

Meeting Summary March 8, 2019

Council Members Present:

Carlo Colella, Vice President for Administration and Finance (Chair) Linda Clement, Vice President for Student Affairs David Cronrath, Associate Provost for Planning and Special Projects Maureen Kotlas, Executive Director, Department of Environmental Safety, Sustainability & Risk Scott Lupin, Assoc. Dir., Environmental Safety, Sustainability & Risk, and Director, Office of Sustainability MaryAnn Ibeziako, Director, Engineering and Energy, Facilities Management Eric Wachsman, Professor, Materials Science and Engineering and Director, Energy Research Center Bryan Quinn, Director of Technical Operation, Department of Electrical & Computer Engineering Joe Sullivan, Professor, Plant Science and Landscape Architecture Jelena Srebric, Professor, Mechanical Engineering Jana VanderGoot, Assistant Professor, Architecture Amelia Avis, Undergraduate Student, Government and Politics and Policy Timothy Reedy, PhD Student, International Education Policy

Meeting start time: 10:00am

Meeting Highlights

Welcome and Review of December 11, 2018 Meeting Minutes

Carlo Colella welcomed the Council members and called the meeting to order. Meeting summary from December 11, 2018 was approved.

2025 Carbon Neutrality Benchmarking

Sally DeLeon and Mark Stewart from the Office of Sustainability provided a summary of other universities' climate action goals compared to the University of Maryland. The overview can be viewed as Appendix A.

Sustainability Fund Proposals

Amelia Avis presented eleven University Sustainability Fund projects to the Council for approval. Information about the projects are available as Appendix B.

The Council reviewed the following projects:

<u>Weather Technology HVAC Strategy for Stamp</u> The Council voted on a request of \$25,000: APPROVED <u>Terps vs. Pros Sustainable Food Challenge</u> The Council voted on a request of \$20,000: APPROVED

Lewisdale Elementary School Flooding Prevention and Courtyard Restoration The Council voted on a request of \$13,500: APPROVED

<u>Maryland Food Collective Dishwasher</u> The Council voted on a request of \$6,206: APPROVED

<u>Hydraze</u>

The Council voted on a request of \$6,015: APPROVED

<u>Creating A UMD Sustianability Video</u> The Council voted on a request of \$5,000: APPROVED

South Hill Exterior Water Bottle Fill Station The Council voted on a request of \$5,000: APPROVED

<u>GEMstone Team NO SALT</u> The Council voted on a request of \$3,722: APPROVED

<u>Bicycle Recycle Program</u> The Council voted on a request of \$3,500: APPROVED

Banners to Bags The Council voted on a request of \$3,000: APPROVED

Using Macro Algae to Remove Heavy Metals from Water The Council voted on a request of \$855: APPROVED

Open Forum Topics

- Scott Lupin shared that the Request for Proposals (RFP) has been sent out for a new carbon offset portfolio. Recommendations will be ready for the Council meeting in May.
- Scott Lupin also shared that the new Sustainability Outreach Coordinator, Tanvi Gadhia will start in mid-April. Tanvi was previously the Sustainability Coordinator at UMBC.
- Eric Wachsman shared that Engineering Sustainability Day will take place on Monday, April 22.
- Amelia Avis shared that the UMD Earth Day Festival will also take place on Monday, April 22.
- Andrew Muir shared that the Earth Month at Maryland calendar will be shared via the SustainableUMD newsletter in a few weeks, highlighting sustainability events at UMD in April.
- Sally DeLeon shared that the UMD submission for AASHE STARS was recently submitted. She anticipates UMD will achieve STARS Gold.
- Mark Stewart shared that the Maryland Commission on Climate Change will soon release its draft "40 by 30 Plan" to describe how the State will meet the legal requirements of the Greenhouse Gas Reduction Act to reduce emissions statewide 40% by 2030. He will examine the draft plan to see if any parts apply to UMD.

• Amelia shared that Clean Energy Jobs Act is moving through the Maryland General Assembly and, if approved, requires that 50% of the electricity consumed in Maryland would be produced by renewable sources by 2030.

