

Lafayette College
Climate Action Plan 2.0

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Executive Summary

Lafayette College's Climate Action Plan 2.0 proposes achieving carbon neutrality by or before 2035. It is a continuation of the College's ongoing commitment to academic excellence and social responsibility. In January 2008, College President Dan Weiss signed the American College and University Presidents' Climate Commitment (ACUPCC), which initiated the College's commitment to eventually achieve carbon neutrality. To track progress toward the goals set out in the first version of the Climate Action Plan (CAP), the College agreed to conduct an annual inventory of its greenhouse gas (GHG) emissions and re-evaluate its CAP every five years. This updated plan is a product of the most recent evaluation of the College's CAP and process.

Achieving carbon neutrality is an ambitious goal, but Lafayette's unique identity as a small liberal arts college with a robust engineering division makes the College enormously well-situated to become a recognized leader in campus sustainability. Having a strong Climate Action Plan will play an integral role in establishing Lafayette's reputation as a forward-thinking, enterprising leader in higher education.

A Lafayette education provides rigorous academic preparation and research training within an environment that cultivates original, creative thinkers who have an understanding of the broad cultural, political, and social influences that shape our world. This is vital because the problems of the future will not be solved by individuals in isolated disciplinary silos. Environmental challenges will require collaboration among teams of people with different expertise. Having a robust Climate Action Plan not only provides strong affirmation of the College's articulated commitment to sustainability. It also provides a wealth of educational opportunities. The projects and initiatives proposed in the plan will bring students, faculty, and staff together to use the campus and surrounding community as a living laboratory, to explore and test new models of sustainable systems. In this way, the CAP will enhance the Lafayette educational experience, giving students the knowledge, skills, and confidence to help solve environmental challenges of the future.

Integrating sustainability into the curriculum, operations, and culture of Lafayette and demonstrating best practices to our students, neighbors, and future prospects isn't just the right thing to do. It's the strategic thing to do. Many of our peers have already recognized the benefits and opportunities of leadership in this sphere. Colby, Colgate, Bowdoin, Dickinson, Hobart & William Smith, Bucknell, Gettysburg, and Middlebury, for example, have already achieved carbon neutrality or are on the path to do so in the near future. Joining this collective effort will enable us to remain competitive in the ever-shifting landscape of higher education and also build upon Lafayette's legacy of integrating academic excellence with social responsibility.

Since the College drafted its inaugural CAP, Lafayette has made significant strides. ***We have reduced our emissions*** by more than 20 percent—even as the College has expanded enrollment, programming, and building spaces. ***We have formally embraced our commitment*** by declaring sustainability one of Lafayette's three core institutional values, by establishing an Office of Sustainability, and by signing the "We're Still in Pledge" in support of climate action to meet the goals of the Paris Climate Agreement. ***We have enhanced our curriculum*** by creating degree programs in Environmental Studies and Environmental Science and positioning sustainability as a core theme in our classrooms. In 2018, the faculty approved an academic plan that identified "environment and sustainability" as one of six key focal areas. ***We have engaged our community*** by actively working with several student-led campus

groups who promote environmental responsibility and demonstrate best practices to their peers in an effort to foster an ethos of sustainability on Lafayette's campus.

A Call to Action

Lafayette's Climate Action Plan 2.0 is designed to serve as the framework for the College's ongoing efforts to reach carbon neutrality by 2035. Through climate action planning, we aspire to use our campus as a living laboratory that enables transformational learning experiences for our students and teaches them to live within environmental bounds. The following is a brief overview of the key elements of the proposed Climate Action Plan.

Key Goals

Reach Carbon Neutrality by 2035: This updated Climate Action Plan provides a road map for reaching carbon neutrality by 2035, with an emphasis on the initial steps for implementation. In addition to annual greenhouse gas reporting, the College will continually invest in and assess progress toward carbon neutrality and also update the Climate Action Plan every five years.

Phase 1: Immediate Opportunities for 2019-2020

Reduce Energy Emissions: While reaching carbon neutrality is a long-term goal that will require a consistent commitment through 2035 and beyond, we have an immediate opportunity to make a significant change to our carbon footprint by reducing our heating and electric energy consumption through efficiency and conservation. Through these projects, from optimizing or replacing existing HVAC systems to installing occupancy sensors, Lafayette can reduce carbon emissions while saving money.

Establish a Green Revolving Fund: Making an initial investment in tools and resources with quick payback periods will enable Lafayette to reduce energy use on campus. That energy savings—and its resulting cost savings—can enable the College to create a green revolving fund to provide capital for projects that reduce the College's environmental impact and operational costs. So called "green revolving funds" are well-established at many institutions. As a number of our peers have done, including Penn, Bucknell, and Cornell, we propose the establishment of a green revolving fund that will allow us to undertake higher-cost capital projects that will be crucial to achieving our goal of carbon neutrality (i.e., Phases 2 and 3 below).

Investigate Renewable Energy Options: Though many emissions can be avoided with energy efficiency, energy conservation, and on-site use of renewable energy sources, a portion of the College's emissions from purchased electricity could be addressed through partnering with other local educational institutions to enable construction of a large-scale off-campus renewable energy project like solar, wind, or small-scale hydroelectric. Teaming with other local colleges or universities would allow the College to take advantage of economies of scale for purchasing components like solar panels and to share costs for retaining a renewable energy advisory firm. In the near term, the College would like to partner with Lehigh Valley Association of Independent Colleges (LVAIC) institutions to investigate options for purchasing off-site renewable energy that, if implemented in the near term, would allow the College to capitalize on existing but soon-to-expire incentive programs. In vetting renewable energy projects, projects should clearly add additional renewable energy capacity to the grid. Ideally, these projects should be local enough to provide curricular benefits.

Secure Financial Support: The success of these initiatives is dependent on financial support. External funding assistance, including grants, incentives, and donations, can be explored to offset costs. Lafayette's Office of Development will be a key strategic partner in this effort. The Office of

Sustainability plans to collaborate with the Office of Development to identify possible fundraising opportunities related to sustainability initiatives in capital projects and across campus.

Phase 2: Recommendations for 2021-2025

Achieve Carbon Neutrality at Metzgar Fields Athletic Complex: Because of the significantly higher cost of electricity at the Metzgar Field complex relative to the main campus, the College has a unique opportunity to achieve on-site carbon neutrality at the athletic complex site in Forks Township. By installing a solar array sized to match the annual electricity consumption at Metzgar Fields and planting and maintaining a forest on a portion of the surrounding farmland to offset emissions from on-site heating loads, we can rapidly achieve a carbon neutral athletic complex at a modest cost. A solar-powered and afforested Metzgar would be an early and highly visible symbol of Lafayette's emergence as a sustainability leader while also providing students and educators with firsthand access and ongoing exposure to a living laboratory for sustainability.

Enhance Visibility and Emissions Reductions through On-Site Solar: Lafayette can reduce emissions from purchased electricity by producing electricity with on-site solar arrays. Small solar projects in locations like Allan P. Kirby Sports Center or Buck Hall would provide a visible sign of the College's commitment to sustainability and a host of curricular benefits.

Phase 3: Recommendations for 2026-2035

Transform Campus Heat and Hot Water Generation: Lafayette can maximize emissions reductions from on-site combustion of fossil fuels by making several key improvements to campus infrastructure. The Office of Sustainability will partner with academic departments to research, analyze, and recommend strategies for achieving carbon-neutral on-campus heat and hot-water generation. Infrastructure changes, including installing a combined heat and power plant to boost efficiency, changing the steam plant energy source to a biogenic carbon-neutral fuel, and converting from steam to a more energy-efficient hot-water district heating system, would enable the College to dramatically reduce or even eliminate emissions from on-site fossil fuel combustion.

Partner with Others to Offset Remaining Emissions: As noted above, some of the College's emissions will need to be addressed through carbon offsets. We plan to partner with institutions throughout the Lehigh Valley to implement carbon sequestration offset projects. We want to prioritize offsets that come from the development of sustainable energy projects or carbon sequestration projects. In addition, all offset projects must depend on the College's participation to occur and be local enough to contribute to the educational mission of the College.

Conclusion

Lafayette College's unwavering commitment to excellence has made it an outstanding undergraduate institution that attracts talented, high-achieving students, faculty, and staff. The College's efforts to build upon that reputation and position it for future success were at the heart of the recently concluded *Live Connected Lead Change* campaign—and the Climate Action Plan. Climate action planning puts the mission and goals of the campaign into action. The steps outlined in the plan will advance our aspirations to lead in innovative teaching and learning, promote interdisciplinary connections, be

environmentally responsible, and prepare our students to confront challenges they will face as citizens of the world. It also will enable us to remain competitive among our peers, many of whom have already achieved carbon neutrality or are on the path to do so. By leveraging the strengths of the College--rigorous academics, experiential learning opportunities, collaborative work--and positioning the College as an environmental leader, climate action planning embodies *living connected to lead change*. This is an opportunity to solidify the College's legacy as an institution of excellence where academic excellence and social responsibility are intertwined, and ensure our students graduate with the knowledge, experience, and passion to be tomorrow's leaders.

I. Vision

Global climate change is one of the defining issues of our time. As articulated in the Intergovernmental Panel on Climate Change's recent special report on the impact of global warming of 1.5 degrees C published in October 2018, there is an urgent need for action to prevent "dangerous anthropogenic interference with the climate system," which will result in major detrimental irreversible changes to natural systems and the human societies that rely on them. Human activities have already caused approximately 1.0 degree C of global warming above pre-industrial levels, which has resulted in a wide range of adverse impacts including more extreme weather, rising sea level, and accelerated biodiversity loss. According to the report, climate-related risks to health, food security, and economic growth will be significantly exacerbated if warming reaches 2 degrees C (Allen, 2018).

As an institution, we have already declared sustainability as one of our core values. In keeping with our institutional mission to train our students "to develop systems of values that include an understanding of personal, social, and professional responsibility" we must teach them how to live within environmental bounds. As the problem-solvers of the future, they must possess the knowledge and skills required to help the communities they are members of be able to adapt to and mitigate climate change. We can best serve this educational need of our students by transforming our campus into a living laboratory for sustainability, a key component of which will be meeting our articulated goal of carbon neutrality.

