

College of EMS sustainability action plan

Preamble: The Pennsylvania State University's Sustainability Institute has framed its approach to sustainability in the context of addressing the seventeen United Nations' Sustainability Development Goals (SDGs). Recognizing that no one college has the requisite expertise to address all goals, the College of Earth and Mineral Sciences (EMS) identifies special strengths relevant especially to the following SDGs: 2) Zero hunger; 4) Quality education; 5) Gender equality; 7) Affordable and clean energy; 11) Sustainable cities and communities; 13) Climate action; and, 15) Life on land, with aspirations to strengthen our presence relating to 10) Reducing inequality. The overarching goal of the EMS Sustainability Council actions is to make progress meeting these goals while exercising university-level leadership in advancing Penn State's approach to these SDGs. In the plan below we have linked our specific goals to the relevant SDGs as a way of promoting and inspiring the grander vision of the UN within our EMS effort.

We view halting and reversing anthropogenic climate change and global warming while providing affordable, clean energy as the major sustainability challenge facing Penn State, the commonwealth, nation and global society, for which EMS is most suited to provide leadership. We recognize that we face many other environmental, political and societal threats, including those that motivated the UN SDGs, and we recognize the important EMS strengths and the contributions that can be made in numerous other areas, so we couple the leading focus on energy and climate with activities addressing these other threats. We view many solutions to those other threats as encompassing remedies to anthropogenic climate change and global warming. We anticipate that those solutions lie at the heart of an economic revival for society, and therefore actions aimed at solutions will present opportunities for future employment and careers for our students. Thus, we have framed a sustainability action plan around addressing anthropogenic climate change and global warming while also considering many other threats, including nutrient loading and water quality of the Susquehanna River watershed and Chesapeake Bay, recycling efficiencies and waste stream reduction. EMS, with its breadth of expertise spanning the environmental, social, energy, and materials sciences, is uniquely poised to find the most effective solutions to the problems posed by supplying abundant, affordable energy while addressing anthropogenic climate change and global warming. Hence, we have a responsibility to lead by example and to put forth a sustainability action plan that can serve as a model for other entities, including other colleges and campuses of Penn State.

Our primary goal is to reduce EMS greenhouse gas (GHG) emissions to net zero by 2030, and ideally to be carbon (C) negative by that time, in ways that support the other SDGs. Our approach is to act and facilitate actions and dialog that create change and help decarbonize society through our: research, curriculum and student engagement, outreach, operations, and faculty and staff hires. We intend to communicate and collaborate with other colleges and campuses of Penn State, and organizations outside of Penn State that are pursuing these goals of reducing GHG emissions to see what ideas and plans have been developed. Below we outline a more detailed approach to addressing these topics.

Operations

Goal 1 - EMS should play a significant role in reducing Penn State's carbon footprint by focusing on reducing our GHG emissions (SDG 13, Climate Action; SDG 7, Affordable and Clean Energy).

Objective 1.1: Reduce the CO₂ impact due to all activities of EMS faculty, staff and students (see APPENDIX I).

Action 1.1.1: Annually implement a college-level GHG emission inventory based on the report from the Summer 2020 Drawdown REU report.

Action 1.1.2: Based on data gathered, establish goals and strategies to reduce the EMS CO₂ footprint, and reconsider those goals on an ongoing basis.

Action 1.1.3: Establish an EMS Decarbonization venture capital fund for research and innovation in emissions reductions, energy efficiency and offsets; that,

- a) offers proposal-driven financing of activities that reduce and/or offset GHG emissions, and increase energy efficiency;
- b) considers further incentives by leaving financial savings with the “saver”;
- c) approaches donors/ industry/ other potential partners to leverage private capital;
- d) supports innovations and incentives in energy efficiency and emission reductions (See APPENDIX II for examples).
- e) creates a viable C offset program (see APPENDIX II for some details).

Key Performance Indicator 1: An effective and efficient plan to achieve the CO₂ reduction goals related to EMS activities.

Key Performance Indicator 2: Annual decreases in the EMS C footprint that ultimately lead to a net negative footprint by 2030.

Objective 1.2: Educate EMS faculty, staff and students about C footprint calculations, causes of CO₂ emissions, and methods and practices to reduce their C footprint.

Action 1.2.1: Use multiple forms of communication and multiple communicators to educate broad and diverse stakeholders.

Key Performance Indicator: EMS stakeholders who are knowledgeable about and understand the basis for C footprint calculations, and work collectively to reduce the EMS and university footprint.