Adjourn 12:00pm

Appendix A



2025 Carbon Neutrality Benchmarking

Office of Sustainability Report to the University Sustainability Council



Sample of Universities Targeting Carbon Neutrality around 2025

- American University 2020 goal, achieved carbon neutrality in 2018
- Antioch University New England 2020
- University of Montana 2020
- Duke University 2024
- Clarkson University 2025
- Loyola University Chicago 2025
- Oregon State University 2025
- University of California (10 campuses and 5 medical centers) 2025 for scopes 1 and 2
- University of Florida 2025
- University of Vermont 2025
- Arizona State University 2025 for energy and waste, 2035 including transportation
- Harvard University 2026 "fossil fuel neutral" (i.e. carbon neutral), 2050 "fossil fuel free"



FEARLESS IDEAS

UNIVERSITY OF

CALIFORNIA

U California System – GHG Reduction Solutions per Campus













UC Merced









UC Riverside

UC Santa Cruz

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2821

2016

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UC Irvine Medical Center



UC San Diego



UC Office of the President



U California System – Compilation of GHG Reduction Solutions



Estimated Reduction per Solution Type in 2025:

Carbon Offsets: 38% Biomethane: 28% Energy Conservation: 22% Renewable Electricity: 11% Fleet: 1%

UC Davis – GHG Reduction Solutions



Estimated Reduction per Solution Type in 2025:

Energy Conservation: 35% Biomethane: 25% Renewable Electricity: 25% Carbon Offsets: 15% Fleet: 0%

UC San Diego – GHG Reduction Solutions



Estimated Reduction per Solution Type in 2025:

Carbon Offsets: 41% Biomethane: 27% Energy Conservation: 17% Renewable Electricity: 14% Fleet: 1%



Duke University – GHG Reduction Solutions



Estimated Reduction per Solution Type in 2024:

Biomethane: 35% Renewable Electricity: 30% Carbon Offsets: 20% Energy Conservation: 10% Other: 5%



ARIZONA STATE UNIVERSITY

Arizona State University – GHG Reduction Solutions



university of MARYLAND

UMD's Current GHG Reduction Solutions



- Target Emissions Level
- Carbon Neutral New Development
- 100% Renewable Purchased Power
- Energy Conservation: Facility Upgrades (17% reduction 2014-2020)
- Energy Conservation: Behavior Change (3% reduction 2014-2020)
- Carbon Neutral Undergrad Commuting
- Other Commuter Programs
- Carbon Neutral Air Travel
- Remaining Emissions

1. Includes 21 MW combustion turbine CHP, steam distribution upgrades, and conversion of two districts from steam to hot water.

UMD's GHG Emissions – Historical and Potential Future



1. Includes 21 MW combustion turbine CHP, steam distribution upgrades, and conversion of two districts from steam to hot water.

UMD's Future GHG Emissions are Largely Dependent on NextGen and Carbon Capture



Typical Combustion Gas Turbine





Combustion Gas Turbine





UMD's GHG Emissions – 21 MW CT CHP without Carbon Capture



1. Includes steam distribution upgrades and conversion of two districts from steam to hot water.

UMD's GHG Emissions – 30.6 MW CT CHP without Carbon Capture



1. Includes steam distribution upgrades and conversion of two districts from steam to hot water.





Proposed Carbon Capture System in University of Maryland's Discovery District



UMD's GHG Emissions – 21 MW CT CHP with Carbon Capture



1. Includes steam distribution upgrades and conversion of two districts from steam to hot water.

2. A Carbon Capture Facility would need to occupy approximately 60,000 square feet of space to achieve this level of GHG reduction.

UMD's GHG Emissions – 30.6 MW CT CHP with Carbon Capture



1. Includes steam distribution upgrades and conversion of two districts from steam to hot water.

2. A Carbon Capture Facility would need to occupy approximately 60,000 square feet of space to achieve this level of GHG reduction.

UMD's GHG Reduction Solutions with 21 MW CT CHP and Carbon Capture



- Target Emissions Level
- Carbon Neutral New Development
- 100% Renewable Purchased Power
- Energy Conservation: Facility Upgrades (17% reduction 2014-2020)
- Energy Conservation: Behavior Change (3% reduction 2014-2020)
- Carbon Neutral Undergrad Commuting
- Other Commuter Programs
- Carbon Neutral Air Travel
- Carbon Capture Technology
- Remaining Emissions

1. Includes steam distribution upgrades and conversion of two districts from steam to hot water.

2. A Carbon Capture Facility would need to occupy approximately 60,000 square feet of space to achieve this level of GHG reduction.