Reaching carbon neutrality is a goal that Lafayette is well-situated to achieve, as a competitive liberal arts college with distinguished engineering programs. By providing students with rigorous academic preparation and research training within an interdisciplinary, collaborative environment, our faculty are already preparing the next generation of scientists, engineers, architects, and policymakers to make meaningful contributions to society. Making carbon neutrality and sustainability more broadly strategic focal points of that preparation is only appropriate, as climate change is an urgent, complex, and persistent challenge. Through leadership opportunities, volunteer efforts, course collaborations, and a host of environmental research efforts led by faculty members, students will leave Lafayette understanding their ability to help shape an environmentally sustainable future. Sustainability literacy also helps empower students to participate effectively in civic dialogue, which is likely to focus increasingly on sustainability and resilience-related challenges (Dautremont-Smith, 2017).

Additionally, reaching carbon neutrality should increase organizational efficiency, reduce risk, and help to attract, retain, and motivate students and employees. The Association for the Advancement of Sustainability in Higher Education finds that students seek schools that actively demonstrate sustainability leadership. For example, the College of the Atlantic noted that its recruitment website traffic increased by 25 percent following the announcement that the college had reached net-zero carbon emissions. Additionally, strong sustainability practices help to recruit highly skilled and motivated faculty and staff who are eager to work for organizations making a positive impact on the world. Research, education, and outreach for reducing greenhouse gas (GHG) emissions helps to strengthen community relations, enhance partnerships, and unify the campus around a shared sense of purpose (Dautremont-Smith, 2017).

Abiding by high environmental standards and adopting best practices will enable the College to model civic engagement and demonstrate our role as a community leader. By applying our knowledge, resources, technology, and innovative spirit to creating pilot projects and programs, we can create

on-campus solutions that can inform and inspire, and result in broader benefits for the wider world.

II. Progress to Date

In January 2008, Lafayette College President Dan Weiss signed the American College and University Presidents' Climate Commitment (ACUPCC). Through this commitment, the College pledged to take action to achieve carbon neutrality. To work toward this goal, the College also committed to conducting an annual inventory of its GHG emissions and reviewing and updating its comprehensive Climate Action Plan (CAP) every five years.

A CAP committee consisting of faculty, students, and staff provided expertise, campus knowledge, and valuable insights as Entech Engineering Inc. led the development of Lafayette's first CAP, which was released in November 2011. The inaugural report included recommendations for educational and operational initiatives to conserve energy, highlighted energy efficiency updates, and proposed a plan to reduce total GHG emissions. After issuing the CAP, the College updated its GHG targets to reduce GHG emissions 15 percent by 2027, 35 percent by 2031, 55 percent by 2035, and 60 percent by 2039 relative to 2007 levels. Lafayette has made significant progress in reducing its carbon footprint by following the recommendations outlined in the CAP 1.0.

A. Climate Action Plan 1.0 Accomplishments

1. ***We Measured Emissions and Energy:*** The College's first emissions inventory was completed in 2007 and serves as the baseline year against which subsequent emissions reductions are tracked. The 2007 inventory showed the College emitted 30,231 metric tonnes of CO₂ equivalents, with more than 80 percent of those emissions coming from heating and electricity consumption. To develop emission-reduction strategies, a comprehensive energy audit was completed by Entech in 2007, which examined 51 of the College's largest on-campus buildings and compiled a comprehensive list of energy conservation measures (ECMs) the College could implement to reduce carbon emissions. In response, the College enacted several large-scale ECMs as the first step in achieving carbon neutrality (see list below). Since then, the College has reported annually on GHG emissions generated from heating and cooling, electricity use, and additional sources like transportation and waste. The College has pledged to provide this data to Second Nature, an agency that sets the standard for carbon inventories of institutions of higher learning. Second Nature tracks different institutions' carbon pledges; reporting data for all institutions is found on its website and available to the public.
2. ***We Reduced Emissions:*** In 2017, the College's total GHG emissions were 24,092 MTCO₂e annually, a 20 percent reduction (6,229 MTCO₂e) from the 2007 base year (30,231 MT CO₂ annually) (Figure 1 and 2) and the realization of the CAP 1.0 2027 goal 10 years early. This is an especially notable accomplishment considering that during this interval, the campus population grew by 200 students, 80 faculty, and 170 staff, and gross square footage of building space increased by 10 percent.

The emissions reduction was largely the result of two factors:

- a. Switching the central steam plant to natural gas instead of No. 6 fuel oil (9 percent emissions decrease) (Figure 1; Table 1).
- b. Using a cleaner, less carbon-intensive regional electric generation mix (i.e., the fraction of electricity produced from coal decreased from 50 to 33 percent while that from natural gas increased from 20 to 33 percent) contributed an additional 10 percent emissions reduction (Figure 1).

Various energy efficiency and conservation projects decreased emissions an additional 1 percent (Figure 1). These projects included lighting retrofits, installation of variable frequency drives on selected air handling units and pumps, and insulating tanks.

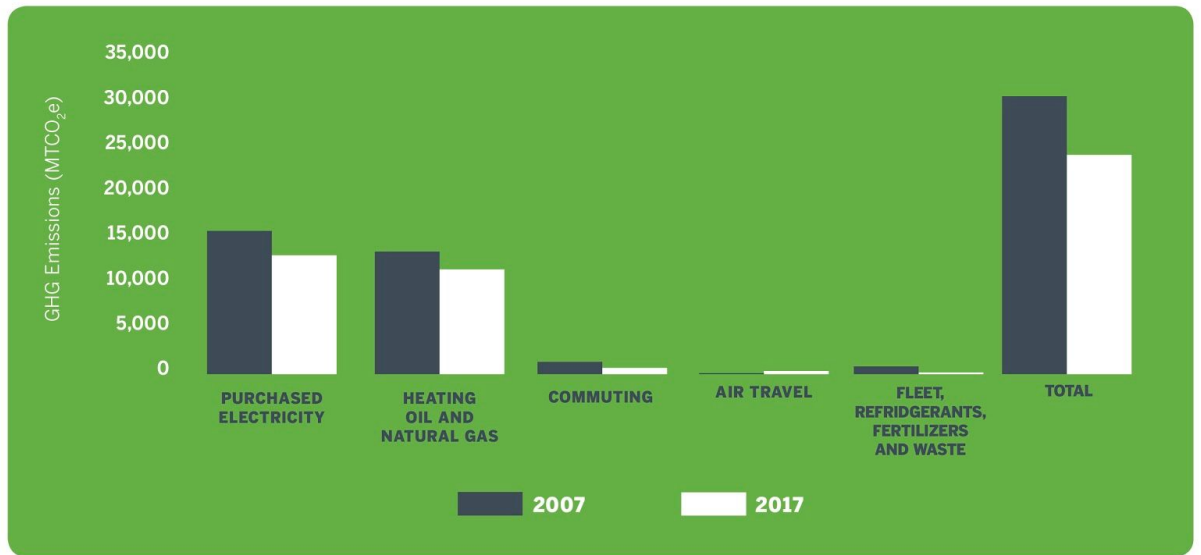


Figure 1: Lafayette’s Total GHG Emissions Reduction 2007-2017

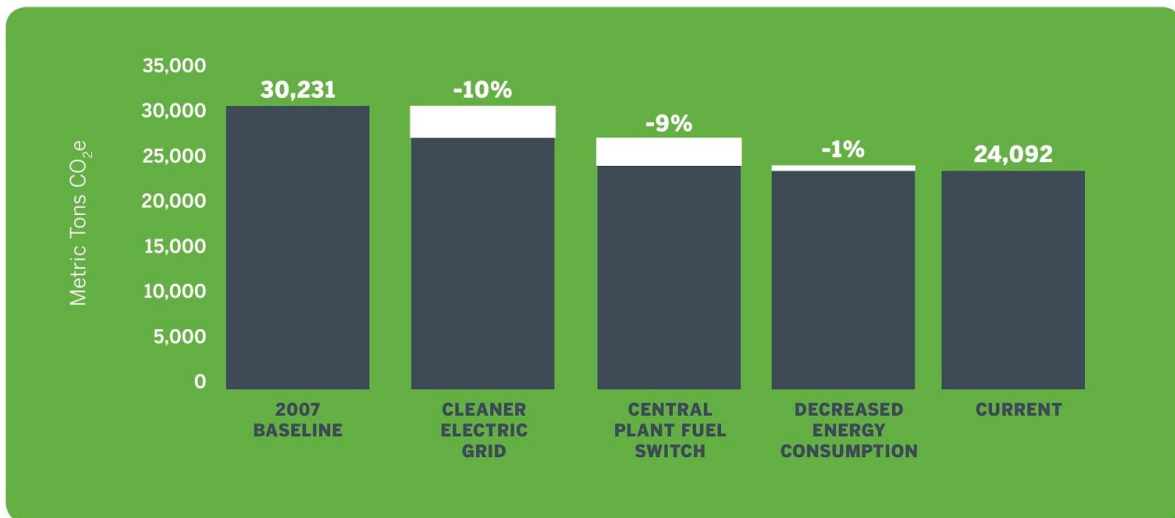


Figure 2: Lafayette’s GHG Emissions in Metric Tons CO₂ Equivalentents (CO₂e)

Like most colleges and universities, the majority of the College’s emissions are from purchased electricity and heating. Combined, emissions associated with purchased electricity and space and hot-water heating were 91 percent and 88 percent of the College’s total emissions in 2007 and 2017, respectively (Figure 2). Because most of our emissions come from electricity and heating, the Climate Action Plan will focus on reducing emissions from those two sources. However, in keeping with our objective of carbon neutrality and our core educational mission, the CAP also will outline a plan to address the remaining 12 percent of emissions from air travel, faculty and staff commuting, waste, and the campus fleet.