Goal 2 - EMS should play a significant role in reducing Penn State's consumption and disposal of materials by focusing on reduction/modification of our purchasing/ procurement, reuse of materials, and recycling materials (reduce/reuse/recycle) (SDG 11, Sustainable Cities and Communities).

Objective 2.1: Educate EMS faculty, staff and students about practices that lead to waste and develop programs that lead to reduction of waste generated by EMS.

Action 2.1.1: Document current EMS waste production rates.

Action 2.1.2: Host an office exchange to promote the reuse of office supplies, furniture, and equipment, and promote/incentivize employees to use Lion Surplus to furnish office setups including home offices.

Action 2.1.3: Evaluate white board supply alternatives (i.e. refillable markers, washable erasers, black boards/chalk).

Action 2.1.4: Eliminate single-use plastic items and other items that cannot be recycled/ reused, through consultation and collaboration with Penn State Purchasing Services.

Action 2.1.5: Use cones and biodegradable bowls and spoons at EMS Ice cream socials.

Action 2.1.6: Use multiple forms of communication and multiple communicators to reach broad and diverse stakeholders regarding these actions.

Key Performance Indicator: An overall reduction in the amount of waste generated by EMS.

Goal 3 - EMS should support constructing new buildings and maintaining existing buildings/ structures in a manner that contributes to achieving Penn State C footprint goals and other measures of sustainability (SDG 11, Sustainable Cities and Communities).

Objective 3.1: Maximize energy and resource-use efficiencies by designing all new buildings to be LEED Zero certified, and include consideration of sacrificing space to achieve high performing buildings.

Action 3.1.1: Immediately engage with architectural design of new building on South Burrowes St.

Objective 3.2: Identify infrastructure shortcomings that adversely impact energy efficiency and resource conservation.

Action 3.2.1: Collect, assess, and evaluate relevant data (ex: windows, doors that are broken or not fitting properly, leaking faucets/fixtures, inefficient/outdated equipment, etc.) and develop a plan to correct the deficiencies identified.

Objective 3.3: Promote remediation/ replacement of buildings where maintenance/upkeep practices are no longer effective or economically feasible to achieve sustainability objectives.

Action 3.3.1: Develop an inventory of buildings that require remediation or replacement and include them in the EMS capital plan.

Action 3.3.2: Use multiple forms of communication and multiple communicators to inform and educate broad and diverse stakeholders about these actions.

Key Performance Indicator: EMS infrastructure that consistently and effectively meets the carbon footprint and sustainability goals defined by Penn State.

Goal 4 - EMS should give students agency in EMS Sustainability efforts (SDG 5, Gender Equality; and SDG 10, Reducing Inequality).

Objective 4.1: Create twelve (12) paid part-time competitive internships to enable students to be a part of EMS Sustainability at every stage (brainstorming initiatives, collecting data, developing action plans and solutions, communicating activities and progress).

Action 4.1.1: Request funds, describe internship roles and responsibilities, promote opportunity to apply, select students.

Objective 4.2: Allow students to craft and deliver messages about sustainability programs and progress in EMS to their peers and other stakeholders.

Action 4.2.1: Use multiple forms of communication and multiple communicators to reach broad and diverse stakeholders.

Key Performance Indicator: Enhanced student engagement in EMS sustainability initiatives.

Curriculum and student engagement

Goal 1 - Integrate sustainability-related curriculum into each of the undergraduate majors offered by the College (SDG 4, Quality Education).

Goal Summary Name: Integrating sustainability in curriculum

Goal Description: For all undergraduate majors offered in the College, engage students in sustainability-related concepts through the use of relevant examples, case studies, readings, experiences, and other supporting curricula.

Objective 1.1: Inventory existing undergraduate curriculum for presence of sustainability-related content.

Action Item 1.1.1: Conduct survey of all EMS faculty who teach undergraduate courses to create college inventory of sustainability related curriculum.

Action Item 1.1.2: Supplement faculty survey with follow-up information directly from Associate Heads in each department.

Key Performance Indicator: Completed inventory of courses.

Objective 1.2: Identify areas for near term integration of sustainability into curriculum.

Action Item 1.2.1: Seek faculty volunteers who wish to integrate sustainability into their courses.

Action Item 1.2.2: Further integrate sustainability into coursework by supplementing course content via lectures/ symposia using external sustainability expert resources in addition to faculty resources.