Hypothetical GHG Reduction Solutions for Carbon Neutrality in 2025



- – Target Emissions Level
- Carbon Neutral New Development
- 100% Renewable Purchased Power
- Energy Conservation: Facility Upgrades (17% reduction 2014-2020)
- Energy Conservation: Behavior Change (3% reduction 2014-2020)
- Carbon Neutral Undergrad Commuting
- Other Commuter Programs
- Carbon Neutral Air Travel
- Carbon Capture Technology
- Offset Fleet Emissions
- Offset Faculty, Staff, and Grad Student Commuter Emissions
- Biomethane/Offsets
- Remaining Emissions

- 1. Includes steam distribution upgrades and conversion of two districts from steam to hot water.
- 2. A Carbon Capture Facility would need to occupy approximately 60,000 square feet of space to achieve this level of GHG reduction.

Conclusions and Discussion

- 1. NextGen and carbon capture are the greatest determinants to CAP success.
- 2. Carbon capture should be pursued if the campus will continue burning carbonbased fuels from a large stationary source.
- 3. Energy conservation goals (thermal and electric) should be integrated into the NextGen Program to reduce operating costs and emissions.
- 4. Current energy conservation goals expire next year.
- 5. Biogas credits should be explored as carbon-neutral fuel to offset natural gas.
- 6. Carbon offsets are expected to increase in price, so look for long-term contracts.
- 7. Strategies for reducing fleet and commuting emissions will be developed by Sustainability Council Work Groups between spring and fall 2019.

FEARLESS IDEAS

Appendix B

University Sustainability Fund

PROPOSED PROJECTS - MARCH 8, 2019

Summary

11 Projects:

- 1. Weather Technology HVAC Strategy for Stamp
- 2. Terps vs Pros Sustainable Food Challenge
- 3. Lewisdale Elementary School Flooding Prevention and Courtyard Restoration
- 4. Maryland Food Collective Dishwasher
- 5. Hydraze

Average Request: \$10,042.98

Total Recommended Funding: **\$91,353.45**

- 6. Creating a UMD Sustainability Video
- 7. South Hill Exterior Water Bottle Fill Station
- 8. Gemstone Team NOSALT
- 9. Bicycle Recycle Program
- 10. Banners to Bags
- Using Macroalgae to Remove Heavy Metals from Water

1. "Weather Technology HVAC Strategy for Stamp"

<u>Requested</u>: \$25,000

Submitted by: Stamp Student Union Facilities (Staff)

<u>Summary</u>: Stamp Facilities, UMD Energy and Engineering, and UMD researchers plan on implementing a novel technology to adjust HVAC scheduling based on weather forecasting to **reduce energy consumption in Stamp Student Union**.

<u>Benefits</u>: Improved university performance in high-traffic area, cost savings, proportional funding request

Recommendation:

Full funding (\$25,000)

Project Fund Sources applied for	
MEA Grant	\$200,000
Pepco (estimated highest rebate)	\$234,000
Student Sustainability Fund	\$25,000
Student Facilities Fund	\$75,000
FM Energy Reserve Fund	\$50,000
Remaining Funds (Stamp)	\$459,600
Total:	\$1,043,600

2. "Terps vs Pros Sustainable Food Challenge"

Requested: \$25,459 (Appendix A)

Submitted by: Nutrition and Food Science, Dietetics Program (Undergraduate Student)

<u>Summary</u>: Would produce a student-created educational web series and cooking competition aimed to help UMD students to **develop sustainable behaviors and skills to decrease food waste, promote better use of campus resources, and increase food security**.