We Conserved Energy: Even as enrollment grew by 30 percent and building spaces increased by 10 percent from 2007 to 2017, the College was successful at reducing electricity usage and electricity intensity (kWh/ person) (Table 1). In 2017, due to more efficient buildings and systems, the College used 2 percent less purchased electricity annually than it did in 2007.

	BASELINE 2007 CALENDAR YEAR	2016-2017 FISCAL YEAR
CAMPUS POPULATION Students, faculty, staff	3,004	4,358
TOTAL BUILDING SPACE (square feet)	1,940,424	2,148,251
ELECTRICITY (kilowatt hours)	29,113,981	28,507,909
kWh/PERSON	9,692	6,542
EMISSIONS FROM ELECTRICITY (MTCO _{2e})	15,130	11,240

Table 1: Lafayette’s Electricity Use and Associated Emissions

Lighting Upgrades: Depending on location, lighting may be in use 10 hours or more daily. Thus, increasing the efficiency of lighting on campus can have a large impact on improving overall energy efficiency.

- Fluorescent lighting in Markle and Sullivan parking decks was retrofitted by Facilities Planning with light-emitting diode (LED) lights with bilevel controls that operate at a reduced level during vacant periods and at full brightness when occupied.
- Lighting also was upgraded in Skillman Library: Approximately 2,000 T-5 fluorescent lamps were replaced with LED lamps. In addition to reducing electric usage and maintenance costs, switching to LEDs improved lighting quality in the library. The College also was awarded a \$19,500 rebate by the utility company, against a total cost of \$31,000 for completing the project, allowing for an eight-month payback.

B. Additional Achievements

1. **We Introduced Composting to Campus:** In summer 2008, faculty from Civil and Environmental Engineering collaborated with a student to develop a composting program to serve as a demonstration-scale educational tool for the campus and wider community. Through their efforts, the College was awarded more than \$200,000 in grants and donations to create a scalable system for composting food waste in the dining halls, including two Earth Tubs and two food waste pulpers for Marquis and Upper Farinon dining halls. Lafayette’s facilities and grounds department installed the Earth Tubs in May 2010. (Earth Tubs are 7.5-foot-wide composting tubs from Green Mountain Technologies that allow food scraps and yard waste to be dumped and spun to create compost.)

2. ***We Established LaFarm:*** In 2009, we secured funding from the Clinton Foundation to establish an organic garden and utilized funding from the College's Mellon Foundation grant to support a campus farmer. The campus farm established at Metzgar Field now has a 3-acre footprint. It grows several thousand pounds of produce for the dining halls, recycles nutrients from composted food back to the soil, and serves as a laboratory for collaborative student-faculty education and research. LaFarm has been modeling scalable solutions to reduce GHG emissions by using solar energy to power the vegetable washing station and compost and cover cropping to replenish soil and increase carbon storage. LaFarm and the sustainable food loop represent Lafayette's best current example of a living laboratory for sustainability education.

3. ***We Built Sustainably:*** In 2012, the Grossman House for Global Perspectives became the College's first LEED-certified building. (LEED, or Leadership in Energy and Environmental Design, is a rating system that evaluates environmental components of buildings.) Rather than demolish the nearly 100-year-old former fraternity house and construct a new building, the College decided to adaptively reuse the structure. In addition to using sustainable building materials, many energy- and water-saving features were incorporated, including energy-efficient windows that reflect heat, a rainwater collector that supplies a gray-water toilet flushing system, and a dashboard that provides real-time feedback on energy use to residents. The design team also incorporated new furniture made from recycled materials. Construction of the new Rockwell Integrated Sciences Center (to be completed in August 2019) is a work in progress that also embodies Lafayette's commitment to sustainability. It will boast an energy-consumption benchmark far below that of peer science buildings. In keeping with its LEED Platinum certification, the building will feature a broad array of energy-saving innovations.

4. ***We Minimized Waste and Expanded Recycling and Reuse:*** Since the 2011 Climate Action Plan, the College has become a better environmental steward by reducing its landfilled waste. While the 2011 Climate Action Plan didn't lay out specific goals or targets for reducing waste, the College has launched or enhanced a number of programs to reduce waste and increase recycling and reuse on campus. These programs successfully increased recycling and reuse from 23 tons in 2007 to 84 tons in fiscal year 2017), which is a 268 percent increase over the decade. Facilities Operations also has contributed to this effort, which has increased the diversion rate from 3 percent in 2007 to 14 percent in 2017, an improvement the Office of Sustainability intends to continue to build on in the future.
 - a. ***Reducing Food Waste:*** In the United States, approximately 30-40 percent of all food produced is wasted, and yet in 2015 only around 5 percent of food was diverted from landfills. While many landfills employ methane management, using organic waste for composting dramatically reduces emissions and has the added benefit of providing nutrients to amend soils (Hawken, 2017). Reducing food waste is good for communities, the environment, and the economy (Sustainable Management of Food Basics, 2018). Students and the assistant director for food and farm have estimated that our on-campus composting effort, which collects compostable food waste from the College's two dining halls, composted an average of 8,000 pounds of food waste per year from April

2010 through November 2016, or a total of approximately 56,000 pounds. Due to the start of construction for the Rockwell Integrated Sciences Center in November 2016, the College had to move the Earth Tubs that generate compost. They were reinstalled at 901 Bushkill Drive and brought back online in November 2018. After a nearly two-year hiatus of the compost program at Lafayette College, as of November 5, 2018, the Earth Tub compost program has been reinstated, reanimating the Sustainable Food Loop and supporting Lafayette's ability to divert food waste from landfills toward a closed-loop composting system.

- b. Expanding Reuse Programs:** Green Move Out is a program to collect gently used clothing, books, and housewares at the end of the academic year and to donate these items to local community-based nonprofit organizations. This program was started more than 10 years ago by a group of faculty as a volunteer effort to help neighbors in need. In addition to reducing the amount of material going to the landfill, Green Move Out has grown into an annual sustainability office-led, mostly volunteer-staffed campus-wide program benefitting 10+ local organizations that annually collectively receive more than 10,000 pounds of donations.
- c. Reducing Emissions through Waste-to-Energy:** The College benefited significantly as a result of Chrin Brothers Landfill implementing a waste-to-energy system. The majority of the College's landfilled waste is disposed at the Chrin Brothers Landfill, located ~3 miles from campus. In 2011, the landfill completed a project with PPL Renewable Energy LLC to create a Landfill Gas-to-Energy project, which generated enough electrical power to run approximately 2,200 homes. This project reduces emissions in two ways: first, by using the methane for power generation instead of letting the methane escape to the atmosphere, where its greenhouse effects are highly potent relative to CO₂. Second, although the generated electricity produces CO₂, it replaces more carbon-intense electricity, thereby creating negative *net* emissions. As a result of this change, Lafayette's solid waste-related emissions decreased from 840 MTCO₂e in 2007 to -25 MTCO₂e in 2018.
- d. Expanding Recycling:** In 2014, thanks to the efforts of a student-comprised "sustainable solutions" workgroup, the College transitioned to single-stream recycling, which aims to improve ease of use for consumers by allowing all recyclables to be placed in the same container. Additionally, in 2014 the Sustainability Committee spearheaded a plan that led to the installation of outdoor recycling containers throughout campus. In 2017, the College drafted a recycling bin standard to create a cohesive and standardized recycling infrastructure. The standard outlines specific containers to be used in different types of buildings to match the architectural style and function of each building. Additionally, in 2017 the Office of Sustainability collaborated with the Division of Communications to create easy-to-read signs highlighting containers used on campus and clearly defining what materials can go into recycling and trash. These efforts were successful: In 2017, Lafayette recycled roughly 60 tons more than in 2007. According to the EPA's Waste Reduction Model version 14, that's

equivalent to removing annual emissions from 36 passenger vehicles and conserving 7,000 gallons of gasoline.

- e. *Measuring Impact:*** In 2017, the Office of Sustainability and students from ECOreps (environmental peer educators), Lafayette Environmental Awareness and Protection (LEAP), Lafayette Food and Farm Cooperative (LaFFCo), and the newly created Food Recovery Network collaborated to better measure waste on campus. In March and October 2017, the Office of Sustainability led a waste audit at Farinon Student Center and Skillman Library café. This allowed the Office of Sustainability to compare diversion rates and see if new signage, installed between the two audits, was improving understanding of what can and can't be recycled. The spring audit results showed 67 percent of recycling was clean and free to be recycled. In fall 2017, those results improved: 81 percent of recycling was clean and could be readily recycled. Throughout 2017, the Office of Sustainability, ECOreps, LEAP, LaFFCo, and the newly created Food Recovery Network partnered with dining services to hold Weigh the Waste events during meals. Together these groups increased awareness and successfully reduced food waste by weighing food waste remaining on plates after lunch and dinner in Marquis and Upper Farinon dining halls.
- 5. *We Improved Transportation:*** Lafayette's 2011 Climate Action Plan addressed the value of providing reliable, shared transportation. Since 2011, Lafayette has incorporated integrated GPS tracking onto shuttles, allowing users to track the Lafayette College Area Transportation (LCAT) online and via apps, initiated a Student Government transportation subcommittee, improved the walkability of campus, and introduced the U-Haul car share program on campus. While College-financed air travel results for 4 percent of the College's emissions or 1,064 MTCO₂e and was an area of significant growth in transportation-related emission since 2007, this sector includes study-abroad experiences, which have expanded considerably over the past decade and which Lafayette considers an indispensable part of a liberal arts education (Table 2).