Action Item 1.2.3: Sustainability Institute (SI) hosts professional development workshop for integrating sustainability into courses.

Key Performance Indicator: Increase number of faculty who are actively teaching aspects of sustainability in their courses, and successfully develop a professional development workshop with the SI.

Research

Goal 1: Sustainable Energy Research (SDG 7, Affordable and Clean Energy; and SDG 13, Climate Action).

Goal Description: EMS is uniquely positioned to address a major challenge facing our world today: sustainable energy. We seek to leverage our strengths at the forefront of such research areas as energy, materials and meteorology to develop energy storage and renewable energy (e.g., wind, solar, and nuclear).

Objective 1.1: Improve materials for electric energy storage.

Objective 1.2: Develop strategies for site selection of renewable energy plants, specifically for on-shore wind and solar.

Objective 1.3: Improve materials and processes for nuclear power, storage, and waste management.

Objective 1.4: Extend research on effects of differing oil and gas industry practices on capturing and/or preventing fugitive gas and vapor emissions.

Action item 1.4.1: Provide seed grants, and press for faculty hires in sustainable energy research.

Action Item 1.4.2: Establish college research grant focused on the sustainability research goals of EMS, to be awarded at the Wilson Banquet.

Action Item 1.4.3: Communicate to faculty that the College wishes to further develop research in this area.

Key Performance Indicators: Successful externally funded research programs as a proxy for our research effort in sustainable energy research. Research papers in the areas of electric energy storage, site selection for wind and solar energy plants, improvement in materials and processes for nuclear power, storage and waste management, and the effects of differing oil and gas industry practices on capturing and/or preventing fugitive gas and vapor emissions. Number of faculty hired with expertise in sustainable energy research. Development of a data base of funding sources and interdisciplinary research projects on sustainability issues, and a program to actively connect faculty with funding sources and promote interdisciplinary research.

Goal 2: Pollution Abatement Research (SDG 12, Responsible Consumption and Production; and SDG 6, Clean Water and Sanitation).

Goal Description: Research on life cycle analysis for materials, and developing low water and energy technologies.

Objective 2.1: Develop tools to consider life cycle analysis for materials.

Objective 2.2: Develop low-water-use energy technologies.

Action Item 2.2.1: Provide seed grants and consider faculty hires in pollution abatement research.

Action Item 2.2.2: Establish college research grant focused on the sustainability research goals of EMS, to be awarded at the Wilson Banquet.

Action Item: 2.2.3: Communicate to faculty the College's wish to further develop research in this area.

Key Performance Indicators: Research funding as a proxy for research effort in pollution abatement research. Research papers on tools to consider life cycle analysis for materials and low water energy technologies. Number of faculty hired with expertise in pollution abatement research.

Goal 3: Research on Societal Impacts of Climate Change and Pollution (SDG 13, Climate Action; SDG 15, Life on Land; SDG 3, Good Health and Well-Being; SDG 6, Clean Water and Sanitation; and SDG 10, Reduced Inequalities).

Goal Description: Current research led by EMS faculty encompasses a wide range of topics crucial to leading the way to solving societal challenges related to changing climate, which should be further developed in the coming years. Through this goal, we seek to focus more EMS research on societal impacts of climate change and pollution.

Objective 3.1: Improve understanding of the effects of climate change on severe weather.

Objective 3.2: Study linkages between air and water pollution and human health.

Objective 3.3: Focus research on the effects of global warming on hydrates (i.e., frozen methane).

Objective 3.4: Continue strong research programs in climate risk management and the C cycle.

Objective 3.5: Enhance research programs in food security/ crop health, and health and human rights.

Action Item 3.5.1: Provide seed grants and consider faculty hires in the societal impacts of climate change and pollution.

Action Item 3.5.2: Establish college research grant focused on the sustainability research goals of EMS, to be awarded at the Wilson Banquet.

Action Item 3.5.3: Communicate to faculty the College's wish to further develop research in this area.

Key Performance Indicators: Research funding as a proxy for research effort focused on the societal impacts of climate change and pollution. Research papers in the effects of climate change on severe weather, linkages between air and water pollution and human health, the effects of global warming on hydrates, climate risk management and carbon cycle, and food security and human rights. Number of faculty hired with expertise in the societal impacts of climate change and pollution.

Goal 4: Cross disciplinary collaborations in sustainability (SDG 17, Partnerships; SDG 5, Gender equality; and SDG 10, Reduced Inequalities).