Benefits: Sustainability education, food waste reduction, cost savings, high student involvement

Recommendation:

Partial funding (\$20,000)*

*Justification: find more affordable video editing by UMD students (\$8,190.00 requested) (Appendix 1)

3. "Lewisdale Elementary School Flooding Prevention and Courtyard Restoration"

Requested: \$13,055.00 (Appendix B)

<u>Submitted by</u>: Maryland Sustainability Engineering (Undergraduate Student)

<u>Summary</u>: Maryland Sustainability Engineering (MDSE) Local Project Team is proposing to solve two problems at **Lewisdale Elementary School** in Prince George's County: (1) address flooding in the Lewisdale facility by **implementing a storm-water management device** and (2) restore an existing courtyard at Lewisdale into an **outdoor classroom space** that can be used to educate Lewisdale students about sustainability and environmental science.

<u>Benefits</u>: Sustainability education, community connection, high student involvement, environmental performance improvement

Recommendation:

Full funding (\$13,055.00)

4. "Maryland Food Collective Dishwasher"

<u>Requested</u>: \$6,206.00 (Appendix C)

Submitted by: Maryland Food Collective (Undergraduate Student)

<u>Summary</u>: Project would purchase an **energy-efficient commercial dishwasher** for the Maryland Food Collective's kitchen. The addition of a dishwasher would provide a sustainable alternative to the current hand-washing method used in the kitchen, which uses excessive amounts of water, electricity and labor.

<u>Benefits</u>: Environmental performance improvement, cost savings, high student involvement, sustainability values

Recommendation:

Full funding (\$6,206.00)

5. "Hydraze"

Requested: \$7,320.12 (Appendix D)

Submitted by: Undergraduate Student

<u>Summary</u>: Hydraze (formerly FlushX) is a sustainability driven social venture that aims to save buildings, universities, and cities millions of gallons of water every by **eliminating unnecessary "phantom flushes" from automatic toilet sensors**, reducing water waste and improving facility maintenance.

<u>Benefits</u>: Environmental performance, cost savings, high student involvement, sustainable entrepreneurship

Recommendation:

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Partial funding ($6015.45)*
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*Justification: Strike budget item "Miscellaneous" (\$ 1,304.67)

6. "Creating a UMD Sustainability Video"

<u>Requested</u>: \$5,000 (Appendix E)

Submitted by: Office of Sustainability (Staff)

<u>Summary</u>: The Office of Sustainability and Strategic Communications would create a **campus sustainability video** that will further tell the story of our sustainability successes as a university. The video will highlight efforts in all areas of campus life: education, research, operations, community, and culture.

<u>Benefits</u>: Sustainability education, high student involvement, university promotion, idea sharing, proportional costs

Recommendation:

Full funding (\$5,000)

7. "South Hill Exterior Water Bottle Fill Station"

Requested: \$10,005 (Appendix F)

Submitted by: Department of Residential Facilities (Staff)

<u>Summary</u>: Would add an outdoor water bottle fill station to the Washington Quad, to 1) provide an easily accessible space for students to refill a water bottle as students come and go from their residence hall; and 2) allow anyone using the Quad area for study, volleyball, grilling, etc. to refill their water bottles.

Benefits: Waste reduction, student need

Recommendation:

Partial funding (\$5,000)*

*Justification: High cost-benefit ratio; cost sharing with Residential Facilities

8. "Gemstone Team NOSALT"

Requested: \$6,844.20 (Appendix G)

Submitted by: Gemstone Honors Program (Undergraduate Student)

<u>Summary</u>: Current methods of desalination used in commercial seawater desalination plants are energy intensive and therefore, expensive. Gemstone Team NOSALT is a team of eight undergraduate students researching **biological alternatives to traditional desalination** in order to decrease energy requirements and thereby reduce cost.

Benefits: Student-led research, global sustainability

Recommendation:

Partial funding (\$3,722.00)*

*<u>Justification</u>: Strike "travel costs" (\$2,500) and "Administrative support" (\$622.20)

9. "Bicycle Recycle Program"

Requested: \$5,583.50 (Appendix H)

Submitted by: Department of Transportation Services (Staff)

<u>Summary</u>: Project would **refurbish and redistribute abandoned bikes on campus to UMD students** to foster a culture of donation and to reduce environmental waste associated with abandoned property. Bikes would be sold for \$75 at Transportation Fair.