	BASELINE 2007	2011	2016-2017
POPULATION	3,004	3,120	4,358
FACULTY/STAFF COMMUTING (MILES)	5,971,406	5,929,862	4,453,214
GASOLINE (GALLONS)	29,960	33,480	23,656
STUDY-ABROAD AIR TRAVEL (MILES)	293,476	293,476	810,760

Table 2: Transportation

- a. **Introducing a Car Share:** The U-Haul car share was introduced in 2011 with the arrival of the original Climate Action Plan. Since then, it has provided students with the option to rent out vehicles by the hour or day. A student representative for the car share maintains the cars and promotes the program to peers. In 2014, the car share expanded its social media presence. Two vehicles are currently part of the car-share fleet. From December 2017 to December 2018, transportation records indicate that 372 reservations were made for the two vehicles. That is a 63 percent increase from the 235 reservations made between December 2016 and December 2017. The Office of Sustainability plans to conduct surveys and collect additional data to better understand car-share use and determine how it impacts individual car use as well as work to increase student awareness of this opportunity.
- b. **Improving LCAT Shuttle:** Lafayette College Area Transportation (LCAT) is a shuttle that provides regularly scheduled transportation to local grocery stores, shops, and bus stops on campus and nearby. Over the years, it has been revamped to include more locations. Public Safety now runs an integrated GPS online tracking system, available via a smartphone app. This real-time online location map provides the whereabouts for each shuttle on its route. In 2015, Student Government formed a subcommittee to investigate new shuttle stops. These students helped to establish additional stops in Easton that give students easy access to the arts campus as well as other downtown locations, including the city's bus terminal. Additionally, engineering classes recommended more efficient routes and new student-centric stops. The Office of Sustainability plans to conduct a survey to better understand how individual car usage is impacted by the shuttle.
- c. **Implementing Charging Stations:** Charging stations for electric vehicles were introduced on campus in 2010. There are now a total of six stations spread

throughout campus (Markle Hall parking deck, Watson Hall parking lot, and at 901 Buskill Drive). The outlets at Watson Hall get regular use and provided an incentive to faculty who were considering purchasing electric vehicles to follow through. As demand increases, the College anticipates continued expansion of its charging station availability.

- d. ***Designing a More Walkable Campus:*** Lafayette's welcoming and close-knit community reduces the need for a vehicle. Implementation of the Campus Master Plan of 2009 resulted in significant improvements in campus walkability, such as removal of vehicles from the Quad. Residence halls are in close proximity to dining halls, libraries, and academic buildings. Roadways winding around buildings have been gradually phased out by brick paths, sidewalks, and safer crosswalks. Travel is almost exclusively by foot to most buildings. Not only does a walker-friendly campus help the environment by lowering carbon emissions, it also increases community connectivity, boosting social interaction while also creating more safe traffic-free spaces for outdoor gatherings. The number of commuter students has decreased over the past few years, which reduces vehicle mileage and emissions. There is little need for a car around campus, and when traveling off College Hill students can rely on the LCAT shuttle, car share, and services like My Bus Home (an intercollegiate busing system that links campuses to convenient locations), and LANta, the Lehigh and Northampton Transit Authority. In 2019, the College formed a partnership with LANta to provide transportation at no cost to students, faculty, and staff.

6. We Reinforced the College's Commitment: In 2017 the Provost's Office directed the faculty to provide strategic recommendations for future academic programming. "Environment and Sustainability" emerged as one of six key focal areas. In its report, the environment and sustainability working group noted "our vision is to be a national leader among liberal arts colleges in both the teaching and practice of environment and sustainability, as well as in sustainability-focused collaborative research." Additionally, the working group noted that "national recognition will come through both academic excellence and demonstrated commitment to sustainable operations." They proposed establishing a goal of carbon neutrality by 2035 (Environment and Sustainability Working Group Members, 2017). The Academic Plan for the College that developed from this and the working groups for the other five focal areas was approved by the faculty in December 2018.

III. Climate Action Plan 2.0

In fall 2017, the Office of Sustainability began the task of updating the original Climate Action Plan by assessing and summarizing progress made since the inception of the CAP, investigating new opportunities for emissions reductions, and charting a new path forward that incorporates a more ambitious timetable for achieving the goal of carbon neutrality. In doing so, the Office of Sustainability investigated carbon-reduction strategies including utility master planning, strategic purchasing, waste reduction, campus energy use policies, behavior modification, installing renewable energy sources, carbon offsets, and carbon sequestration.

To assist with this major undertaking, the College hired The Stone House Group (SHG), a facilities consulting firm with extensive experience working with institutions of higher education, to audit campus energy usage, analyze technological solutions, and update emissions-reductions goals. The Office of Sustainability also convened a 21-person advisory committee to vet ideas, provide advice, and assess recommendations. Additionally, several representatives from the committee met with the Trustee’s Grounds and Building Committee to gain its insight on initial recommendations. Given that feedback, the Climate Action Plan Committee established a new goal of reaching net-zero emissions by or before 2035, a goal that is more in line with efforts at most of our peer institutions, several of which have already achieved carbon neutrality and many others who are on-target to do so in the next few decades.

Given that on-campus stationary combustion and purchased electricity account for the vast majority of the College’s current emissions (Figure 3), the Climate Action Plan primarily focuses on strategies to reduce emissions in these two areas. Commuting, landfilled waste, and air travel (Figure 3) have a smaller impact on overall emissions, but also are addressed in CAP 2.0 recommendations because they are part of the College’s carbon footprint and offer particularly viable opportunities for engaging and educating a diversity of different campus constituencies about environmental issues and campus sustainability efforts.

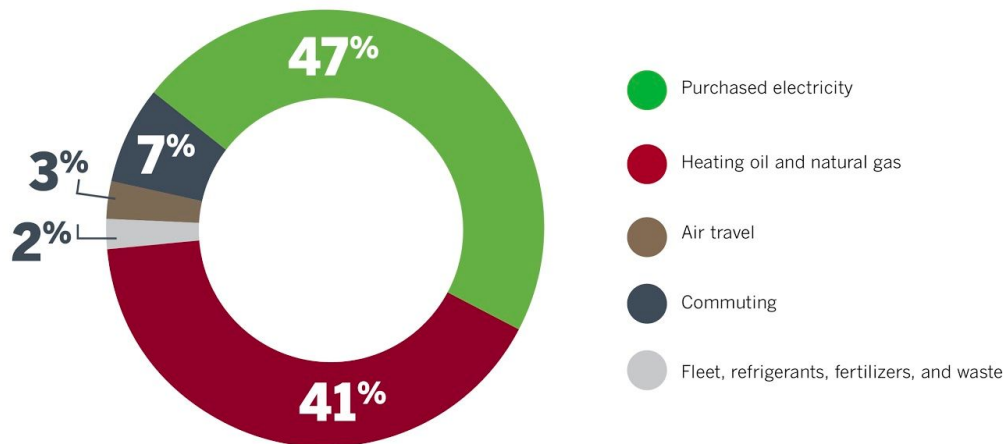


Figure 3: Lafayette’s Carbon Emissions by Sector

III A. Buildings and Facilities Energy Use

Summary: *The fact that 88 percent of the College's GHG emissions come from purchased electricity and natural gas for space and hot-water heating dictates that these two sectors are the areas of emphasis for climate action planning. The College can reduce overall emissions by 15 percent and save money by completing a suite of energy-efficiency projects. The savings from these projects will be rolled into a green revolving fund, which, along with fundraising projects, will fund future more costly emissions-reduction projects. Producing electricity renewably on-site will further reduce our reliance on carbon-intensive electricity from the grid. The emissions from remaining purchased electricity can be addressed through thoughtful offset projects. Transforming on-campus heat and hot-water generation by implementing a combined heat and power system and by changing to a renewable fuel source will enable the College to vastly reduce emission from this sector. Moving forward, implementing policies that codify the promotion of sustainable building design, construction, and operation will result in future energy savings. These initiatives and projects will expand the educational opportunities available to students.*

Recommendations

Phase 1: Immediate Opportunities for 2019-2020

Implement Energy Conservation and Efficiency Projects: Increasing the energy efficiency of campus is a key first step to reducing the College's energy consumption and thereby reducing emissions. Efficiency involves using technology to cut back on the energy needed to perform a particular function or task. Conservation involves changing culture and behavior to avoid wasting energy. An everyday example of energy efficiency is changing to a light bulb that uses less energy, while an example of conservation is turning off the light when you leave the room. In its energy audit, SHG identified \$3.8 million in energy conservation and efficiency projects with an estimated six-year payback and annual reduction in GHG emissions of 4,650 MTCO₂e, which is equivalent to 15 percent of the College's annual emissions. These projects range from installing occupancy sensors to controlling bathroom exhaust fans in Fisher Field House to sealing openings to the exterior of Markle Hall's basement mechanical area. Of these 150 energy-efficiency projects, 88 were identified as high-priority projects at a cost of \$1.8 million with an estimated four-year payback and annual reduction of 3,670 MTCO₂e. Thus, the first step of the College's Climate Action Plan is to implement these high-priority projects as soon as possible because they provide the dual benefits of saving the College money and reducing our emissions.

Establish a Green Revolving Fund: The Finance Office will set up a Green Revolving Fund (GRF) by fiscal year 2020. By making an initial investment in tools and resources that will enable Lafayette to reduce energy use on campus, the College will gain a lasting economic benefit. These energy savings—and resulting cost savings—will contribute to the GRF and enable the College to provide capital for projects that reduce its environmental impact and operational costs. GRFs are well-established at many institutions, including Penn, Bucknell, and Cornell. Establishment of a GRF will support higher-cost projects that will nonetheless be crucial to achieving our goal of carbon neutrality.

The GRF will be a component of the College's capital reserve. Funds placed in the reserve will be invested by the College's Investment Office. Use of the fund will be a recommendation by the Sustainability Steering Committee with approval by the Financial Policy Committee of the Board of Trustees.

The GRF will be funded through direct energy savings from the initial energy efficiency and conservation projects and any rebates that the College is eligible to receive (e.g., from utility companies by installing verified energy-efficiency projects).

Investigate Renewable Energy Options: The Office of Sustainability, Facilities Operations, and Finance will begin partnering with a renewable energy consultant to investigate on- and off-campus renewable energy options by May 2019. For on-site renewable energy projects, this will entail partnering with a renewable energy consultant and solar developer(s) to evaluate the solar potential for candidate sites, verify electricity loads, estimate performance capacity, understand land-use impact, determine purchase power agreement (PPA) rate (a financial agreement in which a developer arranges for the design, permitting, financing, and installation of a renewable energy system), model cash flows, develop a plan to meet all relevant local ordinances, leverage educational value of project, and retain project renewable energy credits. For an off-site renewable energy project, the College will work with a renewable energy consultant to create a request for proposal (RFP) to enable construction of a large-scale renewable energy project.