Goal description: We recognize that sustainability goals can specifically benefit from collaborations between people with diverse educational backgrounds. Thus, we seek to promote interactions between various groups working towards societally relevant research in sustainability.

Objective 4.1: Promote interactions between EMS faculty, postdocs, local stakeholders, and local environmental community members.

Objective 4.2: Engage undergraduate students in sustainability-related research towards creating a workforce for the future.

Objective 4.3: Encourage interdisciplinary collaborations related to sustainability, particularly between social scientists, and physical scientists/engineers.

Action Item 4.3.1: Hold workshop/ networking events to foster interactions between EMS faculty, local stakeholders, and local environmental community members.

Action Item 4.3.2: Hold workshop/ networking event for undergraduate students to learn about sustainability research and career paths.

Action Item 4.3.3: Provide resources for integrating students into sustainability-related research projects to foster their professional development.

Action Item 4.3.4: Fund summer research program for undergraduate students encouraging co-mentors from social sciences with those from physical sciences.

Action Item 4.3.5: Workshop/ networking event to connect social, physical and engineering sciences within EMS and beyond.

Action Item 4.3.6: Incentivize sustainability outreach in student and faculty recruitment as well as promotion and tenure policies.

Key performance indicators: Events held to promote cross disciplinary research in sustainability. Number of undergraduate students engaged in sustainability research.

Goal 5: Recognition of sustainability efforts (SDG 3, Good Health and Well-Being).

Goal description: Sustainability-related research, education and outreach should be specifically recognized within EMS. We acknowledge that outreach in particular is very time-consuming (partnerships with community and team building require much time and energy from faculty members), but is a key component of solving societal issues related to sustainability

Objective 5.1: Specifically recognize the importance of sustainability-related research, education, and outreach within EMS.

Action Item 5.1.1: Incorporate a sustainability section into the faculty annual review process.

Key performance indicator: Sustainability section incorporated into faculty annual and tenure reviews AND increasingly those annual reports show sustainability actions by faculty.

Goal 6: Increase Sustainable Practices (SDG 11, Sustainable Cities and Communities; and SDG 12, Responsible Consumption and Production).

Objective 6.1: Strive to do research more sustainably in EMS departments and institutes.

Action Item 6.1.1: Workshops to inform departments/ institutes of steps to become a “Green Team” and to brainstorm on sustainable practices.

Action Item 6.1.2: Announcements to explain proper recycling in order to eliminate miscategorized items. Program to enable sharing of resources (i.e., laboratory chemicals) to curtail waste.

Action Item 6.1.3: Eliminate (or drastically reduce) plastic packaging for on-campus meals, snacks and drinks. Prioritize local, organic foods and beverages at events ideally using locally sourced products and vendors observing sustainable business practices.

Key Performance Indicators: Number of departments/ institutes within EMS that are “Green Teams”. Increasing percentage of events held within EMS without utilizing single-use plastics.

Outreach

The Outreach Subcommittee is the hub for the Sustainability Council’s outreach efforts. The Outreach Committee works with the Operations, Curriculum, and Research subcommittees to promote sustainability objectives.

Goal 1 – Increase awareness and knowledge about sustainability (SDG 3, Good Health and Well-Being; SDG 4, Quality Education; and SDG 17, Partnerships).

Objective 1.1: Develop and implement educational programs that promote knowledge about sustainability.

Action Item 1.1.1: Create an ongoing sustainability speakers series.

Action Item 1.1.2: Launch a sustainability “lunch and learn” series.

Key Performance Indicator 1: Number of speakers/ attendees.

Action Item 1.1.3: Partner with the Office of Development and Alumni Relations and GEMS Board to build support for EMS sustainability initiatives.

Action Item 1.1.4: Engage alumni in sustainability programs and initiatives by inviting them to speak and/ or attend both speaker series and other activities.

Key Performance Indicator 2: Number of alumni engaged.

Key Performance Indicator 3: Create, distribute and analyze feedback from survey.

Objective 1.2: Increase faculty, staff *and student* engagement to foster a sense of community, to accelerate behavioral change, *to increase recognition* of the value of sustainability, and to *build a sustainability culture in the college*.

Action Item 1.2.1: Include sustainability in staff onboarding and new faculty orientation.

Key Performance Indicator 1: Onboarding and orientation materials developed in conjunction with other subcommittees.

Action Item 1.2.2: Work with the University's Sustainability Institute to form Green Teams.

Key Performance Indicator 2: Number of active college Green Teams.

