once in FY17 (382.10 gallons).

Over the 10-year study period only 32.70 MT CO_2e has been emitted from burning fuel oil #2. This comprises only 0.23% of AL's total emissions.

All On-Campus Stationary Sources have emitted a total of 3424.30 MT CO_2e over the course of the study period. This comprises 23.74% of our total emissions.

Fleet Use: Gasoline

Gasoline consumption (Table 3) was compiled from current fleet fuel provider bills for the AL vehicle fleet use. Fleet vehicles are provided to support University activities including **official lab business** - *travel to events or meetings as an official representative of the AL, UMCES, or USM*; **field work** - *travel in support of scientific research*; **research and/or collaboration** – *travel to meet with various state/federal officials to discuss research projects or grants, or meet with colleagues at different institutions to work on proposals to secure external funding, grants and/or contracts;* and **conference travel** - *travel to scientific conferences*. *Gallons* are used for this inventory.

Over the 10-year study period, 448.80 MT CO_2e were emitted due to fleet use. This equates to 3.11% of AL's total net emissions.

Table 3: Gasoline - Fleet Use			
FY	**Gallons**	**Kiloliters**	**MT CO_2e emissions**
FY09 (7/08 – 6/09)	7322.63	27.719	**65.16**
FY10 (7/09 – 6/10)	8506.69	32.201	**75.37**
FY11 (7/10 – 6/11)	5610.94	21.240	**49.61**
FY12 (7/11 – 6/12)	3984.76	15.084	**35.20**
FY13 (7/12 – 6/13)	3600.78	13.630	**31.80**
FY14 (7/13 – 6/14)	4728.85	17.901	**41.75**
FY15 (7/14 – 6/15)	4515.47	17.093	**39.84**
FY16 (7/15 – 6/16)	4278.56	16.196	**37.75**
FY17 (7/16 – 6/17)	4216.17	15.960	**38.40**
FY18 (7/17 – 6/18)	3728.85	14.111	**33.90**

Fugitive Emissions
Fugitive emissions (Table 4) from refrigerants were estimated by compiling direct purchase records for refrigerant and contractor records for refrigeration unit repairs to calculate the amount of refrigerant that has been replaced. A total of 407.0 pounds of Refrigerant 22 (R22), 10.44 pounds of Refrigerant 134A (R134A) have been replaced over the study period of this inventory (FY09-FY18).

Over the study period, 316.01 MT CO_2e have been released due to fugitive emissions. This contributes only 2.19% to our total emissions.

Table 4: Refrigerant Replacement				
FY	**R22 (lbs.)**	**R134A (lbs.)**	**R404A (lbs.)**	**MT CO_2e**
FY09 (7/08 – 6/09)	152.0	2.00	0	**126.09**
FY10 (7/09 – 6/10)	37.5	0	0	**30.79**
FY11 (7/10 – 6/11)	37.5	0	0	**30.79**
FY12 (7/11 – 6/12)	37.5	0	0	**30.79**
FY13 (7/12 – 6/13)	37.5	3	0	**32.73**
FY14 (7/13 – 6/14)	37.5	0	0	**30.79**
FY15 (7/14 – 6/15)	37.5	3	0	**32.73**
FY16 (7/15 – 6/16)	0	0	0	**0.00**
FY17 (7/16 – 6/17)	0	2	0	**1.30**
FY19 (7/17 – 6/18)	0	0	0	**0.0**

Total emissions for Scope 1, direct sources of emissions, over the 10-year study period were 4189.10 MT CO_2e. **This equates to 29.04% of our total emissions.**

II.C.2. Scope 2: Indirect Sources of Emissions
Scope 2 or Indirect Sources include emissions from sources that are neither owned nor operated by the institution but whose products are directly linked to on-campus energy consumption. Currently, indirect sources of emission at AL include purchased electricity.

Purchased Electricity
Purchased electricity (Table 5) use was collected from Allegany Power and Reliant and Pepco utility bills. Total *Kilowatt Hours (KWH)* were used for this inventory. Over the course of the study period, 8343.83 MT CO_2e were released due to electric usage. This comprises 57.97% of our total net emissions, making

electricity our principal source of carbon emissions. *Note, emissions from electricity lost in transportation and distribution are calculated in the Scope 3 emissions.*

Table 5: Electricity		
FY	**KWH**	**MT CO_2e emissions**
FY09 (7/08 – 6/09)	1315555	**913.89**
FY10 (7/09 – 6/10)	1263923	**868.20**
FY11 (7/10 – 6/11)	1320272	**906.91**
FY12 (7/11 – 6/12)	1424627	**898.47**
FY13 (7/12 – 6/13)	1314924	**829.28**
FY14 (7/13 – 6/14)	1329311	**838.35**
FY15 (7/15 – 6/15)	1240259	**782.19**
FY16 (7/15 – 6/16)	1166066	**735.40**
FY17 (7/16 – 6/17)	1258902	**793.95**
FY18 (7/17 – 6/18)	1232366	**777.00**

MD state law requires that the supplier meet the Renewable Portfolio Standard (RPS,) This is based on the MD RPS Schedule ranging from 7.5000% in 2011 to 25.000% in 2020 of our energy supply in RECs. For FY 18, this was 19.8000%. UMCES was apportioned RECs associated with the three power purchase agreements with Roth Rock, Pinnacle and Mt. St. Mary's through the USM System wide purchase. Because of the inherent difficulty in tracking RECs allocations, FY15 is the final year that USM allocated RECs to institutions not on the Block and Index supply contract, including UMCES.

Electricity is our only Scope 2, indirect emission source. Our total Scope 2 emissions over the 10-year study period were 8343.83 MT CO_2e**. This equates to 57.84% of our total emissions.**

II.C.3. Scope 3: Other Sources of Emissions

Scope 3, or Other Sources include emissions that are attributed to the institution but occur from sources neither owned nor controlled by the institution. These sources are normally directly financed by or directly linked to the institution. Currently, other sources of emissions include employee business travel, solid waste disposal, wastewater, employee commuter miles, electric T&D losses, and paper purchases.

Transport – Air, Bus and Rail Miles Traveled

Employee transport miles (Table 6) - Air, Rail and Bus - include travel by faculty, staff and students while on business that were both arranged and paid for directly by our staff or arranged by the employee and expensed back to our institution. Travel arranged and paid for by other agencies were not included Data were collected in *miles* traveled, which is the required format for the CA-CP calculator. Transport saw an increase due to increased air travel for sponsored research.

Employee travel by air, rail and bus emitted 419.20 MT CO_2e over the 10-year study period. Transport comprises 2.91% of our total net emissions.

Table 6: Air, Rail and Bus Travel			
FY	**km**	**miles**	**MT CO_2e emissions**
FY09 (7/08 – 6/09)	80274	49880	**27.09**
FY10 (7/09 – 6/10)	121110	75254	**39.64**
FY11 (7/10 – 6/11)	76671	47641	**24.21**
FY12 (7/11 – 6/12)	104218	64758	**32.91**

FY13 (7/12 – 6/13)	157346	97770	**47.17**
FY14 (7/13 – 6/14)	80718	50156	**24.20**
FY15 (7/14 – 6/15)	122313	76002	**36.66**
FY16 (7/15 – 6/16)	114653	71242	**34.37**
FY17 (7/16 – 6/17)	147006	91345	**44.10**
FY18 (7/17 – 6/18)	364001	225643	**108.85**

Solid Waste Disposal

To manage solid was disposal (Table 7), AL has one 8-cubic yard dumpster hauled by an external trash removal company and sent to Mountain View Landfill. Mountain View currently operates a passive flare system that runs on solar power with battery backup. The landfill is in the process of starting construction on an active landfill gas system that will consist of a flare unit that will flare off the landfill gas. Based on gas generation and output, the possibility exists for the landfill to produce alternate energy in the future.

Until FY06, the dumpster was emptied once every week, assuming 0.40 tons per week. In FY07, due to increased recycling efforts, the dumpster hauls were reduced once every other week, assuming 0.20 tons per week. For 2012, MDE updated the conversion rate for solid waste disposed. The previous ratio was 0.05 cubic yards (Yd^3s) to tons and was updated to 0.10 Yd^3s to tons. This change lowered our resulting recycling rate, however our recycling efforts did not decrease and our solid waste disposed did not increase in 2012. Beginning in 2014, pickups were decreased to monthly pickups. Solid waste disposal has resulted in 31.00 MT CO_2e emissions over the course of the study period. This equates to 0.21% of our total net emissions.

Table 7: Solid Waste Disposal

FY	Dumpster Size	Tons/Yr.	MT CO_2e emissions
FY09 (7/08 – 6/09)	8 CY	10.40	**3.22**
FY10 (7/09 – 6/10)	8 CY	10.40	**3.22**
FY11 (7/10 – 6/11)	8 CY	10.40	**3.22**
FY12 (7/11 – 6/12)	8 CY	10.40	**3.22**
FY13 (7/12 – 6/13)	8 CY	10.40	**3.22**
FY14 (7/13 – 6/14)	8 CY	10.40	**2.98**
FY15 (7/14 – 6/15)	8 CY	9.60	**2.98**
FY16 (7/15 – 6/16)	8 CY	9.60	**2.98**
FY17 (7/16 – 6/17)	8 CY	9.60	**2.98**
FY18 (7/17 – 6/18)	8 CY	9.60	**2.98**

Wastewater

Wastewater (Table 8) from AL is collected by the Braddock Run Sanitary District and flows to the Wrights Crossing Pumping Station (WCPS). The WCPS receives the combined sewer flow from Frostburg and conveys it to LaVale Sanitary Commission's system which then conveys the combined sewer flow to the City of Cumberland's Wastewater Treatment Plant (WWTP). The City of Cumberland's WWTP is a regional 15 million gallons per day biological nutrient removal facility followed by anaerobic digestion for biosolids. This anaerobic digestion treatment process reduces the carbon emissions from waste treatment when compared to other waste treatment processes.

Wastewater resulted in only 1.16 MT CO_2e emissions over the study period and comprises less than 0.01% of our net emissions.

Table 8: Wastewater		
FY	**Gallons**	**MT CO_2e emissions**
FY09 (7/08 – 6/09)	187800	**0.10**
FY10 (7/09 – 6/10)	159200	**0.08**
FY11 (7/10 – 6/11)	374500	**0.19**
FY12 (7/11 – 6/12)	239810	**0.12**
FY13 (7/12 – 6/13)	332520	**0.17**
FY14 (7/13 – 6/14)	203660	**0.11**
FY15 (7/14 – 6/15)	156260	**0.08**
FY16 (7/15 – 6/16)	154140	**0.08**
FY17 (7/16 – 6/17)	229213	**0.12**
FY18 (7/17 – 6/18)	221330	**0.11**

Commuter Miles

Commuter miles (Table 9) were compiled by surveying all resident personnel at the lab starting with the FY08 inventory. All personnel were surveyed the initial two years of employment. Commuter miles for every year thereafter have been estimated based on home zip codes and most common route of travel. The minimal turnover in personnel does not require a yearly survey. The survey estimates number one way trips per week, number of weeks per year, and mileage for each trackable group. Additionally, the percentage personal vehicle and carpooling are used is estimated. For data input, CA-CP separates personnel into three categories: Students, Faculty and Staff. However, the calculator then tallies emissions by two commuter categories, Faculty/Staff commuters and Students commuters.