These goals should be incorporated into the decision-making process when investigating renewable energy projects:

- Provide a financial benefit to the College over the life of the project.
- Drive additional renewable capacity through completion of the renewable energy project.
- For on-campus renewable energy projects, give preference to accessible, visible, and central campus locations to maximize the educational benefit of these installations.
- Off-campus renewable energy projects will ideally be in driving distance of campus.
- Provide students, faculty, and staff with access to generation data.
- Retain renewable energy certificates (RECs) for solar energy generated on-site. (RECs are proof that energy has been generated from renewable sources, such as solar or wind power, and selling them would be selling the right to claim emissions reductions.)
- Partner with credible consultants and developers who do their due diligence regarding the environmental impact of the project.
- Maintain or augment biodiversity.

In addition, the Office of Sustainability will investigate potential partnerships with other local colleges or universities for renewable energy generation. Doing so would allow the College to take advantage of economies of scale for purchasing components like solar panels and to share costs for retaining a renewable energy advisory firm.

Investigate Offsetting Remaining Emissions: The College plans to fast-track investigating off-site renewables as the magnitude of Federal Business Energy Investment Tax Credit (ITC) will start to decline as of January 2020. The ITC is a financial incentive that provides corporate tax credits for investing in renewable technologies. The current incentive for solar, fuel cells, and wind is 30 percent, however, after December 31, 2019, the incentive will drop to 26 percent, and beyond 2022, the incentive will drop to 10 percent. As a 501c3, the College can't monetize the tax credit. However, if the College were to finance a new renewable energy installation with a PPA, the developer or investor can capitalize on the ITC and then potentially pass the savings onto the College. However, to benefit from the full 30 percent incentive, the College will need to begin construction on a renewable project by December 2019.

After a PPA is established, the developer sells the power generated to a customer at a fixed rate that is typically lower than the local utility's retail rate. This offsets the customer's purchase of electricity from the grid with renewable energy. PPAs are typically structured for 10 to 25 years, and the developer remains responsible for operation and maintenance of the system throughout the duration of the agreement. PPAs present an attractive option for Lafayette, as the developer is responsible for system performance and operating risk, there is no or low upfront capital costs, and the developer is able to capitalize on tax incentives, which are not possible for a nonprofit institution. When institutions enter into a PPA for creating a new renewable energy facility, the power agreement often includes educational benefits such as monitoring the solar array's real-time energy production, tours of the installation, and opportunities like internships, scholarships, or research grants. For instance, at University of Richmond, a power purchase agreement enabled construction of a 20-megawatt solar energy facility that meets all the university's power needs. The 47,000 panel array, which is located 50 miles from campus, has enabled the university to become the first institution in the southeast to match 100 percent of its electricity needs with renewable energy. In addition, it has enhanced the curriculum and added to vocational opportunities (Setting the Standard for Sustainability, 2018).

Revise Green Building Guidelines: By fall 2019, the College will more clearly articulate standards for integrating efficiency and conservation measures into all construction and renovation projects. The Climate Action Plan Committee has recommended creation of a green building policy that clearly specifies expectations for new construction, major renovations, minor renovations, and purchasing. The policy will apply to all existing buildings. This policy should be comprehensive and forward-looking. The policy should cover everything from routine purchases and replacements (e.g., incandescent and fluorescent light bulbs should be replaced with LED bulbs), to major renovations that affect building energy systems, building envelope, and use patterns, to new construction. The policy should draw on the state of the art in green building renovation practices. The guidelines will be comprised of a diversity of different required benchmarks including purchasing Energy Star-certified products, LED lighting, and occupancy sensors. Purchasing Energy Star-certified products ensures the College is investing in appliances that are in the top 25 percent for efficiency and will support our GHG emissions reduction goals.

The guidelines will ensure that new buildings and major renovations meet LEED Silver certification design criteria as a minimum benchmark. Eighty percent of Second Nature Carbon Commitment signatory campuses (our higher education peers who also have pledged to go carbon neutral) mandate that all future campus buildings be built to standards for achieving LEED Silver certification or higher (Sightlines and the University of New Hampshire, 2016). LEED Silver is an established minimum standard for sustainable design, but the College also will consider more comprehensive sustainable buildings standards. For example, some other Carbon Commitment signatory campuses (UC Davis, Georgia Tech, and more locally Millersville University) have used International Living Future Institute (ILFI) Zero Energy Building (ZEB) Certification as their benchmark (Second Nature). ZEB certification is based on actual performance and requires that 100 percent of the building's energy needs be supplied by on-site renewable energy. Thus, constructing ZEB buildings would demonstrate a commitment to creative, imaginative, and innovative thinking, and would allow the campus to keep growing without adding emissions. Additionally, the College will require that all new buildings, whether built by the College or for the College, be built to connect to our existing central steam plant. This approach will prevent stranded natural gas systems and will allow more buildings to benefit from future on-site efforts like converting to a biogenic fuel source for the steam plant.

Incorporate Energy-Efficiency Measures into Existing Projects: The Office of Sustainability will collaborate to find deferred maintenance projects that are already planned and incorporate energy-efficiency upgrades. For instance, future renovation projects in Van Wickle Hall, Simon Center, and Kunkel Hall should incorporate energy-conservation measures within their renovation plans, thus reducing overhead to manage and install energy-efficiency projects.

Create a Green Lab Program: By 2020, the Office of Sustainability will develop a Green Lab Program to improve lab energy conservation, water conservation, and recycling. Such a program would implement sustainable practices and technologies in labs with the help of staff, researchers, and professors. For example, policies and/or protocols could be created to shut down equipment when not in use and to eliminate waste. Lab equipment is energy-intensive. Fume hoods alone can require 3.5 times the amount of energy a residential home uses. Plug loads associated with devices such as ovens, freezers, refrigerators, autoclaves, and incubators add to this high energy demand. Also, lighting energy intensity in labs is up to twice that of a typical office space, accounting for 8 to 25 percent of total electricity use in the building. Laboratory buildings use three to five times more energy per square foot than an equivalent size office or classroom. Green Lab Programs are in place at Harvard, MIT, Cornell, and Penn State University. At Harvard, for example, fume hoods were responsible for 44 percent of energy consumption in lab space. Harvard implemented a Shut the Sash Program that resulted in a 30 percent reduction in fume hood exhaust levels and an annual energy savings of more than \$240,000. Not only did the program successfully lower energy use and utility costs, it also promoted a sustainable culture in the labs (Harvard).

Phase 2: Recommendations for 2021-2025

Achieve Carbon Neutrality at Metzgar Fields Athletic Complex: The College has a significant opportunity to adopt best practices in energy management and infrastructure design while reducing its carbon footprint by implementing measures to achieve on-site carbon neutrality at the Forks Township athletic complex. Installing a solar array that matches the annual electricity consumption at Metzgar Fields and planting a forest on a portion of surrounding leased farmland would enable the College to achieve a carbon neutral athletic complex at a modest cost. The afforestation serves as a “carbon sink” that will offset the emissions from on-site fossil fuel combustion for heat and hot water. In doing so, the College would expand its status as a living laboratory, providing opportunities for hands-on education in carbon-efficient technology and sustainable design.

Maximize Emissions Reductions through Renewable Energy Sources and Systems: Beyond the emissions reductions achievable through basic efficiency and conservation, further emissions reductions will come from campus-based renewable energy sources and advanced technologies. Broadly, these renewable energy sources will address emissions from the two largest sectors of our current carbon footprint: purchased electricity or on-site combustion of fossil fuels (which are primarily used to generate heat and hot water).

- ***Maximize Visibility and Emissions Reductions through On-Site Solar:*** Lafayette can further reduce emissions from purchased electricity by producing electricity with on-site solar arrays, building on the groundwork that will be completed in Phase I. While we do not have the physical space on campus to fully meet our electricity needs with solar energy and current cost of

electricity from the grid on the main campus is low, educational and promotional benefits of on-site installations are high. As we have learned from higher education peers across the country, on-site solar installations send a highly visible and clear message to members of the community and visitors about an institution's commitment to sustainability. They also afford the opportunity for on-site educational experiences for students who can learn about renewable energy in courses from a diversity of different departments and programs at the College. The Office of Sustainability and past research reports from students in Engineering Studies have identified these potential sites for on-site solar:

- Metzgar Field Athletic Complex (detailed above)
 - Allan P. Kirby Sports Center
 - Buck Hall
-
- ***Investigate Transitioning Campus Heat and Hot Water Generation:*** Emissions from on-campus use of natural gas and fuel oil constitute around 40 percent of the College's GHG emissions (Figure 3). This fuel use primarily occurs in the College steam plant, which provides energy for heat and hot water for two-thirds of campus space, including Oechsle Hall, Farinon College Center, South Hall, and Skillman Library. Because the steam plant doesn't operate in the summer months, during this interval hot water is supplied by an independent natural gas service. Further fuel use occurs to meet heating loads in buildings that are not connected to the steam plant, including Watson Courts, Oechsle Center for Global Education, and Feather House. Through efficiency upgrades focused on reducing heat loss through the building envelope and reducing use of hot water, some emissions reductions are possible. However, as with electricity, the College also faces upward pressure on heat and hot water demand due to planned growth. Therefore, updating energy infrastructure and switching to a renewable fuel source for heating are clearly the next key elements in developing a strategy to both reduce carbon emissions and increase the efficiency of our heating and hot water systems on campus.

There are several key improvements that will enable us to eliminate or dramatically reduce our emissions from on-site combustion of fossil fuels. During Phase 2, the College will investigate these infrastructure changes:

- Converting from steam to hot water district heating, which is significantly more energy efficient than steam.
- Installing a combined heat and power plant (CHP) to boost efficiency and provide resiliency during power outages. A CHP plant uses the energy released during combustion of a fuel to provide both electricity and hot water, making the plant significantly more efficient than a plant that only provides electricity or heat. The CHP plant will provide the College with greater resiliency to power outages, which will be an important adaptation to potential future risks as climate change is predicted to lead to more intense storms in the future.
- Changing the steam plant energy source to a biogenic carbon-neutral fuel.