Benefits: Waste reduction, student involvement, student services, culture of sustainability

Recommendation:

Partial funding (\$3,500.00)*

*<u>Justification</u>: Strike some amount of marketing costs (deemed too expensive)

10. "Banners to Bags"

Requested: \$3,000 (Appendix I)

<u>Submitted by</u>: Office of Strategic Communications (Staff)

<u>Summary</u>: The project involves **repurposing retired campus light pole banners to create ~100 promotional grocery tote bags**. The bags can be used for any type of University outreach purposes.

<u>Benefits</u>: Waste reduction, university promotion, culture of sustainability

Recommendation:

Full funding (\$3,000)*

*<u>Request</u>: bags sent to local business

11. "Using Macroalgae to Remove Heavy Metals from Water"

<u>Requested</u>: \$3,000 (Appendix J)

Submitted by: Gemstone Honors Program (Undergraduate Student)

<u>Summary</u>: Project would support 4-year research project research to improve water quality through the **removal of excess nutrients and heavy metals from aquatic effluents** with the use of macroalgae harvested from on-campus sources.

Benefits: Student-led research, environmental performance potential, resource use

Recommendation:

Partial funding (\$855.00)*

*<u>Justification</u>: Strike unspecified amount from Phase 2 of project (prematurely requested)

Appendix A: Terps vs Pros Budget

Terps vs Pros: Sustainable Food Challenge Itemized Budget

Item	Cost per Item (\$)	Quantity	Total Cost (\$)	
<u>Videography</u>				
Pre Production				
Meetings with ATDS	97.50/hour	3 hours	292.00	
Script Shotlist Editing	97.50/hour	15 hours	1,462.50	
Storyboarding	97.50/hour	15 hours	1,462.50	
			3,217.50	
Production				
Shooting (3 person crew)	1,755.00/day	6 days	10,530.00	
Location, lighting, and audio		6 days	2,145.00	
			12,675.00	

Post Production			
Basic editing	45.50/hour	180 hours	8,190.00
Titles and graphics	175.00/hour	5 hours	1,137.50
Closed captioning	2.60/minute	15 minutes	39.00
			9,366.50
Videography Total	\$25,259.00		
Marketing			
Social media advertising (Facebook, Instagram, and Twitter)			200.00
Marketing Total			\$200.00
Total amount requested			<u>\$25,459.00</u>