Commuters' miles resulted in a total of 657.91 MT CO_2e emissions over the study period. This contributes 4.56% to our total net emissions.

Table 9: Commuter Miles					
FY Commuter Miles	**Faculty/Staff Miles**	**Student Miles**	**Total Miles**	**Gallons Gasoline Consumed**	**MT CO_2e *Emissions***
FY09 (7/08 – 6/09)	153763	19430	173193	6351	**62.93**
FY10 (7/09 – 6/10)	173658	16385	190043	7813	**69.22**
FY11 (7/10 – 6/11)	168002	18873	186875	7120	**62.96**
FY12 (7/11 – 6/12)	164583	16720	181303	7012	**61.91**
FY13 (7/12 – 6/13)	162176	11696	173872	6853	**60.50**
FY14 (7/13 – 6/14)	153647	11856	165503	6533	**57.65**
FY15 (7/14 – 6/15)	181968	15946	197914	7615	**67.19**
FY16 (7/15 – 6/16)	173604	13690	187294	7740	**68.30**
FY17 (7/16 – 6/17)	175566	15128	190694	7881	**71.70**
FY18 (7/17 – 6/18)	177628	23373	201001	8303	**75.55**

Electric Transmission and Distribution Losses (T&D)

Emissions due to electricity lost in transmission and distribution (Table 10) are calculated based on the emissions factors provided by the CA-CP calculator, version 6.0. These emission factors are taken from the Environmental Protection Agency's (EPAs) Emissions & Generation Resource Integrated Database (eGRID), which uses plant specific emission factors for each electrical region in the United States. This calculation is different from previous versions of the calculator, which included these losses in the institution's Scope 2 emissions. This was methodology error that has been corrected in version 6.0 and now includes the emissions due to these losses in Scope 3, indirect emissions.

Electric T&D losses resulted in a total of 771.18 MT CO_2e emissions over the study period. This contributes 5.35% to our total net emissions.

Table 10: Electric T&D Losses	
FY	**MT CO_2e emissions**
FY09 (7/08 – 6/09)	**90.38**
FY10 (7/09 – 6/10)	**53.66**
FY11 (7/10 – 6/11)	**56.05**
FY12 (7/11 – 6/12)	**90.71**
FY13 (7/12 – 6/13)	**83.73**
FY14 (7/13 – 6/14)	**84.64**
FY15 (7/14 – 6/15)	**78.97**
FY16 (7/15 – 6/16)	**74.25**
FY17 (7/16 – 6/17)	**80.31**
FY18 (7/17 – 6/18)	**78.47**

Paper Purchases

The collection of data for paper purchases (Table 11) was added to this inventory starting with FY 2008. In August 2009, our purchaser began purchasing general office paper with a recycled content of not less than 30% and in 2010 AL began purchasing 100% recycled general use copy paper. In 2014, we were able to purchase other paper products with various amounts of recycled content as shown below.

Upstream emission from purchases of paper resulted in 12.77 MT CO_2e. This contributes to 0.08% of our total emissions.

Table 11: Paper Purchases							
FY	**Pounds 100% Recycled Content**	**Pounds 70% Recycled Content**	**Pounds 65% Recycled Content**	**Pounds 50% Recycled Content**	**Pounds 30% - 40% Recycled Content**	**Pounds 0% Recycled Content**	**MT CO_2e Emissions**
FY09 (7/08 – 6/09)	0				0	1650	**2.25**
FY10 (7/09 – 6/10)	900				400	0	**1.16**
FY11 (7/10 – 6/11)	1500				0	0	**1.15**
FY12 (7/11 – 6/12)	400				0	0	**0.31**
FY13 (7/12 – 6/13)	1504				2	0	**1.16**
FY14 (7/13 – 6/14)	858	12		240	28	0	**0.96**
FY15 (7/14 – 6/15)	1226	0		480	0	0	**1.46**
FY16 (7/15 – 6/16)	906	0	300	640	0	0	**1.67**
FY17 (7/16 – 6/17)	2051	0	0	5	20	0	**1.51**
FY18 (7/17 – 6/18)	1436	0	0	0	20	0	**1.14**

Total emissions for Scope 3, indirect sources of emissions, over the 10-year study period were 1893.22 MT CO_2e. This equates to 13.12% of our total emissions

II.C.4 Offsets
AL currently has no on-campus activities and has not purchased any Renewable Energy Credits (RECs) directly to offset carbon emissions.

MD state law requires that energy suppliers meet the Renewable Portfolio Standard (RPS). This rate of return is based on the schedule provided by the MD DGS to reach a goal of 25% by 2020. The renewable energy offset is represented in this report based on AL energy use. See Table 12 for schedule.

Additionally, UMCES was apportioned Renewable Energy Credits associated with the three power purchase agreements (PPA) with Roth Rock, Pinnacle and Mt. St. Mary's through the USM System wide purchase. However, because of the inherent difficulty in tracking RECs, allocations, in FY15 the USM discontinued the practice of allocating RECs to institutions that are not on the Block and Index supply contract – this included UMCES. While our institution may still purchase RECs through their supplier under a separate agreement, FY15 is the last year we will receive an additional annual allocation from the PPAs.

UMCES was allocated the National Green E SRECs totaling 14,080,000 kwh to be used in FY15. AL's prorated amount based on total electric usage is 10.63% (of UMCES) for a total kwh offset allowance of 1,496,704 kwh, however the REC offset cannot exceed the scope 2 emissions for any given year.

FY15 electricity use was 1,240,259 kwh, so we have allocated the 161,234 RPS RECs and 1,079,205 PPA RECs for a total kwh offset of 1,240,259.

The remainder of our PPA REC allocation was used in FY16. FY16 electricity use was 1,166,066, for a RPS REC allocation of 177,242 and a PPA REC allocation of 421,824 resulting in a total offset of 599,066.

Our FY18 Scope 2 emissions are 777.20 MTCO2e and with the MD RPS we claimed offsets that resulted in a -153.90 MTeCO2 carbon emissions offset for electricity, scope 2 emissions. This results in a net scope 2 emission of 623.30 MTeCO2 for FY 18.

Table 12: Offsets

FY	Total Electric Usage KWH	MD RPS Schedule	RPS - % of KWH RECS	PPA National Green E KWH RECS	Total KWH Offsets	MT CO_2e Emissions offset
FY09 (7/08 – 6/09)	0				0	**0**
FY10 (7/09 – 6/10)	0				0	**0**
FY11 (7/10 – 6/11)	1320272	7.5%	99020	0	99020	**-68.00**
FY12 (7/11 – 6/12)	1424627	9.005%	128288	0	128288	**-80.90**
FY13 (7/12 – 6/13)	1314924	10.7%	132413	0	132413	**-83.50**
FY14 (7/13 – 6/14)	1329311	12.8%	170152	0	170152	**-107.30**
FY15 (7/14 – 6/15)	1240259	13%	161234	1079205	1240259	**-782.20**
FY16 (7/15 – 6/16)	1166066	15.2%	177242	421824	599066	**-377.80**
FY17 (7/16 – 6/17)	1261326	16.75%	211272	0	211272	**-133.20**
FY18 (7/17 – 6/18)	1232366	19.80%	244008	0	244008	**-153.90**

Section III: Budget, Personnel, & Organizational Boundaries

III.A. Budget Data

Operating, research and energy budget data (Table 13) have been provided for each of the fiscal years. AL energy costs over the study period average ~38% of the operating budget and average ~8% of the total operating and research budget. (Note: FY 12 electricity is lower due to Direct Energy billing error that was not corrected until FY13 resulting in higher numbers for FY13.)

Table 13: Budget Data

	FY09	FY10	FY 11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Operating Budget	524,066	478,087	458,035	439,325	422,293	398,104	443,924	400,278	401,154	427,317
Research Dollars	1,635,780	2,329,699	1,470,448	1,294,997	1,817,057	2,647,560	3,164.050	2,411,190	2,103.232	5,490,504
Total Budget (R&O)	**2,159,846**	**2,807,786**	**1,928,483**	**1,734.322**	**2,239,350**	**3,045,664**	**3,607,974**	**2,811,468**	**2,504.386**	**5,917,821**
Energy Budget										
Electricity	137,288	111,975	125,605	89,565	131,886	98,522	115,130	108,046	114,691	98,898
Natural Gas	90,104	50,250	68,515	57,989	53,873	55,090	56,567	48,227	46,609	47,397
Water/Sewer	2,573	2,732	4,590	3,545	5,470	2,573	2,551	3,059	4,218,	4,742
Total Energy Costs	**229,965**	**164,957**	**198,710**	**151,099**	**191,229**	**156,185**	**174,248**	**159,332**	**165,519**	**149,037**
Energy % of Operating	**44%**	**35%**	**43%**	**34%**	**45%**	**39%**	**39%**	**40%**	**40%**	**35%**
Energy % of Total	**11%**	**6%**	**10%**	**9%**	**9%**	**5%**	**5%**	**6%**	**7%**	**3%**

III.B. Personnel Data

Personnel at the AL facility have reached an average level of about 56 (Table 14). Personnel counts were derived from the Space Guidelines and Planning (SGAP) reports filed each February and are based on personnel as of the previous Fall semester.

Table 14: Personnel Data

FY	Full Time Students	Full Time Eq. Faculty	Full Time Eq. Staff	Number of Employees
FY09 (7/08 – 6/09)	12	23	20	55
FY10 (7/09 – 6/10)	11	26	19	56
FY11 (7/10 – 6/11)	15	27	16	58
FY12 (7/11 – 6/12)	11	25	24	60
FY13 (7/12 – 6/13)	8	24	21	53
FY14 (7/13 – 6/14)	8	23	20	51
FY15 (7/14 – 6/15)	11	27.5	21.5	60
FY16 (7/15 – 6/16)	11	27	18	56
FY17 (7/16 – 6/17)	11	26	24	61
FY18 (7/17 – 6/18)	13	27.5	16	56.5

III.C. Organizational Boundaries

The Appalachian Laboratory sits on 8.47 acres at the south end of the Frostburg State University campus near the corner of University Drive and Braddock Road. Figure 1 shows the AL property lines as adjusted by the 2015 revised ground lease to accommodate the Business Park storm water management requirements. The blue highlighted section identifies the storm water ponds as a no-build area to establish a buffer between the Business Park activities and the UMCES Appalachian Lab.

