Carbon, Climate, and Co-Generation:
A History of Emory University's Energy and Climate Commitments

Katelyn Boisvert
April 2017

Introduction

Energy is very important on a college campus, and Emory is no exception. As Georgia Power's sixth largest customer, Emory uses a lot of energy to power classrooms, residence halls, and chiller and steam plants, along with other aspects of campus. Emory is making great strides, however, toward energy conservation and reduction. Emory has had an Energy Engineer since at least 1985, working on projects to reduce energy consumption. One of the first big steps towards energy reduction was working with Siemens Building Technologies as part of a program called URECA, the Utility Reduction and Energy Conservation Plan. This was different than previous initiatives because it was a multi-building specific project that took a very comprehensive look at energy in those buildings. The third parties conducted energy audits to improve efficiency through lighting alternatives, use of occupancy sensors, temperature adjustments, and other enhancements that are able to drive down energy use in a building. This was only the start of Emory's success with decreasing energy use throughout campus.

Energy conservation is closely related to carbon reduction, and many of Emory's goals towards reducing energy use are also local ways to combat climate change. Climate change is becoming more and more of a globally recognized issue, and many places, even within the US, are beginning to experience changes. As global temperatures rise, extreme weather events are becoming more prevalent, and issues impacting human health, water pollution, and water scarcity are becoming more of a concern. The US is a major contributor to carbon dioxide and other emissions that are exacerbating climate change, so undertaking initiatives to reduce emissions is an important step toward mitigating the negative impacts of climate change.

This topic has recently become a larger focus for the Emory community, due to the creation of the Emory University Climate Action Plan and rising awareness on campus. More courses, research, and extracurricular activities are beginning to revolve around or include climate aspects, allowing more opportunities for students to get involved with and learn more about creating a difference for climate change on campus. The university is investigating many important alternatives to decrease its carbon footprint and the climate impact of the students and faculty who are part of the Emory community.

Methods

This Report was written in the spring of 2017, as part of the course Writing Emory's Sustainability History (ANT 385W) taught by Dr. Peggy Barlett to document the course of sustainability efforts at Emory University. It builds on four Reports completed in 2008:

- The Sparks of Sustainable Energy: Sustainable History at Emory (Mona Patel)
- Constructing a Movement, One Building at a Time: The History of Green Buildings at Emory University (Micah Hahn)

- Alternative Transportation (Andrew M. Foote)
- "Going Into a Place of Beauty": Forest Preservation and Restoration (Whitney Easton)

Our 2017 class chose eight sectors of action for research and interviews, to contribute to the oral and written history of sustainability efforts at Emory. The seven other topics are

- Institutionalization of Change: A History of Emory's Office of Sustainability Initiatives (Kristen Kauffman)
- Teaching the Future: Academic Infusion of Sustainability at Emory (Meggie Stewart)
- Greenspace at Emory: Finding the Balance (Orli Hendler)
- Sustainability in Campus Life: The Changing of Behavior (Jamie Nadler)
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- Sustainable Healthcare at Emory University (Lauren Balotin)
- Emory's History of Waste Diversion and Recycling (Amelia Howell)
- Stormwater Management and Water Conservation at Emory University (Kelly Endres)

Focused on Emory's energy and climate commitments, this report was based on written materials, available quantitative and qualitative data, and interviews. Background information was obtained from Emory Campus Services Reports, the Emory Office of Sustainability website, and the Climate@Emory website. Interviews were scheduled via email, and in the revision process, interviewees were given the chance to review the document and provide feedback. We are especially grateful to interviewees for sharing their time and insights with us, and also to Ciannat Howett and other members of the Office of Sustainability for their generous help in constructing these histories. The individuals interviewed for this report are listed below, with the date of interview:

- Mae Bowen, Post-Graduate Fellow in the Emory Scholars Program (3/21/17)
- Ciannat Howett, Director of the Office of Sustainability Initiatives (3/17/17)
- Joan Kowal, Senior Director of Energy and Utilities (2/28/17)
- Rob Manchester, Director of Engineering (3/10/17)
- Geoff Martin, Environmental Science Graduate Student (2/8/17)
- Hiram Maxim, Professor of German Studies (2/17/17)
- Marc Overcash, Deputy Chief Information Officer (3/29/17)
- Daniel Rochberg, Professor of Environmental Sciences and the Rollins School of Public Health (2/24/17)
- Eri Saikawa, Professor of Environmental Sciences (3/31/17)
- Sheila Tefft, Professor of English (2/15/17)
- James Wagner, Emeritus President of Emory University (3/27/17)

This paper begins with a discussion of Emory's efforts toward energy reduction including energy efficiency, renewable energy, and behavior-change initiatives. The second half of the paper discusses initiatives related to climate change ranging from the Climate Action Plan to several organizations involved in climate-related work on campus.