Appendix B: Lewisdale Elementary Budget

Lewisdale Eler	nentary Infiltration Trench		Date:	10/15/2018		Lewisdale Elementary Courtyard Restoration		Date:	10/1	15/2018		
						FEATURE	DESCRIPTION	QUANTITY	UNIT	PRICE	Т	OTAL
						Canvas Canopies	2' x 6' x 7' pergola w/ canvas roof	8	\$	148.52	\$	1,188.16
ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL	· · · · · · · · · · · · · · · · · · ·	Pine 2" x 6" x 16'	3.00	S	10.98	\$	32.94
Labor						-	Pine 6" x 6" x 8' Posts	4.00	S	10.17	\$	40.68
2206	Final Grading (Slope)	Ac	0.02	4 000 00	70.00		Pine 2" x 3" x 8'	2.00	S	2.98	\$	5.96
2200	Clear and Grub Light	Ac.	0.02	3,300,00	57.74		Behr Waterproofing Wood Stain (1 gal)	1.00	S	28.98	\$	28.98
2200		AU	0.02	3,300.00	57.13		Sunbrella Outdoor Fabric, 54" wide (per yard)	2.00	S	19.98	\$	39.96
2300		Cy	60.00	10.00	600.00	Planter Box Gardens	1' x 3' x 18" rectangular box	15.00	\$	41.16	\$	617.40
2108	Remove Sidewalk	St	125	2.00	250.00		Pine 2" x 6" x 16'	2.00	S	10.98	\$	21.96
2308	Unsuitable Material	Су	60	37.00	2,220.00		Kellogg Organics Raised Bed Soil (2 cubic ft)	1.50	S	7.97	\$	11.96
1037	Infiltration Trench	Су	46.00	75.00	1,725.00		Behr Waterproofing Wood Stain (1 gal)	0.25	S	28.98	\$	7.25
5885	Concrete Sidewalk - 5 Foot Wide	Lf	25	20.00	375.00	Benches	4' x 1.5' backed wooden bench	8	\$	32.19	\$	257.48
Materials							Pine 2" x 6" x 16'	2.00	S	10.98	\$	21.96
1037	Infiltration Trench	Cv	46.00	75.00	1 725 00		Pine 2" x 3" x 8'	1.00	S	2.98	\$	2.98
6006	Constate Sidewalk E East Wide	16	40.00	20.00	1,725.00		Behr Waterproofing Wood Stain (1 gal)	0.25	S	28.98	\$	7.25
COOC	Concrete Sidewalk - 5 Foot Wide	LI	25	20.00	125.00	Insect Hotel	3' x 18" x 3' "House Style" insect hotel	1	\$	56.62	\$	56.62
							Pine 2" x 6" x 16'	2.00	S	10.98	\$	21.96
Material Subtotal	5,297.75	BASE CONS	STRUCTION COST	[7,147.7		Pine 2" x 4" x 8'	2.00	S	2.98	\$	5.96
Labor Subtotal	1,850.00	10% FOR S	EDIMENT CONTR	OL	714.78		1/4" x 2' x 4' Sanded Pine Plywood	1.00	S	11.21	\$	11.21
		TOTAL CONS	TRUCTION COST		7,862.53		Behr Waterproofing Wood Stain (1 gal)	0.50	S	28.98	\$	14.49
							Oldcastle Concrete Brick	6.00	S	0.50	\$	3.00
Quantitios contai	ned hereon are estimates only and sh	ould not be reli	ed upon as procis	A Unit costs used	horoin are based	Living Umbrella	Solar Irrigated Living Canopy	2	\$	1,300.00	\$	2,600.00
author on information provided to SolteszCo, by the alignt or from the best qualitable industry date. For consistent aide walk, it			Purchase and Installation	1.00	\$	1,300.00	\$	1,300.00				
was assumed that lab control.	or and materials would be a 50/50 split	of the cost way t Material and 12	s for materials. Fo	r the Inflitration tren o not include 10% fo	ch, it was or sediment		Base Construction Cost	\$ 4,719.66 \$ 471.97				

Appendix C: Maryland Food Collective Dishwasher Budget

Product	Quantity	Cost
1. Noble Warewashing HT-180 High Temperature Dishwasher	1	\$5 <i>,</i> 889
2. Noble Products Full-Size All Purpose Peg Rack with Closed Sides	5	\$54.95
3. Noble Products Full-Size Combination / Flatware Rack with Closed Sides	5	\$54.95
4. Noble Chemical 8 lb. Power Green Enviro-Friendly Solid Dish Machine	1 case/4 indv	\$103.99
Detergent		
5. Noble Chemical 1 gallon. Dry It Plus Rinse Aid for High Temp Dish Machines	1 case/4 indv	\$103.99
	Total Cost:	\$6206.88

All these products were found on <u>www.webstaurantstore.com</u>

Appendix D: Hydraze Budget

Item (cost calculated for each in speperate tabs in this spreadsheet)	Cost	Quanity	Cost for Purchase
Flush Counting Device	\$55.23	40	\$2,209.23
Latch Counting Device	\$57.29	40	\$2,291.79
Stall-Activated Prototype	\$75.72	20	\$1,514.43
Miscellaneous	\$ 1,304.67	1	\$1,304.67
	Total	\$7,320.12	

Appendix E: UMD Sustainability Video Budget

The total project budget requested is \$5,000. This will primarily cover the costs of working with the UMD video production team. They provide all technical staff and equipment. The estimated cost for their services will be \$3,000 with an additional \$2,000 requested for additional funding in case there is any need to do extended edits or re-shoots. We can also use any additional leftover funds to boost social media posts of the video.

Appendix F: South Hill Water Bottle Filling Station Budget

Our total budget is \$10,005	
Eklay Bottle Filler/Halsey Taylor Bottle Filler	\$6,200
Freeze Resistant Kit	150
Trenching and PVC Supply	1,000
Special Equipment (1 day rental)	200
Turf and Concrete Repair	500
Other labor costs	500
WSSC Permit	150
Subtotal	\$8,700
15% Contingency	1,305
Total	\$10,005

If the project is not fully funded, Residential Facilities will make up the difference.