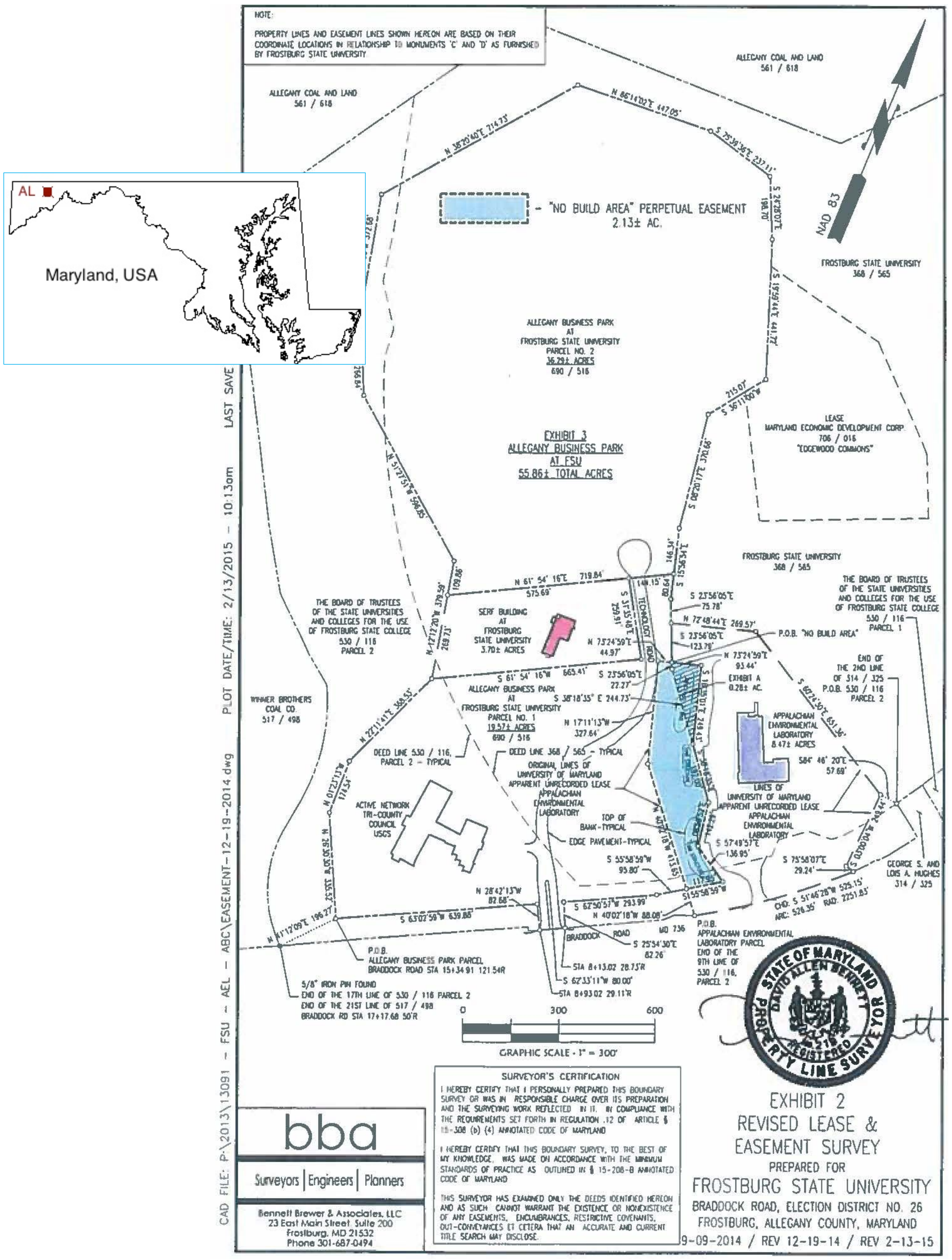


Figure 1: Property Boundaries

Figure 2 is an October 2015 image courtesy of Google Earth[tm] 2016 showing an aerial view of the AL campus.

Figure 2: Aerial View of AL Property

The Appalachian Laboratory campus is approximately 8.47 acres and 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 accounted for in this inventory.

Section IV: Methods & Outcomes

IV.A. Methods

For this inventory, AL used the Campus Carbon Calculator v9.1 (CCC) developed through collaboration with the University of New Hampshire and CA-CP until 2017. In FY18, with the discontinuation of the CCC, we moved to SIMAP (Sustainability Indicator Management and Analysis Platform) hosted by the UNH Sustainability Institute. SIMAP® is a carbon and nitrogen-accounting platform that can track, analyze, and improve your campus-wide sustainability and is based on nearly two decades of work supporting campus inventories with the Campus Carbon Calculator, CarbonMAP and Nitrogen Footprint Tool. We chose to use these models because it is designed for campus environments and has already been widely used by Colleges and Universities across the country. Additionally, using this model will provide for consistency and fair comparisons of emissions across UMCES units.

Data collected were entered into the data collection tools to obtain the mt eCo_2 emissions for each source. As new versions of the calculator are released, the new and existing data are entered into the most recent calculator so data are current with the latest emission factors. The emissions tables are updated annually to reflect any changes.

IV.B. Outcomes

As reflected in the following table (Table 15) and the following chart (Chart 1), AL emissions rise and fall in varying categories over the study period. However, over-all our emissions are on a downward path. Historically, there were notable decreases in overall emissions after 2008. Higher pre-2008 emissions were attributed to several factors. The building was a new facility and the cost associated with running the facility did not yet have a baseline. Additionally, it takes time to determine where and what resources at a new facility can be adjusted to save energy and cut costs without impacting research and education goals. Once the facility became established, areas for cost and energy saving were addressed as appropriate.

The drops and averages in other categories on can be attributed to the adjustment and streamlining of facility practices and research needs. Areas such as increased recycling followed by a reduction in solid waste disposal, light and heat conservation both by building and individual offices, and increased use in video conferencing all contributed to a decrease in carbon emissions and our climate footprint.

For FY18 we see a slight increase in overall emissions. Although over the 10 year period we are on a downward trend, some years will fluctuate. FY18 had a higher natural gas demand as well as nearly triple the air travel for sponsored research. Fluctuations can be countered with better facilities practices including facilities renewal projects that continue to streamline and upgraded our laboratory exhaust systems and provided better automated internal controls of the HVAC systems. Additionally, AL retired RPS recs an additional offset of our scope 2 -electricity emissions. AL continues to keep aging equipment serviced and maintained to provide the best energy efficiency possible and plans are in place to replaced EOL equipment with energy efficient models.

Although an established facility allows for better understanding of the facility practices for energy and cost reductions, it also implies that the equipment has acquired some age. As of December 2018, most of the major equipment, boilers, heating and AC, generator, etc. were 20 years old and are not as energy efficient as they were when installed nor as energy efficient as newer models. When combined with yearly weather patterns, this would account for the slight ebb and flow in energy cost and emissions, even with usage reductions.

Summary of CO_2e Emissions by Source and Year.

The following table shows a summary of the Appalachian Laboratory's CO_2e emissions in metric tons by year and sources, as well as a total for all sources.

Table 15: Summary of CO_2e emissions by source and year

	FY 09	FY 10	FY 11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	***Total by Source***
Electricity	913.89	868.20	906.91	898.47	829.28	838.35	782.19	735.40	793.50	777.20	**8343.83**
OCSS 1: Natural Gas	392.39	381.34	379.99	344.04	344.41	366.98	223.11	304.74	266.70	387.90	**3391.60**
OCSS 2: Fuel Oil #2	0.00	28.80	0.00	0.00	0.00	0.00	0.00	0.00	3.90	0.00	**32.70**
Fleet	65.16	75.37	49.61	35.20	31.80	41.75	39.84	37.75	38.40	33.90	**448.80**
Fugitive Emissions	126.09	30.79	30.79	30.79	32.73	30.79	32.73	0	1.30	0.0	**316.01**
Solid Waste	3.22	3.22	3.22	3.22	3.22	2.98	2.98	2.98	2.98	2.98	**31.00**
Wastewater	0.10	0.08	0.19	0.12	0.17	0.11	0.08	0.08	0.12	0.11	**1.16**
Air, Rail, Bus Travel	27.09	39.64	24.21	32.91	47.17	24.20	36.66	34.37	44.10	108.85	**419.20**
Commuter Miles	62.93	69.22	62.96	61.91	60.50	57.65	67.19	68.30	71.70	75.55	**657.91**
Electric T&D Losses	90.38	53.66	56.05	90.71	83.73	84.64	78.97	74.25	80.31	78.47	**771.18**
Paper Purchases	2.25	1.16	1.15	0.31	1.16	0.96	1.46	1.67	1.64	1.14	**12.77**
Total by FY MT CO_2e	*1683.49*	*1551.47*	*1515.11*	*1497.69*	*1434.17*	*1448.40*	*1265.22*	*1259.54*	*1305.10*	*1466.10*	***14426.15***
Offsets – Wind/Solar Renewable Energy PPA & RPS	-	-	*(68.00)*	*(80.90)*	*(83.50)*	*(107.30)*	*(782.20)*	*(377.80)*	*(133.20)*	*(153.90)*	***(1786.80)***
Net MT CO_2e	*1683.49*	*1551.47*	*1447.11*	*1416.79*	*1350.67*	*1341.10*	*483.02*	*881.74*	*1171.90*	*1312.20*	***12639.35***

With continued monitoring of our emissions, our goal is to keep emissions on a downward trend. This will require continued monitoring and maintenance of equipment to gain as much energy efficiency as possible from existing equipment, replacement of non-energy efficient equipment, and continuation of recycling and conservation efforts already in place.

The following charts provide a representation of our emissions data based CA-CP Carbon Calculator results.

Chart 1: Net carbon emissions by Fiscal Year over the study period.

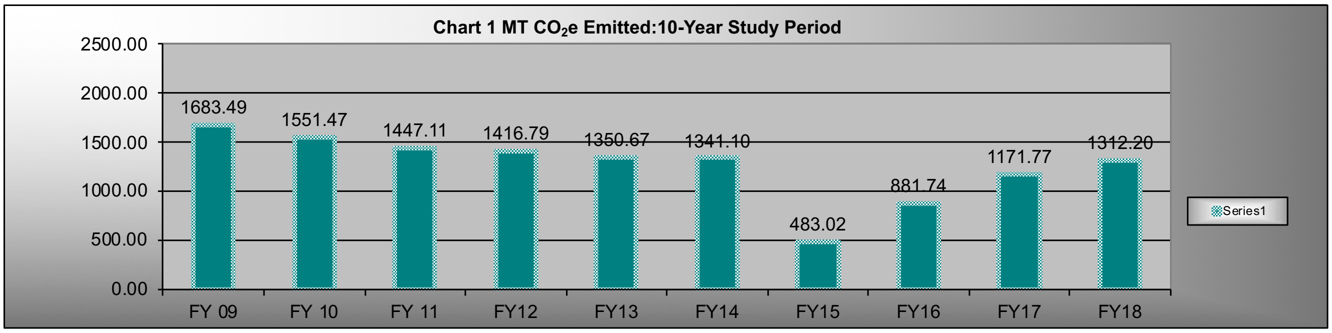


Chart 2: Carbon emissions by source and year over the study period.