Goal 2 – Increase public recognition of EMS as a sustainability leader (SDG 3, Good Health and Well-Being; SDG 4, Quality Education; and SDG 17, Partnerships).

Objective 2.1: Develop sustainability communications strategy to showcase and increase the visibility of the college's sustainability initiatives in research, operations, and teaching and student engagement to key stakeholders and to better inform all stakeholders about sustainability.

Action Item 2.1.1: Communicate through press releases, social media posts, and videos featuring what the college has accomplished, what it is doing, and what it plans to do to improve sustainability in research, operations, and education.

Key Performance Indicators: Number of social media posts and engagement, and number of videos produced and their views.

Action Item 2.1.2: Create sustainability listserv for sharing sustainability information, news, and events.

Key Performance Indicators: Number of subscribers to listserv, number of messages sent to the listserv, and open rate of listserv messages.

Action Item 2.1.3: Enhance and expand sustainability information on college website.

Key Performance Indicators: Amount of relevant content on website, and number of visitors to sustainability section on website.

Objective 2.2: Strengthen existing partnerships and develop new partnerships.

Action Item 2.1.1: Partner with the EMS Museum and Art Gallery on a sustainability-focused exhibit.

Key Performance Indicator: Sustainability exhibit created.

Action Item 2.1.2: Partner with the EMS Library to develop a collection of sustainability-focused resources.

Key Performance Indicator: Library resources developed.

Action Item 2.1.3: Develop new programs, and collaborate with local municipalities, private entities, and citizen groups.

Key Performance Indicator: External partnerships established and active.

Objective 2.3: Create incentives for all college stakeholders to embrace and celebrate sustainability.

Action Item 2.3.1: Create faculty and student sustainability champions awards.

Key Performance Indicator: Faculty sustainability award established and winner announced at annual Wilson Awards Presentation.

Key Performance Indicator: Student Sustainability Award category added to annual Celebration of Undergraduate Engagement event.

Action Item 2.3.2: Include sustainability as an evaluation measure in annual faculty and staff reports.

Goal 3 – Work specifically with other EMS Sustainability committees to accomplish Operations Actions 1.2.1, 2.1.6, 3.3.2, and 4.2.1; and Research Action 3.5.3.

APPENDIX I – Operations, Objective 1 details. Objective 1 was originally narrower in focus but White broadened and in doing so encompassed what were originally Objectives 2 and 3 as listed below.

Objective 2: Reduce the CO₂ impact due to travel by EMS faculty, staff and students.

Action 2.1: Gather and evaluate data on EMS travel practices to determine CO₂ impacts, and to establish a plan to reduce CO₂ impacts due to travel. Examine current travel to meetings, conferences, and other events, commuting to campus, and travel to/ from field work.

Action 2.2: Based on travel data gathered, establish goals to reduce CO₂ impacts due to travel.

Key Performance Indicator: A plan to achieve the CO₂ reduction goals related to EMS travel in an effective and efficient manner.

Objective 3: Reduce the CO₂ impact of purchased electricity related to EMS activities.

Action 3.1: Press for and support efforts to purchase all university electricity from renewable energy sources.

Key Performance Indicator: University enters more power purchase agreements with renewable energy providers.

APPENDIX II – Operations, Objective 1, Action 1.1.3 details and examples

- f) supports innovations and incentives in energy efficiency and emission reductions. Examples might include:
- employ virtual meeting coordinator/ staff with state-of-the-art facility and technology that would allow all of the College (ideally university) to switch some in-person meetings to online, thus reducing travel emissions
 - fund CAUSE or other classes to guide students in providing C accounting to groups who wish to minimize emissions and/or increase energy use efficiency, and help them achieve their goal
 - research: 1) solar cell efficiency improvements; 2) grid stability to increase the penetration of renewables; 3) new battery technologies; 4) agrivoltaics to improve the economic viability of renewables and farming; 5) C capture including direct air capture; and, 6) C storage and geological sequestration. Others, probably outside the College: 1) bioenergy and C capture; 2) H production, storage and distribution; 3) Real-time measurement/ verification of building efficiency, methane leaks, etc.
- g) creates a viable C offset program, that:
- generates \$60K/year or \$1M to invest in C offset infrastructure.
 - initially may involve 3rd party purchase of C offsets, but eventually develops an internal program through collaborations with OPP and other colleges
 - includes a genuine educational aspect, – such as field trips to digesters, class projects, senior theses, etc.