Phase 3: Recommendations for 2026-2035

Transform Campus Heat and Hot Water Generation: Implementing the campus infrastructure changes outlined in Phase 2—installing a combined heat and power plant, converting from steam to a more

energy efficient hot water district heating system, and changing the steam plant energy source to a biogenic carbon-neutral fuel—will enable Lafayette to maximize emissions reductions from on-site combustion of fossil fuels. By changing its approach to campus heat and hot water generation, the College should be able to meet the vast majority (if not all) of the hot water and space heating demands of our campus without carbon emissions.

Partner with Others to Offset Remaining Emissions: After implementation of the recommended measures in Phases 1 and 2, SHG recommends the College address any remaining emissions through carbon sequestration. We foresee institutions throughout the Lehigh Valley being key collaborators in both renewable energy (outlined above) and carbon sequestration offsetting projects. Exploration of these potential partnerships is already underway (Phase 1), so that by Phase 3, we can work with our partners to actively implement these projects. In exploring options for offsetting projects, the Office of Sustainability will strongly hold to several key principles. First, by 2035, any needed offsets should come from the development of sustainable energy projects or carbon sequestration projects. Second, all offset projects must meet the condition of additionality—that the project and its corresponding emissions reductions would not occur without the College’s participation. Finally, offset projects should be local enough that they can contribute to the educational mission of the College.

- **Mitigate Negative Impact:** The College may purchase land to sequester carbon through afforestation in order to mitigate the remainder of energy-related emissions. Any afforestation carbon offset project should meet the following requirements:
 - Maximizing emissions reductions and accelerating the goal of reaching net-zero emissions
 - Benefiting the local region
 - Providing academic and research opportunities
 - Creating educational infrastructure that would enhance our campus as a living laboratory
 - Meeting all basic carbon offset criteria: permanent, additional, verified, enforceable, and real
 - Maintaining or enhancing biodiversity

Timeline

Phase 1: Immediate Opportunities for 2019-2020

- Begin implementing high-priority energy efficiency projects as efficiently as is feasible.
- Partner with a renewable energy consultant to investigate using off-site renewable energy. Partner with renewable energy consultant or solar developer to investigate options for on-site solar in 2019. The Metzgar Fields Athletic Complex and the high-priority locations listed above will be explored.
- Create an updated Green Building and Renovation Policy for renovations, office moves, and new construction by fall 2019.
- Establish a green revolving fund by fiscal year 2020 to provide upfront capital to fund high-performance efficiency, operations, maintenance, and occupant behavior projects.

Phase 2: Recommendations for 2021-2025

- Achieve a 15 percent reduction in GHG emissions through investing in \$1,800,000 in high-priority energy efficiency projects by 2024. Use the savings from these projects to grow the green revolving fund to fund additional projects.
- Implement on-site solar at the Metzgar Field Complex and at other high-priority locations on the main campus.
- Partner with a renewable energy consultant to expand and investigate additional off-site renewable energy projects. The estimates of total emissions reductions from off-site renewable energy projects range from 22 to 43 percent.
- Create a Green Lab Program to conserve energy in laboratory spaces by 2024.
- Partner with the academic divisions to research, analyze, and recommend strategies for carbon neutral on-campus heat and hot water generation.
- Explore an internal financial incentive for carbon neutrality projects so that more energy efficiency and long-term infrastructure projects can be cost-justified.

Phase 3: Recommendations for 2026-2035

- Install a combined heat and power system (20+ percent emissions reduction).
- Switch to a cleaner-burning renewable fuel for the steam plant (20+ percent emissions reduction).
- Sequester carbon via afforestation to compensate for the remainder of energy-generated emissions.
- Investigate new viable, additional, and cost-effective options for reducing carbon emissions.

III B. Minimize Waste

Summary: *By instituting a college-wide composting system and enhancing current recycling and reuse programs, the College will work toward diverting 60 percent of waste from the landfill by 2035. Programs and outreach efforts that reduce waste can play a significant role in creating an environmentally conscious campus culture as they are tangible and simple sustainability measures accessible to all members of the campus community. Providing students, faculty, and staff with opportunities to play an active daily role in living a sustainable lifestyle inspires them and empowers them to become even more engaged in the College's commitment to sustainability.*

Recommendations

Phase 1: Immediate Opportunities for 2019-2020

Expand Reuse and Recycling: By encouraging reuse and recycling, Lafayette can reduce emissions associated with landfilling furniture and carpet and ensure useable materials are returned to the production stream. For instance, recycling rather than landfilling 1 ton of fiberboard furniture would be equivalent to taking 37 passenger vehicles off the road. At the end of spring 2018 semester, the Office of Sustainability piloted a Green Move Out program to recycle old wooden furniture, futon frames, and carpets. Inexpensive carpets, fiberboard shelving, and other low-cost, low-durability home goods have a limited life for reuse. Through this pilot program, students recycled more than 6,000 pounds of materials. In upcoming years, the Office of Sustainability will increase the donations collected through Green Move Out, enhance marketing and communications of the effort, and remove barriers to participation. Specifically, in spring 2019, the Office will expand the reach of this program to target students who live in off-campus and interest housing.

Investigate Campus-Wide Composting System: The basis of Lafayette's sustainable food loop is the production of sustainable, nutritious, and student-grown produce at LaFarm, distribution of this produce to Lafayette Dining Services, collection of food waste from dining to the compost program, and return of decomposed nutrients back to LaFarm. Not only does a sustainable food loop enrich the soil of LaFarm, it also enriches the minds of Lafayette students by providing a working model of campus of sustainability. The on-campus composting system is run by student employees. With consistent student labor and more reliable equipment, we were able to collect more than 4,500 pounds of food waste in just one month of production. At this rate, we anticipate diverting approximately 25,000 to 30,000 pounds of food waste per year if we are able to consistently keep tubs operating at their most efficient capacity. Our current on-campus composting, operating at maximum capacity of our digesters, is able to collect approximately half of the plate waste from one of our two main dining halls during the seven months of the year when weather and student schedules allow for collection. The Office of Sustainability plans to limit the amount of food waste collected on campus by outsourcing the remaining percentage of our food waste pickup off campus, including back-of-house waste from catering and all dining halls and 100 percent of plate waste from our two main dining halls, particularly during winter when our digesters are not able to function due to weather limitations.

Increase Food Recovery: Through the leadership of the Food Recovery Network, a campus club established in summer 2018, the College will continue to donate excess dining hall food to Safe Harbor. The Office of Sustainability will facilitate a partnership with Dining Services and Campus Life to help the

club expand food recovery efforts by recovering food waste from smaller catered events. The Office of Sustainability will facilitate the Food Recovery Network partnering with ECOreps and other environmental organizations to organize a food drive at the end of fall semester. Many students study abroad during spring semester, and this would provide them with an opportunity to donate unneeded food before they leave campus.

Increase Diversion Rate by 5 Percent by 2020: During the 2018-2019 academic year, the Office of Sustainability's goal is to increase the diversion rate (amount of waste diverted from the landfill through recycling or composting) by 5 percent from its current rate of 14 percent. This goal can be achieved through composting at large catered events, continuing composting via the Earth Tub program, and enhancing the Green Move In and Green Move Out programs (campus-wide recycling collection events during move-in and move-out weekends). Achieving this goal will keep 13 tons of food waste, clothing, cardboard, books, etc., out of the landfill.

Phase 2: Recommendations for 2021-2025

Achieve an Overall Diversion Rate of 40 percent: The College needs to consider broader strategies for diverting waste from the landfill. Middlebury College, with about 2,500 undergraduate students, composts around 300 tons annually and has a 65 percent diversion rate. As documented in its Climate Action Implementation Plan, Middlebury strives to promote composting and recycling as "the Middlebury way," which sets expectations on campus to compost or recycle at all events (Climate Action Implementation Plan, 2008). If, like Middlebury, Lafayette continued recycling, promoted reuse opportunities, and expanded composting to include both pre- and post-consumer waste, napkins, paper towels, and compostable containers from catered events, the College could increase the diversion rate above 40 percent. The Office of Sustainability will enhance educational outreach about what can and can't be recycled, composted, or reused, to increasing the diversion rate. Recycling, composting, and reuse programs differ from place to place, thus new students, faculty, and staff need better access to relevant information about Lafayette's recycling, trash, and reuse policies and procedures. Additionally, the Office of Sustainability will make recycling bins available everywhere that trash is available and will also partner with Bon Appetit to reduce the amount of non-recyclable materials used in takeout food service. The Office of Sustainability and ECOreps program will explicitly integrate information about what can and can't be recycled into the orientation process.

Phase 3: Recommendations for 2026-2035

Achieve an Overall Diversion Rate of 60 percent: Consultation with the U.S. EPA Region 3 Sustainability Coordinator shows us that reaching a diversion rate above 60 percent is possible. The Office of Sustainability will engage in ongoing education and infrastructural additions so that recycling, composting, and reuse is normalized and incentivized to become embedded in the campus culture. Students, faculty, and staff will assist with researching best practices and recommending new procedures.

Timeline

Phase 1: Immediate Opportunities for 2019-2020

- Increase recycled, composted, and reused materials by 13 tons during the 2018-2019 academic year to achieve a 5 percent increase in diversion rate through building on prior successes.
- Research ways to expand the campus composting program.
- Continue the food recovery program and find new opportunities for capturing student-generated food. Quantify how much food is donated.
- Expand opportunities for reuse and recycling, while also enhancing online communications about these programs with members of the campus community.

Phase 2: Recommendations for 2021-2025

- Boost the overall diversion rate above 40 percent by 2024.
- Accomplish this in part by instituting a campus-wide composting system to remove food waste, pizza boxes, napkins, and other compostable items from the landfill and by enhancing recycling, reuse, and waste-minimization programs.
- By 2021, ensure that there are recycling bins wherever there are trash bins and employ best practices for recycling information, infrastructure, signage, etc.