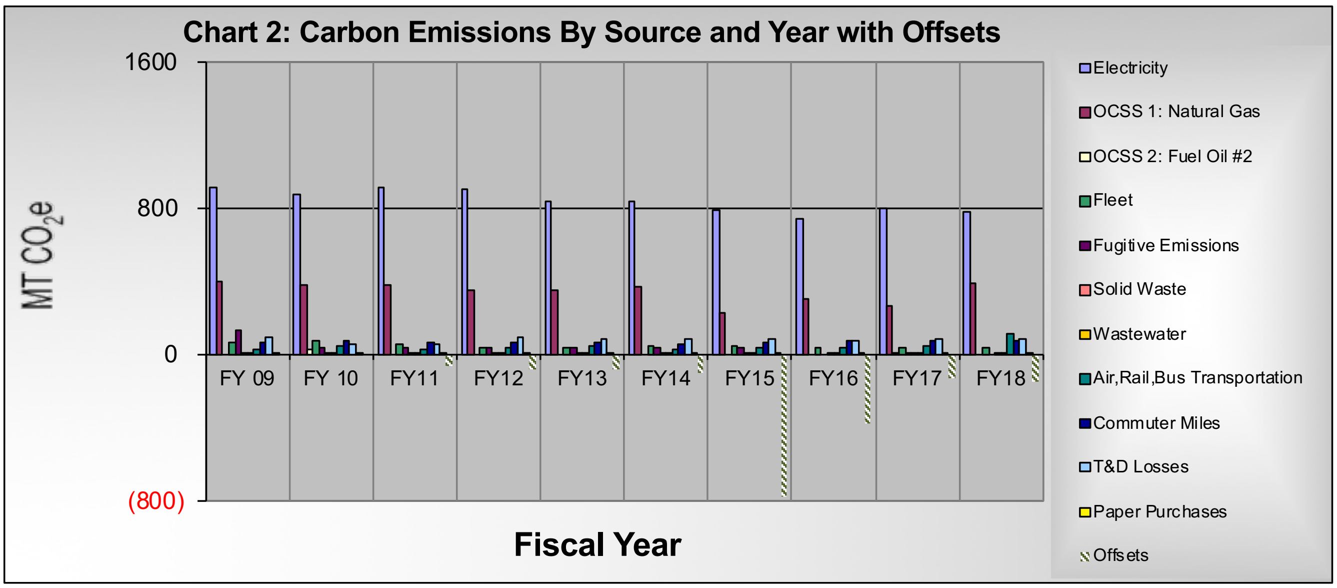


Chart 3: Break-out comparison of carbon emissions by source.

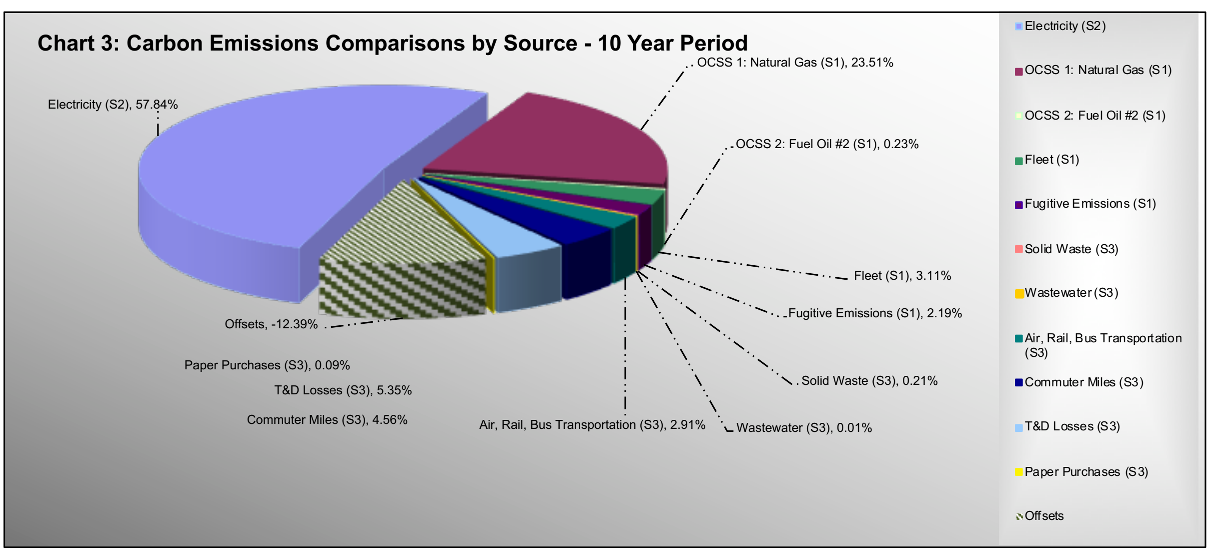


Chart 4: mt net eCO_2 emissions trend over the study period

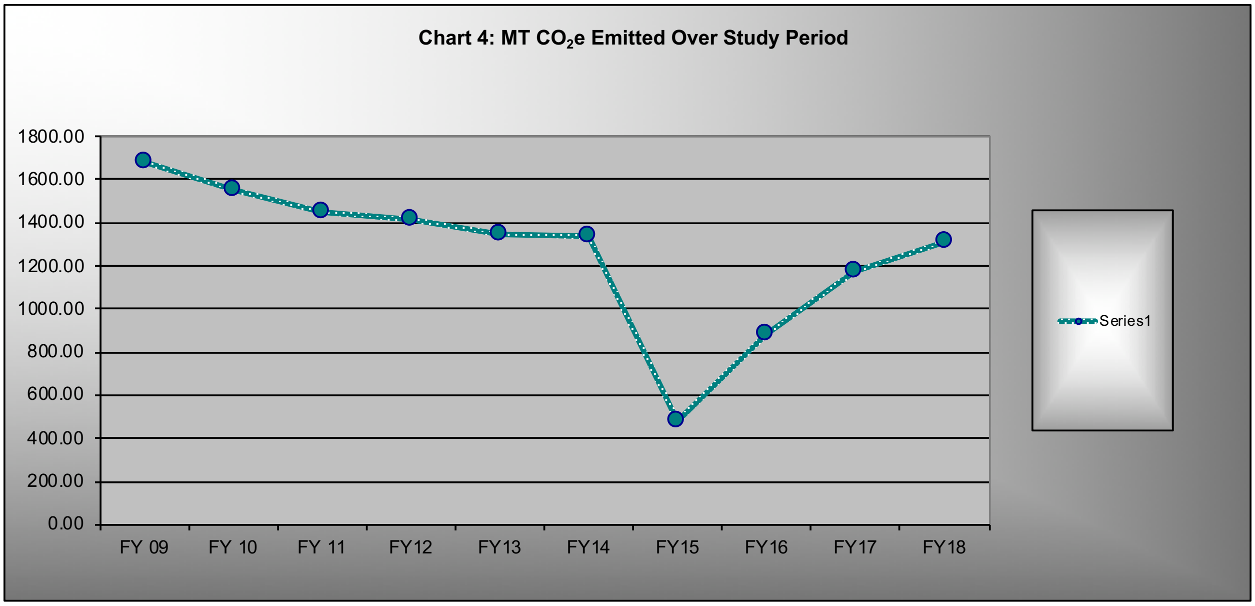
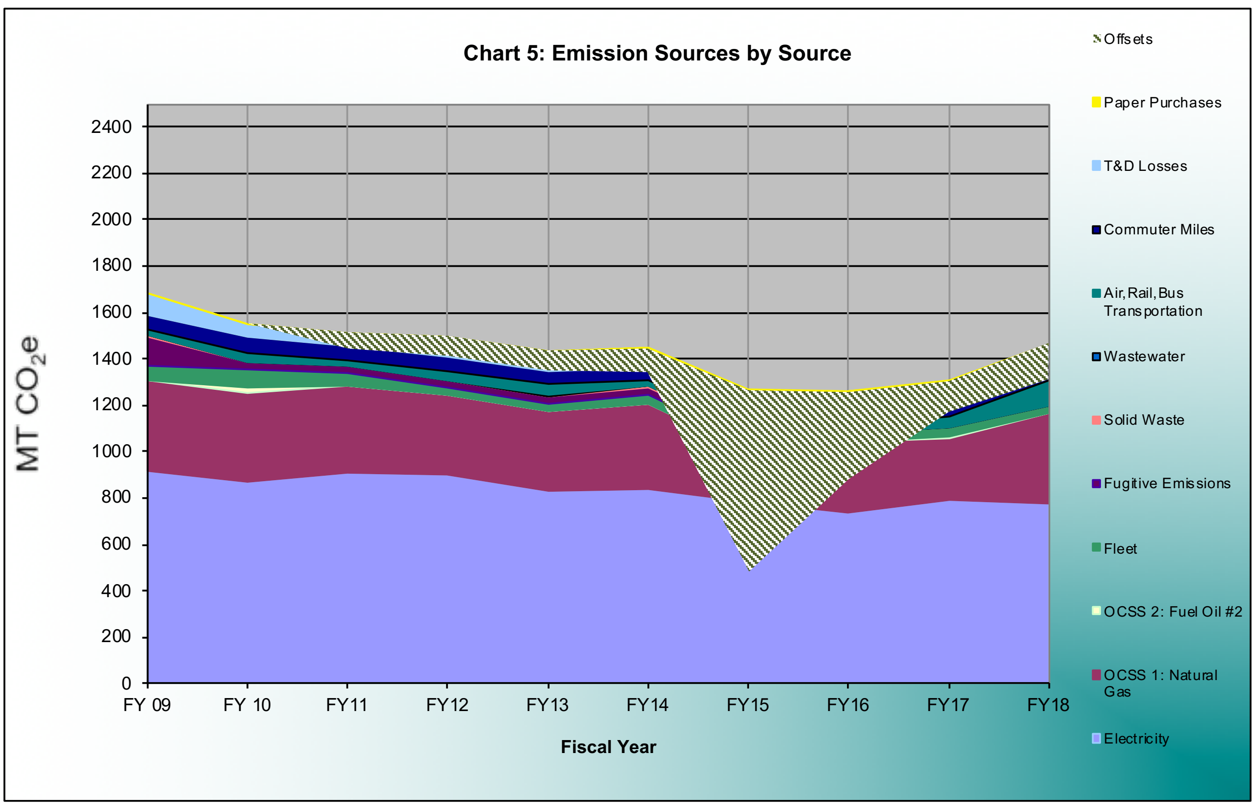


Chart 5: Net emissions over the study period by source.