Appendix G: Gemstone Team NOSALT Budget

Total- <mark>\$6,844.2</mark>

For basic desalination cell: Anode (Solid)

Cathode (Solid)

- \$100 electrode materials
- \$300 different catalyst options
- \$25 Chlorella Vulgaris algae for biocathode

Anolyte (Solution which should include any biological components) + Catholyte Saline solution \$20

Individual chambers (Desalination, Anode and Cathode) (Plastic containers) \$45 Ion exchange membranes \$200

Wiring/Resistor \$20

Data Acquisition System \$2870

https://www.dataloggerinc.com/product/dt80-universal-input-data-logger/

Voltage sensor \$20

Aquarium sealant \$7

For Cyanobacterial desalination: Cyanobacterial cultures \$20 Saline solution \$20 Chamber of comparable size to desalination chamber \$15 Method of removing, storing, growing and examining cultures

- Net for removing \$10
- Petri dishes + mediums \$50

\$2500 travel costs for site visits + educational events

- Visit Washington Suburban Sanitary Commission (WSSC) water treatment plant
- visiting opportunities at research facilities
- presentation of research at conferences

\$622.2

• 10% Gemstone administrative support cost

Appendix H: Bicycle Recycle Budget

Bicycle Recycle Program Budget Over 2 Years						
Expense	Detail	Description	Co	st Per	Cost over 2 Years	Comments
	Stake-ins by bike racks and along popular bike paths	24 - 24" wide X 16" tall	\$	130.00	\$ 260.00	
	Flyers for tabling events	500 - 4.25" X 5.5"	\$	10.00	\$ 20.00	
	Dorm posters	43 - 11" X 17"	\$	10.00	\$ 20.00	
Marketing for program overall	Bus shelter ads	10 - 23" wide X 35" tall	\$	93.00	\$ 186.00	
	Diamondback mobile billboard takeover	1 week	\$	450.00	\$ 1,800.00	2 weeks of campaign per program year
	Diamondback email edition	1 week	\$	75.00	\$ 300.00	2 weeks of campaign per program year
	Facebook promoted post	1 week	\$	100.00	\$ 200.00	
Labor per bike	Hourly rate per bike mechanic	\$10.65/hr*2.5hr/bike*# of bikes	\$	26.63	\$ 1,597.50	according to 60 bike goal
Materials per bike	Replacement parts and materials	\$20/bike	\$	20.00	\$ 1,200.00	average cost per bike, according to 60 bike goal
					\$ 5,583.50	

Appendix I: Banners to Bags Budget

Office of Strategic Communications is currently undergoing Phase 1 of the campus banner renewal process. The retired material from this phase can produce about 100 tote grocery bags, which may cost \$2,000 – 2,500 for production and delivery.

Appendix J: Gemstone Macroalgae Budget

ltem	Purpose	Expected Cost (\$)
ACS grade Nitric acid (HNO₃)	Analytical Reagent (AAS)	44.30 (Sigma-Aldrich)
ACS grade Zinc metal, 99.999% pure (Zn)	Analytical Reagent (AAS)	39.70 (Sigma-Aldrich)
ACS grade Acetylene gas (99.99%)	Analytical Reagent (AAS)	39.00 (Sigma-Aldrich)
Fees for FTIR	Analytical Tool	25/hr (UMD)
Fees for OES	Analytical Tool	90/hr (UMD)
Reagent kit for OES	Analytical Reagents	49.00 (Unique Corals)
Fees and reagents for TEM	Analytical Tool	520.00/sample (UMD)
Lead Metal (1/24 - ½ in. Thick, sheet)	Reagent for prelim. experiment	28.75 (Spectrum Chemical)
Chromium metal (2 in. and Finer, chips)	Reagent for prelim. experiment	28.75 (Spectrum Chemical)
Total		855.50

Designs for the second phase are rudimentary so assigning exact costs is difficult, but the intention is to keep costs between \$1000 and \$2000. AEES estimates a one square meter algal system costs \$500; multiple prototypes and increased size will raise the total cost. Between the two phases, the team expects to require a budget of approximately \$3000. Our team will receive additional funding from the Gemstone program each semester and may reach out to other sources of funding as we see fit.