Phase 3: Recommendations for 2026-2035

- Boost the overall diversion rate to 60 percent by 2035.

III C. Transportation

Lafayette's transportation includes campus fleet vehicles for grounds and facilities maintenance, the LCAT shuttle system, vehicles for transporting students to community activities and appointments, ground (bus) transportation for teams and groups to competitions, commuter vehicles, and air travel to conferences, research sites, and study-abroad programs. In total, transportation accounted for an estimated 11 percent of GHG emissions in 2017 (2,941 MTCO₂e). Accurately quantifying transportation emissions can be challenging, especially when considering emissions from student, staff, and faculty personal vehicle use. The campus can reduce transportation emissions through behavior changes, fuel-switching, increased vehicle efficiency, and carbon offsets. Each emissions source will be addressed through appropriate strategies. The Office of Sustainability envisions a campus that is increasingly pedestrian friendly, where walking, biking, and riding the LCAT is the norm for students, faculty, and staff, and use of personal vehicles to get around campus is a thing of the past. The College will seek out opportunities to reduce emissions from the College-owned fleet and ways to encourage commuting that is increasingly sustainable.

Recommendations

Phase 1: Immediate Opportunities for 2019-2020

Investigate Transportation Emissions: An important first step for transportation emissions reduction is carefully identifying all sources and quantifying their emissions. Thus, the Office of Sustainability will undertake a systematic accounting of campus transportation emissions.

Identify and Assess Strategies for Emissions Reductions: Once sources of emissions have been identified, the Office of Sustainability, perhaps in partnership with faculty-led student projects, will identify potential emissions-reduction strategies for each source and assess their suitability based on the amount of emissions reduction achievable, cost, visibility, opportunities for student engagement, etc. The result of this study will be a clear plan for emissions reduction in transportation, with the goal of net-zero transportation emissions before 2035. In particular, this plan will consider ways to reduce emissions through:

- Investigating new technology or fuel alternatives for the College-owned fleet (e.g., shuttle buses that run on natural gas or electricity)
- Offsetting options for air travel
- Increasing opportunities to reduce overall emissions via programs that encourage faculty and staff to commute by walking, biking, or switching to plug-in electric vehicles
- Encouraging changes in behavior, such as reducing personal vehicle use on or around campus
- Installing additional car-charging stations
- Exploring opportunities for staff cyber-commuting
- Increasing ridership of LCAT shuttles while reducing their emissions

Improve Awareness: During 2019, the Office of Sustainability will work to increase awareness across campus of less carbon-intensive transportation options. As the student population increases, these options will reduce parking tension and create a culture of shared resources and sustainability on campus. Strategies include:

- Add information to the Office of Sustainability website about various transportation options: LCAT shuttle, U-Haul car share, and My Bus Home.
- Install more campus bike racks and introduce a bike repair program to support faculty, staff, and students who bike to, from, and around campus.
- Partner with on-campus groups, including Campus Life, Residence Life, and Public Safety, to understand how they currently promote My Bus Home and the car share.
- Provide information to faculty and staff about on-campus car electric vehicle charging stations and assess the likely short- and medium-term demand for charging stations.

Provide Information about Travel Offsets: Providing students with the opportunity to present at national conferences, study abroad, and conduct off-campus research is all part of a robust liberal arts education. College-financed air travel and study-abroad air travel generated 1,064 MTCO₂e, which accounts for about 4 percent of the College's total emissions. By their senior year, more than half of Lafayette students will have studied abroad. One way to negate the impact of travel emissions is to purchase Green-e® offsets, which would cost between \$12,000 to \$16,000 annually. Another option is to offset these emissions with development of renewable energy or carbon sequestration projects--likely the same projects developed to offset electricity emissions. During Phase 1, the Office of Sustainability will partner with the Office of Study Abroad and other relevant campus partners to update their websites to share resources with students, faculty, and staff about voluntarily purchasing offsets through a vetted and respected offset provider. Additionally, they will explore developing an incentive program to create mindfulness regarding sustainable travel.

Phase 2: Recommendations for 2021-2025

Implement Strategies for Transportation Emissions Reductions: The plan developed in Phase 1 will identify opportunities for emissions reductions from transportation. Beginning in Phase 2 and continuing through Phase 3, those plans will be implemented.

Continue Assessing and Studying Transportation Emissions: Commuting, air travel, and use of personal vehicles around campus are challenging sources of emissions, both to quantify and to address. Thus, efforts to assess the impacts of programs, understand behavior, and identify good reduction strategies will be ongoing.

Enhance Communications: The Office of Sustainability will create a communications strategy for enhancing transportation communications. This will include creating fliers, supplying car share and My Bus Home information to incoming first-year students via email, sending strategically timed campus announcement blasts, and sending summertime reminders to leave cars at home for the upcoming academic year. It also will include creating materials for employees about transportation alternatives and determining the best opportunities to reach target audiences.

Phase 3: Recommendations for 2026-2035

Continue Implementing Strategies for Transportation Emissions Reductions: Strategies for emissions reductions identified in Phases 1 and 2 will be completed in Phase 3. Emissions that cannot be addressed in other ways will be addressed through offset projects by the end of this phase.

Timeline

Phase 1: Immediate Opportunities for 2019-2020

- Investigate transportation emissions sources.
- Identify and assess strategies for emissions reductions.
- Improve awareness about on-campus alternative transportation options.
- Provide information about voluntarily offsetting travel through the Office of Sustainability and the Office of International and Off-Campus Education.

Phase 2: Recommendations for 2021-2025

- Implement plans from Phase 1.
- Continue assessing options and emissions.
- Enhance communications about more sustainable transportation options.

Phase 3: Recommendations for 2026-2035

- Implement plans from Phases 1 and 2.
- Negate all remaining emissions from transportation, including student, faculty, and staff commuting and air travel with offsets meeting Lafayette's criteria.

IV. Curricular Integration

Summary: In 2008, the Climate Action Plan 1.0 set a goal to incorporate sustainability into the College's curriculum to educate all Lafayette students within a learning environment that produces environmentally literate and socially responsible graduates. The Climate Action Plan 2.0 expands upon this goal by providing recommendations that will advance sustainability resources, technology, and hands-on interdisciplinary opportunities for faculty-student collaborations. We envision campus sustainability enacted through the CAP and other initiatives on campus being explicitly linked to and reinforcing teaching and research efforts in sustainability and environmental stewardship. Embracing the opportunities presented by transforming our campus into a living laboratory will enhance the learning environment and deepen the educational experience Lafayette provides. Because sustainability touches a wide range of issues and activities, it can be effectively and creatively incorporated into many different disciplines.

Accomplishments

Lafayette takes an interdisciplinary approach to understanding, modeling, and pursuing environmental sustainability. Faculty bring together coursework from different disciplines across campus, providing students a way to integrate the methods and research of environmental inquiry from engineering, the humanities, natural sciences, and social sciences. Lafayette's curriculum works toward a more sustainable future by developing course projects and capstone experiences in community settings, which helps students gain an understanding of the unique ecological context of our campus, town, and region. In the 2017-18 academic year, there were 144 courses offered focusing on sustainability with 29 academic departments or programs offering at least one sustainability course or course that includes sustainability as a core theme. The impact of this effort is significant: Each year more than 2,000 students are engaging in coursework and thoughtful and intense deliberation about sustainability. It means sustainability is taking an increasingly prominent place in the Lafayette curriculum, just as the need for sustainability education is becoming a critical tool in the skill set of future decision-makers. Embedding environmental sustainability into the fabric of our teaching, research, and overall educational experience will enable our students to take the lead in building a more sustainable future.

A number of initiatives that demonstrate Lafayette's successful integration of sustainability into academics are already underway on campus:

Innovative Faculty-Student Collaborations: Faculty and student collaborations have led to significant achievements that have benefited the campus community while also enhancing faculty teaching and student learning opportunities. LaFarm is an outstanding example of the potential to capitalize on Lafayette's unique institutional identity, which blends liberal arts and engineering. Teams of interdisciplinary faculty and students have collaborated to make it a highly successful site for environmental research and curricular activity. A solar-powered irrigation system designed and built by civil engineers advances the production goals of the farm. A similarly solar-powered wash station conceptually designed by Engineering Studies students and designed and built by an interdisciplinary group of "Grand Challenges" students likewise brought an integrated approach involving social sciences, engineering, and natural sciences. Projects from the Art Department have worked to define the space and illustrate the environmental aesthetics of agriculture, crucial for visibility and community building.

Student-research EXCEL projects in food justice have involved engineering, social science, and natural science students and faculty. Other LaFarm-based projects have brought together students and faculty from anthropology, economics, engineering, environmental studies, government and law, and policy studies to understand the place of campus farms in a liberal arts education. Environmental Science faculty (Biology, Civil and Environmental Engineering, and Geology and Environmental Geosciences) are working with students and local and national agencies to study and promote the removal of several low-head dams on Bushkill Creek to improve fish passage and improve ecological integration of the lower Bushkill with the Delaware River.

Establishment of Environmental Majors: Environmental Studies and Sciences program curricula were designed by a multidisciplinary team of faculty members with support from the Andrew Mellon Foundation and a College-wide strategic plan that included the explicit goal of establishing an environmental studies program. This process involved a variety of workshops with invited experts, review of environmental programs and curricula at comparison institutions, sponsoring of seminars, development of new courses, hiring two postdoctoral appointments, hiring a recent graduate as our first Farm Manager at LaFarm, and sponsoring community engagement events. This work culminated in the College faculty approving an A.B. degree program in environmental studies (EVST) and B.S. degree program in environmental science (EVSC) in May 2012. The first two EVST students graduated the following year. The environmental programs now have a robust cohort of majors and draw courses from more than 15 different departments and programs on campus. The development of the environmental programs has led to new partnerships among faculty and students across campus and new faculty with expertise in environmental science and studies have expanded our offerings and our aspirations in this sphere. New teacher-scholars with expertise in solar energy, biofuels, atmospheric science, atmospheric chemistry, wind energy, sustainable construction, environmental economics, environmental justice, environmental policy, water policy, and environmental literature have recently joined Lafayette's faculty and will contribute to the ever-growing repertoire of courses and research opportunities available to students interested in learning about and building a sustainable future.