Charts 6 & 7: Total emissions over the study period by emission scope

Chart 6 shows the total emissions by scope over the study period as generated by the Campus Carbon Calculator.

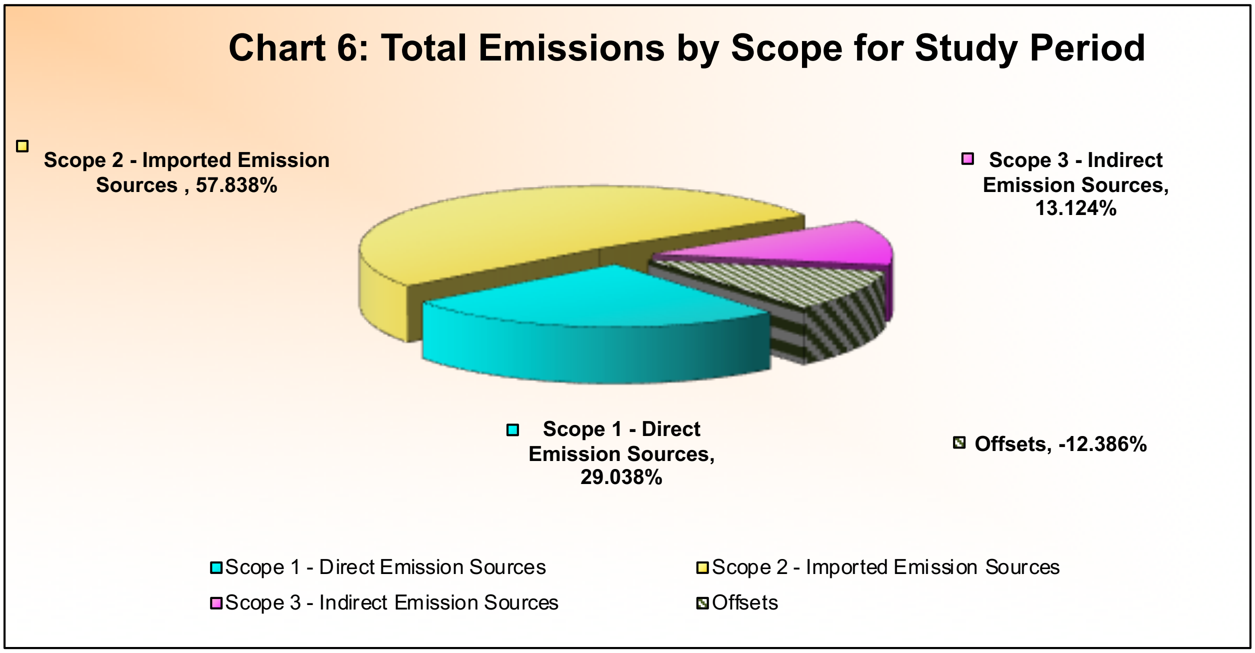
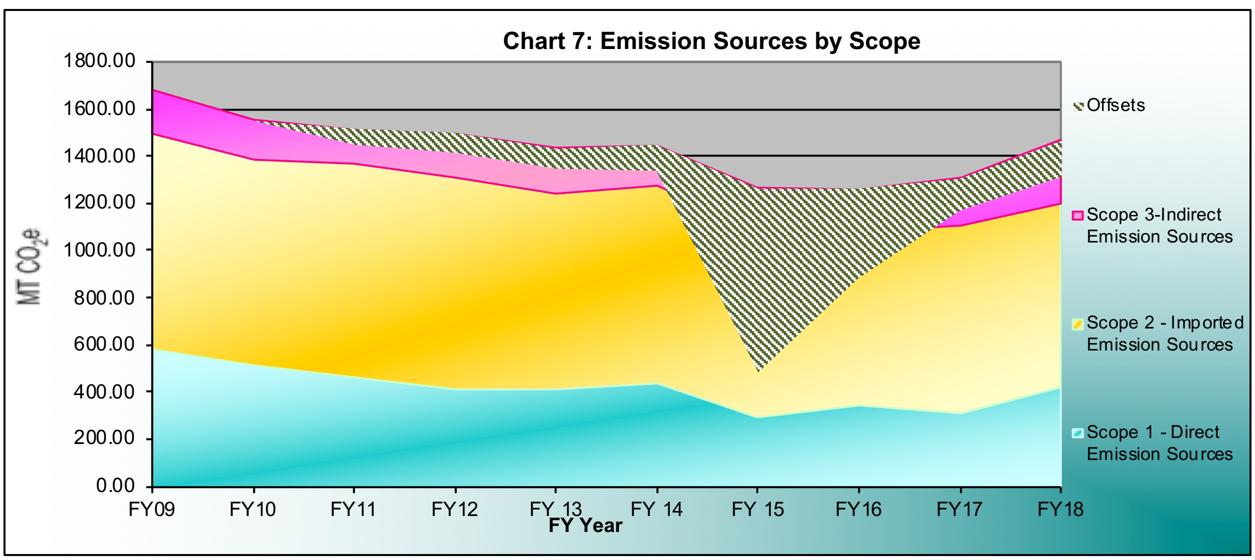


Chart 7 provides an area view of the total emissions by scope over the study period as generated by the Campus Carbon Calculator.



Section V: Results & Actions

V.A. Results

For the 10-year study period, our GHG inventory shows that **63.19%** of the Appalachian Lab's CO_2 emissions result from ***electricity*** use: 57.84% from electricity use and 5.35% from electricity transmission and distribution losses. On-Campus Stationary Sources contribute a total of **23.74**%: 23.51% from ***natural gas*** and 0.23% from ***fuel oil #2.*** Comparatively, **13.97%** result from the remaining emission sources: 2.91% of emissions result from ***air, rail and bus transportation,*** 3.11% from ***fleet use***, 2.19% from ***fugitive emissions,*** 4.56% from ***commuter travel,*** 0.21% from ***solid waste disposal,*** 0.08% from ***paper purchases*** and 0.01% is from ***wastewater.*** Additionally, we have been able to offset our Scope 2 emissions by 12.39*%* .

V.B. Actions

UMCES Appalachian Laboratory has and will continue to use the results from this GHG inventory to help set reduction targets and lessen our potential climate footprint. Several plans are in place and are being developed to help reach this goal. Our primary targets will begin with addressing the emissions from the building itself and working outward. Below is a list of our current and planned courses of action for reductions. These are defined in greater detail in the Climate Action Plan (CAP) with strategies and suggested policies to implement them.

Current courses of action:

1) Administrative Policy Modifications
2) Revised Building Maintenance Plans
3) Stringent Fleet vehicle assignments
4) Hybrid vehicle purchases
5) Greener landscaping
6) Meadow and tree plantings
7) Environmentally Preferred Procurements
8) IT Policies
9) Recycling Program
10) Renewal Energy Certificates (REC)
11) Increased video conferences
12) Power-down policy
13) Chemical laboratory re-design
14) LED lamps to replace metal halide lamps in parking lot lights, emergency building lamps, loading dock lamps, arboretum lighting and pedestal lamps at entrance.
15) Installation of Water Bottle Filling Station in Lobby, Second and Third Floor Hallways.

Proposed courses of action to reduce our climate footprint are:

1) Installation of additional energy efficient bulbs
2) Installation of renewable energy source
3) Installation of an electric car charger
4) Installation of solar film on windows
5) Gray water and/or Barrel collection systems
6) Carbon Offset Projects

AL facility staff are currently reviewing and implementing the list of recommendations provided by the site audit as part of the Energy Performance Contract (EPC) with Constellation Energy.

Section VI: Climate Leadership Commitment

VI.A. Comprehensive Commitment

Dr. Boesch signed the initial ACUPCC commitment on December 18, 2007 and on October 5, 2015, he signed the new, rebranded. The Climate Commitment integrates carbon neutrality with climate resilience and provides a systems approach to mitigating and adapting to a changing climate. The Resilience Commitment is focused on climate resilience and community capacity-building to deal with a changing climate and resulting extremes while the he Carbon Commitment is focused on reducing Greenhouse Gas emissions and achieving carbon neutrality as soon as possible.

Our commitment to climate change is echoed in the development of an UMCES-wide Environmental Sustainability Council (ESC) that consists of students, faculty and staff from the Center's four laboratories (AL, CBL, HPL and IMET), Center Administration, and Maryland Sea Grant College Program. The ESC functions as a task group and advisory body to the President and Administrative Council.

The mission of the ESC includes:

1. *Engaging the faculty, staff and students in an ongoing dialogue about reaching environmental sustainability.*
2. *Providing assessments of the sustainability of operations and recommendations to the President and Administrative Council for improved practices and policies.*
3. *Serving as the "institutional structure" to guide the development and implementation of a comprehensive climate action plan in fulfillment of the ACUPCC signed by Dr. Donald F. Boesch on December 18, 2007.*

In order to support the UMCES ESC, the Appalachian Laboratory Environmental Sustainability Council (ALESC) was created to serve as the laboratory/department level advisory council. This council worked with the Administration to complete a comprehensive inventory of greenhouse gas emissions and will continue to work with the Administration to complete and implement an institutional action plan for becoming climate neutral. These efforts shall be consistent with the standards provided in the Implementation Guide (http://secondnature.org/climate-guidance/).

Our Climate Action Plan will help the Appalachian Laboratory achieve the goal of carbon neutrality. This plan is a “living document” that will be updated regularly to meet this new commitment by our University, State and Nation. The recommended goal for the State of Maryland is to introduce legislation requiring the development and implementation of programs to reduce GHG emissions by 90% by 2050 with interim goals and updates. UMCES is following this lead by setting the same or similar goals for reductions.

To be consistent with other UMCES laboratories, the timeline (Table 16) for our goals for carbon emissions reductions are based on FY08 levels. Our total, Scope 1, 2 and 3 emissions for FY 08 were 1714.08 MT CO_2e

Table 16: Goals for Emissions Reductions				
Fiscal Year	GHG Emissions MT CO_2e Goals	Appalachian Laboratory Reduction Goals - Relative to FY08 Levels	Appalachian Laboratory - Actual Emissions	Appalachian Laboratory Actual Emissions - % of reduction from baseline
2008 - Baseline	1714.08	Actual	n/a	n/a

2012	1542.67	10% below 2008 levels	1416.79	17.34 % below FY 08 levels
2015	1459.96	15% below 2008 levels	482.3	71.86% below FY 08 levels
2030	1285.56	25% below 2008 levels	TBD	TBD
2040	857.04	50% below 2008 levels	TBD	TBD
2050	171.40	90% below 2008 levels	TBD	TBD

VI.B. Climate Action Plan

As a signatory to the ACUPCC, rebranded The Climate Commitment, the following milestones have been set into place.

1. *Develop a comprehensive Climate Action Plan*
   a. Within two months, of signing this document, create institutional structures to guide the development and implementation of the plan.
   b. Within one year, actively support a joint campus-community task force to ensure alignment of the Plan with community goals and to facilitate joint actions, and a complete a greenhouse gas emissions inventory, identifying near term opportunities for greenhouse gas reductions.
   c. Within two years, lead and complete an initial-campus-community resilience assessment including initial indicators and current vulnerabilities.
   d. Within three years of the implementation start date complete the Plan to include:
      i. A target date for achieving carbon neutrality as soon as possible
      ii. A target date by which thresholds of resilience will be met
      iii. Interim target dates for meeting milestones that will lead to carbon neutrality and increased resilience
      iv. Mechanisms and indicators for tracking progress
      v. Actions to make carbon neutrality and resilience part of the curriculum
      vi. Actions to expand research in carbon neutrality and resilience.
   e. Review, revise if necessary, and resubmit the climate action plan not less frequently than every five years.
2. *Submit an annual evaluation of progress*
   a Within one year of the implementation and every year thereafter, complete annual evaluation of progress.
   b Make the action plan, annual evaluation of progress publicly available by submitted to Second Nature's reporting system.

Given the geographical distribution of the UMCES Labs, each lab is tasked with completing the GGE inventory for their respective campus. This data are then collected and compiled to create an UMCES master emissions inventory. This resulting data are used to prepare our UMCES Climate Action Plan and to complete the annual evaluation and progress reporting as required by the Commitment.

VI.B.1. Carbon Commitment

The first component of the Climate Commitment Climate Action Plan is the Carbon Commitment. This requires the establishment of a target date for carbon neutrality, mechanisms to track progress, evaluations of emissions reductions including greenhouse gas inventories and progress reporting.

Although our emissions have been on a slight decrease for the last several years, the bulk of the total emissions are from the building electric and HVAC. Our first step toward continuing our reduction of our climate footprint must focus on the use and consumption of energy within the building. Reductions will require monitoring and continued maintenance of equipment to gain as much energy efficiency as possible from existing equipment, replacement of non-energy efficient equipment and continuation of recycling and conservation efforts already in place.

In order to reduce our carbon footprint, the AL facility staff will continue to review the list of recommendations provided by the site audit as part of the Energy Performance Contract (EPC) with Constellation Energy. 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 –upgrade
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.

VI.B.1.a. Current Energy Conservation Measures

In order to meet our reduction goals, the following strategies have already been or are being implemented.

VI.B.1.a.(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 carbon footprint 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.

The AL ESC will be responsible for the preparation and maintenance of an emissions inventory as a guiding tool for campus sustainability and ongoing efforts to reduce our carbon emissions. This will enable the tracking of AL's goals and achievements.

The AL ESC Sustainability Website designed to educate, encourage and promote sustainability efforts was launched in July 2008. The website contains the sustainability reports, recycling efforts, "green" tips as well as other information relating to a sustainable campus.

VI.B.1.a.(2) Facilities Operations

Heating and cooling.

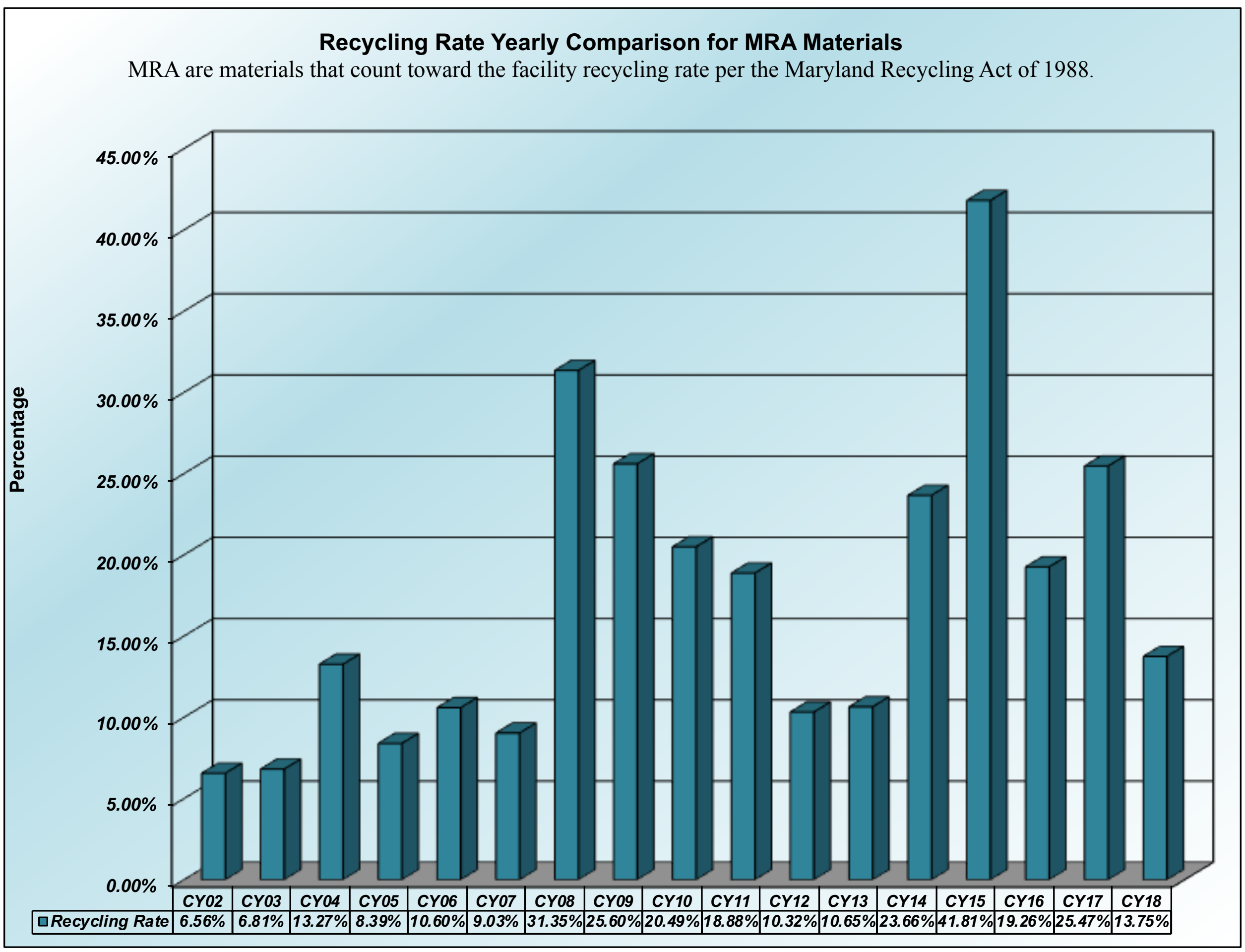
Thermostats are programmed to operate in occupied mode 24 hours a day with minimum and maximum thresholds established for many building zones as most of the lab spaces require continuous operation. This policy was established since temperature recovery was too long to meet the required needs, causing comfort issues. 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.
Exterior 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.

Recycling and Waste Minimization
AL's recycling program, see chart 8, currently includes all mixed office paper, cardboard, paperboard, magazines, toner cartridges, plastics #1 & #2, batteries (alkaline and rechargeable), CPUs, cell phones, monitors, printers and mixed metals through the Allegany County Recycling program.

a. Prior to 2002, all of AL's recyclables were included with Frostburg State University.
b. January 2002, AL initiated their own recycling program, recycling all mixed office paper, magazines, toner cartridges, wet cell batteries, CPUs, cell phones, monitors, printers and mixed metals
c. February 2004, rechargeable batteries and cardboard were added.
d. September 2004, plastics 1 & 2 were added to the recycling program.
e. October 2007, alkaline batteries were added to the recycling program.
f. February 2008, paperboard was added to the recycling program
g. December 2011, glass was added to the recycling program.
h. Annually, building wide electronics recycling

Chart 8: Recycling Rate by Calendar year for MRA Materials



Our 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. 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. This was a 50% reduction in solid waste going to the landfill, which also resulted in a reduction in emissions from the disposal company trucks, and cost savings for the lab. AL maintenance staff has increased maintenance on aging equipment to gain as much energy efficiency as possible and we are replacing non-energy efficient equipment with newer, more efficient models when available and when replacement is necessary.

Power Down Policy
AL has implemented policies to "power down" during non-working hours. This should include computers, printers, equipment, lights, etc. All power sources that will not be harmed by being powered off should be addressed. Implementing software that automatically powers down computer monitors when not in use would aid to this adjustment. The main barriers associated with a power-down policy are personnel related. With often hurried schedules, people simply forget. This is one of the easiest actions that can be implemented building wide. However, just asking does not always work. Policies and possible software to support the "power down" efforts and also to educate and train employees how to set up power save functions on equipment is encouraged. In addition, sustainability education can serve to unite the community by fostering a common understanding of the challenges faced in seeking to live and work sustainably.

Heating, Ventilation, and Air-Conditioning (HVAC)
Appalachian Laboratory's chemical laboratories are designed as negative pressure labs for containment purposes, which results in significant losses of heated or cooled air from the building. In 2015, the building was re-engineered to allow more control over individual rooms and adjust the exhaust when facility use and needs change while ensuring the health and safety of laboratory users. In conjunction with the installation of variable frequency drives, **(ECM-2),** energy efficient exhaust fans and a complete testing, adjusting and balancing of the buildings we have significantly decreased the building's energy usage by approximately 22%. Additionally, we upgraded the outdated Metasys Controls have been to Facility Explorer as our automated building controls to ensure proper operation based on current building needs **(ECM-3 & 4).** Additionally, planned improvements include the installation of variable frequency drives on the hot water & chilled water pumps to meet **ECM-1**. This will be completed when the budget allows.

Lighting System Retrofits
AL is continually looking at ways to reduce energy cost and use though lighting retrofits, referenced in **ECM-5&6.** Additionally, in areas that have been over-lit, extra lamps are removed. This is a relatively easy, cost-less way to reduce electricity use. Almost all offices and labs have windows, so de-lamping in these areas goes mostly unnoticed.

In 2017, the Appalachian Lab had several building areas re-lamped to install energy efficient LED bulbs. First, the exterior parking lot lamps were retrofitted to remove the 175W metal halide lamps and the magnetic ballasts (208 W total) and replace them with 45W LED lamps. The estimated KWHs saved on this project are 21,360 kwh per year and an estimated $3,396 in energy costs per year.

Additionally, in 2017, 5 - 208W Metal Halide lamps and the magnetic ballasts were replaced on our loading dock with 5 - 24 W LED lamps. The estimated KWHs saved on this part of the project are 8,037 KWHs per year and an estimated $1,278 in energy cost per year.