Integrated Sustainability into Coursework: Faculty members have embraced the campus as a living laboratory model in which the College benefits from students' creativity and ingenuity, and students have the opportunity to gain valuable hands-on experience in researching and addressing real-world problems. Environmental faculty have provided opportunities for sustainability and environmental citizenship to be core elements of their coursework while also moving Lafayette in a more sustainable direction. For example, in spring 2015 the Engineering Studies program's sustainable solutions class completed a STARS (Sustainable Tracking Assessment and Rating System) Assessment of Lafayette College. STARS is a common metric used throughout higher education to measure the sustainability performance of institutions. The STARS report subsequently led to Lafayette applying for and earning an inaugural STARS rating of silver. During fall 2015, the inaugural capstone course in Environmental Science and Studies created the module "Greening Lafayette," which successfully designed and implemented an educational module for campus sustainability that was situated within a large campus life initiative. The module led to the establishment of the campus ECOreps program, which now provides ongoing educational opportunities about sustainability and environmental stewardship that are available to all students. Two students from the course subsequently presented the sustainability module at a sustainability conference, and faculty members and students from the class later translated the lessons learned from designing the sustainability module into a scholarly paper published in the *International Journal of Sustainability in Higher Education*. Other recent sustainability-focused projects have sought to transform the Bushkill stream corridor at the base of campus, provide strategic planning

for the future of LaFarm, assess and recommend improvements for biodiversity on campus, and assist the City of Easton in developing its own Climate Action Plan.

Most recently, capstone projects across campus have drawn from our own climate action planning process. The Stone House Group and the Office of Sustainability recommended two dozen CAP-related projects that could be pursued by students and also help inform out CAP decision-making in the future. In fall 2018, 10 of these projects were undertaken by small teams of students in the Economics senior capstone course lead by Lafayette's environmental economist. Students in the class devised projects to conduct the cost-benefit analysis to understand environmental and resource economics. Through researching, formulating, and then presenting their projects, students developed an intimate understanding of climate action planning and the impact of their own actions in addition to contributing to advancing Lafayette's CAP process. Two teams of students in the fall 2018 senior capstone seminar in Engineering Studies also undertook projects related to CAP 2.0.

Attained Faculty Commitment: In December 2018, Lafayette's faculty approved "environment and sustainability" as one of six key focal areas for the College's academic planning. A working group of faculty formulated strategic recommendations that would advance the College's reputation for academic excellence among liberal arts colleges by demonstrating its commitment to sustainable teaching, research, and operations. The group's recommendations are synergistic with the CAP 2.0. They include: establishing a goal of carbon neutrality by 2035, striving to operate the campus within environmental bounds, and locating physical infrastructure improvements, such as solar panels, in visible main campus locations (Environment and Sustainability Working Group Members, 2017).

Supported Co-Curricular Programs: Providing opportunities for students to play an active role in sustainability initiatives and modeling sustainability behaviors and lifestyles to their peers is essential to creating a campus culture where sustainability is part of the campus ethos. The Office of Sustainability, which was established in fall 2016, now provides guidance and ongoing interaction and support of several student-led groups on campus, including ECOreps, the Food Recovery Network, Lafayette Food and Farm Cooperative (LaFFCO), LEAP, Society of Environmental Engineers and Scientists (SEES), and Take Back the Tap (Lafayette's branch of the nationwide organization Food and Water Watch, which promotes the use of reusable bottles). These student-led organizations actively support sustainability initiatives on campus.

Created Educational Outreach Opportunities: In 2018, Lafayette hosted the LVAIC biannual campus sustainability conference. The event drew more than 170 participants, including more than 20 Lafayette students, faculty, and staff who gave presentations highlighting the College's collaborative sustainability-related work both inside and outside the classroom. Additionally, many faculty and their students are engaged in local community-based initiatives including collaborations with the Nurture Nature Center, West Ward Neighborhood Partnership, Easton Area Community Center, Karl Stirner Arts Trail Commission, and local hospitals on sustainability-related projects in Easton. CAP 2.0-related partnerships with institutions throughout the Lehigh Valley promise to afford many more community-focused, real-world learning opportunities for Lafayette students.

Goals

Hire Dedicated Environmental Faculty: At the conclusion of the Mellon Foundation Grant in 2012, the steering committees that designed the environmental majors recommended that two dedicated faculty members be added to the ES&S program in environmental studies-related disciplines to be able to initially deliver degree programs in environmental science and studies. An environmental social scientist line was established in fall 2012, and a new environmental humanist will join the Lafayette faculty in fall 2019. The external review of the environmental programs in 2016-17, five years after the establishment of the degree programs, recommended that beyond these positions two additional faculty be hired to address enrollment pressures in biology courses and to further strengthen natural ties between the liberal arts disciplines and the engineering division, and free up teaching power among faculty in the engineering division who already possess relevant expertise but have insufficient teaching power to offer environmental-themed courses with regularity (i.e., every year or every other year).

Leverage CAP 2.0 to Create Novel Educational Opportunities: One of Lafayette's main goals as an institution of higher learning is to prepare students to be critical and creative thinkers and effective and strategic problem-solvers so that they are prepared to face pressing issues in the world. As noted above, many Lafayette faculty are already incorporating sustainability topics into their coursework and research. The CAP 2.0 gives Lafayette the opportunity to expand that effort and take a broader and more cohesive centralized approach in integrating environmental content into programs and curriculum across all disciplines. The recommendations outlined throughout CAP 2.0 create many valuable opportunities for student engagement.

- **Conduct Collaborative Research:** The CAP 2.0 provides opportunities for interdisciplinary research. For example, as discussed above, in fall 2018 students in Economics and Engineering Studies senior-capstone courses began investigating the viability of a variety of different strategies for reducing Lafayette's carbon emissions proposed by the SHG. One team of Engineering Studies seniors investigating biofuel alternatives, for example, worked closely with staff at SHG; consulted with power plant staff on campus; met with and interviewed engineers at biofuel supply companies; examined and analyzed industry reports and prior analyses; and spoke with leaders at Bates and Middlebury about their experiences with similar decisions. Their interdisciplinary report brought together economic, technical, and cultural analyses to inform SHG's work as part of this CAP process. Faculty from across several divisions are planning future capstone and research experiences focused on CAP 2.0 projects. Additional research projects have been identified for capstone classes to pursue, for example, investigating Kirby Sport Center as a site for solar-generated hot water.
- **Use LaFarm and Metzgar as a Model:** Given common daily eating patterns, food is an optimal entry point for engaging students in CAP and environmental stewardship more broadly. LaFarm and the College's sustainable food loop clearly demonstrate a cradle-to-cradle approach to establishing a sustainable food system rather than the cradle-to-grave approach characteristic of the industrial food system. Thus LaFarm provides an alternative narrative for our campus' and our students' relationship with the Earth. Building from this foundational realization, environmental faculty have been using this model to help students see how such a cradle-to-cradle approach can be applied to other environmental systems. For example, students, faculty, and staff would work together to harvest rainwater from the solar panels to use in community gardens, seed the area under the panels to attract pollinators, design habitats

that provide food and shelter for wildlife, and determine what types of plants would grow best under the panels. In addition to the extensive educational value of such a site, achieving carbon neutrality at Metzgar also would raise the College's profile as a sustainability leader in the community as it would be a highly visible demonstration of the College's commitment to environmental stewardship. In order to expand our ability to teach sustainability and resiliency effectively, the Office of Sustainability plans to establish a LaFarm fellow (akin to the sustainability fellow within the Office of Sustainability) who can work with the Assistant Director of Food and Farm to expand the living laboratory of sustainability and interdisciplinary collaboration that is LaFarm.

- **Increase Involvement in Community Outreach:** As noted above, Lafayette is poised to provide leadership among our liberal arts peers in the ways we understand the relationship of our campus and environmental systems (air, energy, water, food, infrastructure, biodiversity) to each other and as part of the larger Easton, Lehigh Valley, and Delaware River watershed regions. The College's Center for Community Engagement has recently designated environment as one of the priority areas in its strategic planning. The environmental working group and the Office of Sustainability will work to forge new partnerships across campus that prompt sustainability and environmental stewardship in our communities. Indeed, we believe that environmental leadership does not just benefit from community engagement, it requires it.

V. Conclusion and Next Steps

Lafayette's Climate Action Plan 2.0 is designed to serve as the blueprint for the College's ongoing efforts to reach carbon neutrality by or before 2035. By following the recommendations outlined in this plan, we can reach that goal and in the process also provide transformational learning experiences for our students.

There are immediate opportunities we can seize upon to make a significant change to our carbon footprint—starting with reducing our heating and electric energy consumption through efforts to improve efficiency and conservation. These projects also will generate a cost savings for the College, which will help establish a green revolving fund. The fund will eventually enable us to finance higher cost, large capital projects that will be critical to achieving our long-term goals. In the near term, the College will seek to explore and invest in renewable energy options—both on and off campus. Adding additional sources of solar and hydroelectric power and partnering with other local higher-education institutions to form collaborative partnerships will provide curricular benefits to our students while adding renewable energy capacity to the grid.

Going forward, beyond 2020, we see an exciting opportunity to achieve carbon neutrality at Metzgar Fields Athletic Complex. Doing so would provide a highly visible symbol of the College's commitment to sustainability while giving students and educators firsthand access and exposure to a living laboratory. In addition, we recommend transforming heat and hot water generation on campus in order to reduce emissions from on-site combustion of fossil fuels. We will continue to look to peer institutions in the Lehigh Valley to partner on collaborative offset projects.

As an influential leader in higher education and in our surrounding community, it is imperative that Lafayette strengthen its commitment to a sustainable future. Through climate action planning, the campus can be used as a living laboratory, giving students, faculty, and staff the opportunity to participate in initiatives that will advance the College's commitment to a sustainable future. Given the pressing need to address human-induced climate change, we see it as our responsibility to take action.

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