Finally, in 2017, emergency lights on the second floor of the building were re-lamped from 32W Fluorescent bulb to 15W LED bulbs. A total of 16 lamps on the second floor hallway were replaced for an estimated savings of 2,376 KWHs and an estimated $378 in energy costs save per year.

These new LED lamps have a guaranteed life of 5 years as compared to the Metal Halide lifespan of about a year so not only is there an energy savings, there is also a direct savings in the replacement costs. The savings returned will pay for the project cost investing in just over year.

AL is scheduled to replace the current fixtures in the 12 exterior entrance way pedestal lights with LED fixtures as well as the emergency lighting for the 1st and 3rd floor hallways.

Water Bottle Filling Stations

In April 2018, AL installed our first water bottle filling station to replace existing water fountains in our main lobby. The selected unit allows for the refrigeration unit to be scheduled to save energy during times of non-use, and has a low energy LED lamp in the viewing area for dark bottles and hallway illumination. The unit also estimates the number of saved bottles. Two more units have been installed on each of the second and third floor hallways.

VI.B.1.a.(3) <u>Procurement Practices</u>

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 50% post-consumer recycled paper. In October 2009 we moved to 100% post-consumer recycled paper. Office products such as envelopes and mailers & food service items such as paper towels, napkins, cutlery, plates and cups are purchased with the maximum recycled content available through our purchasing sources. 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.

<u>VI.B.1.a.(4) Technology Practices</u>

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 has three such systems for use by the AL community for meetings or remote classes.

CRT monitors are being surplused and replaced with LCD monitors. Overall, LCD monitors can reduce energy consumption by 60% when compared to an equivalant viewing area sized CRT. Additionally, LCD's are now priced comparatively to CRTs, their carbon footprint is much smaller for the equivalent viewing area, the image quality is excellent and they reduce eye strain as there is no glare or screen flicker.

AL's IT administrator is continually moves toward virtualization. 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. 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.

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

VI.B.1.a.(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 Bay Runner 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 desk top solutions, in lieu of face-to-face meetings.

VI.B.1.b. Suggested Energy Conservation Measures

These measures are recommended but have not yet been formally planned or initiated.

VI.B.1.b. (1). Additional Building Insulation

1. Installation of insulating window film or blinds. These insulting blinds and films reduce the amount of solar heat transmission through window glass by increasing the solar reflection (not necessarily visible reflection) and solar absorption of the glass to save on cooling and by reflecting more of the interior room heat back into the room where it is needed to save on heating costs. The primary barriers to this option are the cost and the displacement of personnel during the installation. In the interim, all windows were resealed and caulked to reduce heating and cooling loss. AL will complete these as needed and when funds become available
2. Installation of additional attic insulation to help increase energy efficiency of the entire building and reduce our emissions. The primary barriers to this option are the cost and proof of energy savings. The installation of additional insulation in the attic will reviewed and scheduled should the energy savings support the cost.
3. Installation of additional insulation between brick and glass curtain walls in the lobby. The brick wall may not contain insulation at the window frame to reduce heat loss. Adding insulation panels will reduce heat loss and the heat transfer along the brick wall and behind the window frame. **(ECM-8)** Primary barrier is cost. AL will complete this insulation as soon as funds are available.
4. Inspection and review of building exterior to determine the condition and need for addition caulking and sealing of building seams and cracks to reduce both air infiltration and the building heating load. **(ECM-7).** Primary barrier is cost. AL will complete this caulking and sealing as soon as funds are available

VI.B.1.b. (2). Renewable Energy Sources (Local & System Wide)

1. ***Wind Energy***: Site locations for wind turbines must be Class 1 or at least 4.4 meters per second (mps) average wind speed in order to be an effective alternate energy source. After review by the Maryland Energy Administration in November 2007 and confirmation from wind speed history reports from our greenhouse anemometer, it was determined Appalachian Laboratory's location does not meet the minimum recommended speed for use of a wind turbine, thus this would not be a viable option at this time. A solution would be to participate and promote in system wide efforts to use renewable sources of energy that will benefit all institutions.
2. ***Solar Energy:*** The next option is to research the possibility solar panel system as an alternate energy source. This could be grid-tied or off grid depending on the final application of system. The AL site would need to be surveyed by certified installer to determine options for location, size, and type of solar system. The barriers to solar energy include the initial cost of the materials and the ability to retrofit with current building systems. Solar energy is only able to generate electricity during daylight hours and weather and pollutions levels can affect the efficiency of solar cells. Although, at first glance, this does not appear to be the most viable application for AL, the installation of a solar array that would power our greenhouse, would be an excellent test model and something that can be explored. The AL site would need to be surveyed by certified installer to determine options for location, size, and type of solar system. Additionally, we will continue to participate and promote system and statewide initiatives to use renewable sources of energy that will benefit all institutions.
3. ***Solar Hot Water System:*** The south side of the building would be a prime location for this type of a system; however, a water use survey would need to be conducted at lab as the initial step in determining if the quantity of hot water used at the lab warrants further investigation into this system.
4. ***Electric Vehicle (EV) Charging Station:*** AL is looking at options and locations to install an EV charging station in conjunction with the first electric vehicle purchased for our AL fleet.

VI.B.1.b. (3). Water Collection and Re-use

1. ***Gray water system*** to collect, treat and re-use water from wash areas in the building as a source of plant irrigation, to reduce use of fresh (drinking) water and to reduce the water sent to treatment plant. Additional research on gray water and barrel systems is needed before an estimate on the emissions reductions can be established. The main barriers to a gray water system are the costs associated with retrofitting the building facilities in order to re-route wash water to a gray water system. Local authorities and health officials would need to be contacted regarding any special/local concerns and regulations with respect to gray water systems. A professional engineer would need to be involved to insure that only gray water, water-excluding black waters and free of garbage-grinder residues, is re-routed. Additional data collection to determine if the amount of wash water would warrant the installation of a gray water system.
2. ***Barrel system*** to collect and store rainwater for later use on demand. The main barriers to a barrel system are, again, the costs associated with retrofitting the building facilities in order to re-route rainwater to the barrel system. A well designed system that would provide for overflow, insect and mosquito control and easy access to water is a requirement. To decrease the cost associated with the design, a barrel system could be engineered to collect rainfall from the greenhouse only. As the greenhouse facility is the largest consumer of water we have, it would be good business practice to make this the first structure to be fitted for this type of system and possible an excellent test model.

VI.B.1.b. (4). Carbon Offset Projects

Carbon offset projects to reduce or remove CO_2e GHG emissions, are used to counterbalance or compensate for ("offset") emissions from other activities of the institution. Carbon offsets represent the act of reducing, avoiding, destroying or sequestering the equivalent of a ton of GHG in one place to "offset" an emission taking place somewhere else. Offsets generally represent direct emission reductions or sequestration and can be from non-electric sources, such as planting new tress on previously un-forested acreage. Offsets should be used to reduce Scope 1 and Scope 3 emissions ensuring that each ton emitted is wholly counterbalanced by an additional emission reduction. Offsets face strict rules for approval, including the requirement that the emission reduction credited be real, permanent, verifiable, and most importantly, additional to a business-as-usual scenario. This will present an actual cost to the institution. Budget concerns always impact new projects, especially ones that provide no tangible products or results. Offsets provide for a direct reduction in an institution's carbon footprint, usually from Scope 1 & 3 emissions. Emissions must be reduced by all other methods in order to reach the lowest reduction point. Once this is done, the quantity of offsets that needs to be created in order to offset emissions from sources that cannot be reduced or avoided will be more attainable.

VI.B.1.a. (5). Renewable Energy Certificates (RECs)

RECs, represent 1 MWh of energy generated from a clean, renewable source, such as wind, solar, hydro, or certain types of renewable biomass. RECs bought - either from the utility as "clean energy" or from independent REC suppliers - in addition to actual electricity, are usually used to neutralize Scope 2 emissions by matching out each "dirty" megawatt of electricity an institution uses with a "clean" megawatt represented by a REC. AL currently has no on-campus activities and has not purchased any Renewable Energy Credits (RECs) directly to offset carbon emissions. However, MD state law requires that the supplier meet the Renewable Portfolio Standard (RPS,) based on schedule provide by DGS to meet a 25% portfolio by 2020. This schedule increases by year and has been applied to our energy use as represented in this report. Additionally, beginning in FYs 11, UMCES was apportioned Renewable Energy Credits associated with the three power purchase agreements with Roth Rock, Pinnacle and Mt. St. Mary's through the USM System wide purchase. However, because of the inherent difficulty in tracking RECs, allocations, begin in FY15 the USM discontinued the practice of allocating RECs to institutions that are not on the Block and Index supply contract – this included UMCES. While our institution may still purchase RECs through their supplier under a separate agreement, after FY 15 we no longer receive an additional annual allocation from the PPAs

VI.B.2. Resilience Commitment

The second component of the Climate Commitment Climate Action Plan is the Resilience Commitment. This requires an initial campus-community resilience assessment including indicators and current vulnerabilities, mechanisms to track progress, risk and response evaluations, and progress reporting. As part of our resilience plan, we have identified potential problems and events to assess our vulnerabilities by determining the at-risk areas. This includes investigating options, evaluating the risks and cost associated with each event and recommending actions to adapt. We have outlined our initial evaluation of events and at-risk areas in Table 17.

Table 167: Events, At-Risk Areas and Response

Event - Spring	At Risk Areas/Vulnerabilities	Response
Snow melt	Localized flooding causing damage to SWP, 1 &2. Main or side roads blocked to emergency response teams.	Annual maintenance to clear ponds to ensure proper and quick drainage to avoid overflows. Alternate routes.
Event - Summer	**At Risk Areas/Vulnerabilities**	**Response**
Extreme Heat	Increased utility usage.	Reduce all excess usage to relieve strain on utilities.

	Strain on transformers and AHUs.	Reduce all excess usage to relieve strain.
	Fire hazards.	Additional monitoring of at risk areas, EPP in place to handle response.
Event - Summer	**At Risk Areas/Vulnerabilities**	**Response**
Hurricane/Tornado	Property damage.	EPP in place to handle response.
	Personal Injury.	EPP in place to handle response.
	Interruptions to research and business operations.	Emergency generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and offsite.
	Main or side roads blocked to emergency response teams.	Alternate routes.
	Total facility loss.	EPP in place to handle response.
Event - Summer	**At Risk Areas/Vulnerabilities**	**Response**
Super Storm	Property damage.	EPP in place to handle response.
	Personal injury.	EPP in place to handle response.
	Interruptions to research and business operations.	Emergency generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and off site.
	Main or side roads blocked to emergency response teams.	Alternate routes.
	Total facility loss.	EPP in place to handle response.
Event - Summer	**At Risk Areas/Vulnerabilities**	**Response**
Lightning	Property damage.	EPP in place to handle response.
	Damage to electrical and computing systems.	Systems in place for backup of critical data, on and off site.
	Personal Injury.	EPP in place to handle response.
	Interruptions to research and business operations.	Emergency generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and offsite.
	Fire hazards.	EPP in place to handle response.
Event - Fall	**At Risk Areas/Vulnerabilities**	**Response**
Hurricane	Property damage.	EPP in place to handle response.
	Personal injury.	EPP in place to handle response.
	Interruptions to research and business operations.	Emergency generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and offsite.
	Main or side roads blocked to emergency response teams.	Alternate routes.
	Total facility loss	EPP in place to handle response.
Event - Fall	**At Risk Areas/Vulnerabilities**	**Response**

Super Storm	Property damage. Personal injury. Interruptions to research and business operations. Main or side roads blocked to emergency response teams. Total facility loss.	EPP in place to handle response. EPP in place to handle response. Emergency Generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and offsite. Alternate routes. EPP in place to handle response.
Event - Fall	**At Risk Areas/Vulnerabilities**	**Response**
Nor'easter	Property damage. Personal injury. Interruptions to research and business operations. Localized flooding.	EPP in place to handle response. EPP in place to handle response. Emergency generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and offsite. Maintenance to clear ponds and storm drains to ensure proper and quick drainage to avoid overflows.
Event - Winter	**At Risk Areas/Vulnerabilities**	**Response**
Extreme Cold	Piping systems. Increased utility usage. Interior Flooding	Additional monitoring of at risk areas such as ceilings and attics. Reduce excess usage to relieve strain on utilities. Plan of action in place to cut water supply, control water flow and cleanup.
Event - Winter	**At Risk Areas/Vulnerabilities**	**Response**
Nor'easter	Property damage. Personal injury. Interruptions to research and business operations. Localized Flooding.	EPP in place to handle response EPP in place to handle response Emergency Generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and off site. Maintenance to clear ponds and storm drains to ensure proper and quick drainage to avoid overflows
Event - Winter	**At Risk Areas/Vulnerabilities**	**Response**
Extreme Snow	Property damage. Personal injury. Interruptions to research and business operations. Building and/or greenhouse roof collapse.	EPP in place to handle response. EPP in place to handle response. Emergency generator for short term power to allow longer provisions to be made; Systems in place for backup of critical data, on and offsite. Close monitoring of roof for heavy snow accumulation, plans for removal of snow and closure as/if necessary to prevent injuries.

	Falling ice and snow at building perimeter-danger to pedestrians. Main or side roads blocked to emergency response teams.	Close monitoring of roof for heavy snow accumulation above exits/entrances and closure as/if necessary to prevent injuries. Alternate routes.

The Appalachian Lab's geographical location in the Appalachian Mountains of western Maryland, place us in a climate area where we observe all four seasons and most weather patterns giving us a unique adaptability to changing events. As we are acclimated to our regions, some of these events simply require a change in personnel duties and equipment used on a daily basis to keep the organization in normal operations. However, for significant events that cause disruption to the function of the laboratory, we have created an Emergency Preparedness Committee. This committee's primary function is to plan, develop, and maintain the Appalachian Laboratory-Emergency Preparedness Plan (AL-EPP). The EPP defines policies and procedures which will assure maximum and efficient utilization of resources during any large-scale emergency.

When assessing possible risks, it is critical to have an execution plan in order to prioritize response and initiate damage control.

AL maintains the follow priorities during any emergency event:

1. Life Safety – AL is committed to the protection of human life and health safety. All necessary measures will be taken to ensure the safety of all persons at AL. These measures will include evacuation, closing of campus, shelter as necessary and crisis response, including counseling.
2. Hazardous Materials and Chemical Containment – Essential for life and health safety of staff and emergency responders.
3. Animal Safety – AL is also committed to the protection of research animals housed in our laboratory. All necessary measures will be taken to ensure the safety and well-being of research animals as long as human life is not endangered.
4. Facility and Campus Infrastructure Preservation – Take measures to protect the building structures prior to the event when feasible, such as taping or boarding glass and shutting off utilities.
5. Document and Historical Item Preservation – Take measures to protect the items that cannot be replaced, including (but not limited to) library books and documents, historical valued items, photographs, etc.
6. Research Equipment Preservation – This includes lab capital investments. Valuable research equipment should be moved to safer areas if they are in a danger zone (i.e., susceptible to flooding).
7. Continuity of Research – This includes the preservation of live species, samples, research documents, and non-capital lab equipment.
8. Recovery and Resumption of Operations – Facilities staff and outside contractors will assess and clear campus, clean up damaged areas (equipment and buildings), restore infrastructure, and being normal operations as quickly and efficiently as possible.

The AL building is adjacent to the Frostburg State University campus community making them a valuable resource for the AL building. UMCES AL has an active MOU with FSU Campus Police to provide services for building and grounds security and police protection for AL's facilities. This includes:

- 24-hour on call police protection
- Drive through and walk through surveillance of grounds and building.
- Respond to any fire alarm reported through the building fire alarm reporting system
- Respond to any emergency reported through the elevator reporting system

- Respond to emergencies as reported through the emergency blue light
- Respond to any calls generated by the building security system.

To aid in the continuation of critical functions during an emergency event, AL maintains an emergency generator engineered to support critical labs and administrative areas during a power outage. Supplied by a 2000-gallon fuel tank, the generator will support these functions until fuel is depleted. Additionally, AL has three UPS systems, one building wide system that support designated power outlets throughout the lab and administrative buildings, one to support the PBX and Voice Mail systems, and one so support our CASIF lab do to the sensitive nature of the equipment housed there.

The onset of disasters is usually extremely rapid and allows little or no time for preparation. This advance planning is a critical first step in building our resilience to help ensure that AL can effectively and efficiently prepare and handle any disaster or crisis event affecting the laboratory and also help to ensure a restoration and resumption of campus operations as quickly as possible.

VI.C. Costs and Financing

Affordability is key when dealing with any changes to the way that we do business. As we have seen the cost of products with recycled content continue to drop and products become more widely available, it is clear that with the increased development of sustainable technologies, renewable energy projects are also becoming more financially feasible. The Appalachian Laboratory Administration is committed to providing available funding for 'green' initiatives. The continued support of the recycling program at the Appalachian Laboratory and the purchase of available and affordable recycled materials is a priority for the institution as is the purchase of high efficiency motor vehicles.

VI.D. Communication and Dissemination

UMCES Appalachian Laboratory will use multiple of sources in order to communicate our sustainability efforts and progress to the AL community, UMCES community and the general public. An open door policy for suggestions, ideas, comments etc., has always been in place within the AL community and will continue to be the practice for our sustainability program.

ALOnline is the Appalachian Laboratory intranet with a multitude of features to allow the AL community to easily share information. The URL is http://alonline.al.umces.edu Individuals set up their own account on the homepage and then can add/create/edit content to be shared with other AL-ers.

The Appalachian Laboratory Environmental Sustainability Initiative webpage http://www.umces.edu/al-environmental-sustainability-initiative highlights the sustainability efforts, goals and resources at the Appalachian Laboratory. This website is publicly available.

UMCES, being one of the signatory institutions to the ACUPCC, agrees to make our climate action plan, inventory, and progress reports publicly available by providing them for posting and dissemination per the timelines set up by the plan based on our signing date. http://reporting.secondnature.org/

In August 2009, University of Maryland Center for Environmental Science joined the *Maryland Green Registry*, http://www.green.maryland.gov/registry/index.html a self-certification program offering tips and resources to help organizations set and meet their own goals on the path to sustainability.

VI.E. Conclusions

UMCES Appalachian Laboratory has and will continue to use the results from annual GHG inventories and recommended energy conservation measures to help set reduction targets and lessen our potential climate footprint. Several plans are both in place and being developed to help reach this goal. Our primary targets will begin with addressing the emissions from the building proper and working outward.

With implementation of some of the key strategies, the Appalachian Laboratory anticipates meeting the climate commitment goals we have set in place. Ultimately, when emissions have been reduced as much as possible through the energy conservation measures addressed here, our carbon reductions may need to be further reduced by the purchase of carbon offsets from reputable traders in renewable energy credits in an amount equal to the number of tons of carbon dioxide equivalents (CDEs) remaining.

The identification of events and risk factors and our plans for response will ensure that AL can effectively and efficiently prepare and handle any disaster or crisis event affecting the laboratory and also help to ensure a restoration and resumption of campus operations as quickly as possible.

This plan will be revised and enhanced continually to keep up with new developments, personnel changes, and facility changes, but these changes should not alter our overall commitment to achieving and maintaining a sustainable campus.

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Section VIII: Acronyms and Abbreviations

AASHE	Association for the Advancement of Sustainability in Higher Education
ACUPCC	American College & University Presidents Climate Commitment
AHU	Air Handling Unit
AL	Appalachian Laboratory
CA-CP	Clean Air - Cool Planet
CAP	Climate Action Plan
CBL	Chesapeake Biological Laboratory
CCC	Campus Carbon Calculator
CESU	Cooperative Ecosystems Studies Unit
CF	Cubic Feet
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalency
CRT	Cathode Ray Tube
CW CESU	Chesapeake Watershed Cooperative Ecosystems Studies Unit
CY	Calendar Year
DDC	Direct Digital Controls
DNR	Maryland Department of Natural Resources
ECM	Energy Conservation Measure
eGRID	Emissions & Generation Resource Integrated Database
EPA	Environmental Protection Agency
EPC	Energy Performance Contract
ESC	Environmental Sustainability Council
FMP	Facilities Master Plan
FRA	Faculty Research Assistant
FSU	Frostburg State University
FY	Fiscal Year
G8	Group of Eight
GHG	Green House Gas
GSF	Gross Square Feet
GWP	Global Warming Potential
HPL	Horn Point Laboratory
HVAC	Heating, Ventilation, and Air-Conditioning
IMET	Institute of Marine and Environmental Technology
IT	Information Technology
IVN	Interactive Video Network
KM	Kilometer
KWH	Kilowatt Hour
LCD	Liquid Crystal Display
LEED	Leadership in Energy and Environmental Design
MCCC	Maryland Climate Change Commission
MDE	Maryland Department of the Environment

MDSG	Maryland Sea Grant College
MMBTU	Million Metric British Thermal Units
MPS	Meters Per Second
MT CO2e	Metric Tons Carbon Dioxide equivalent
OCSS	On Campus Stationary Source
R134A	Refrigerant 134A
R22	Refrigerant 22
R404A	Refrigerant 404A
REC	Renewable Energy Credits
SGAP	Space Guidelines and Planning
T & D	Transportation and Distribution
U.S.	United States
UMCES	University of Maryland Center for Environmental Science
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
USM	University System Of Maryland
VFD	Variable Frequency Drives
WCPS	Wrights Crossing Pumping Station
WWTP	Waste Water Treatment Plant
Yd3	Cubic Yard