Emory's Energy Use and Reduction Efforts

Energy Achievements and Goals

With the creation of its first sustainability strategic plan published in 2005, Emory University set a fairly aggressive goal for energy reductions to be achieved by 2015. The university planned to reduce energy consumption by 25% per square foot, which was achieved approximately one year early—by 2015, Emory had surpassed its original goal. The newest sustainability strategic plan completed in 2016 outlines Emory's next goals for energy reduction to be achieved by 2025. The target is to decrease energy use by 50% per square foot and 25% overall. Meeting these goals will continue to be a challenge, especially as the campus expands and new facilities are built. As Emory works to attain its new goals set for energy conservation, additional projects and initiatives are constantly being explored as ways to enhance and expand the energy program. So far, Emory is on track to reach the 2020 intermediary goal, as seen in Figure 1.

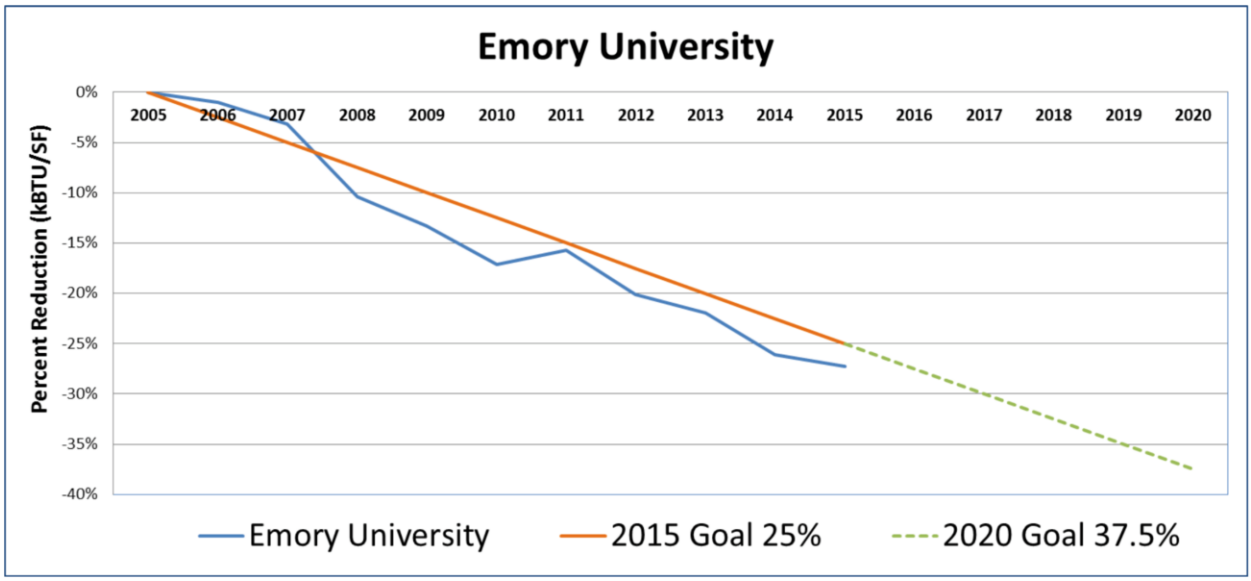

Figure 1. Percent Reduction in Total Emory University Energy Use, 2005-2015 (Source: Campus Services)

The ability to reach energy goals set for the campus is reliant on a variety of factors, the most notable falling into one of the three categories outlined below: energy efficiency improvements, incorporation of renewable energy, and behavior change to reduce use.

1. **Energy Efficiency**
   Energy efficiency describes the goal of reducing the amount of energy required to perform tasks across the university, including examples such as heating and cooling buildings and cycling air through labs. Over the past decade, Emory has employed a variety of strategies to improve energy efficiency. A detailed re-commissioning program was instituted to evaluate the current efficiency of a building and fix any areas that have declined since the building was constructed. Other improvements were made to the steam and chiller plants, and several policies related to temperature control and drinking water usage were implemented. New initiatives addressing energy efficiency include achieving 25% lower energy use intensity for future construction projects, or total energy use required per square foot.
2. **Renewable Energy**

While the use of renewable energy often does not decrease the amount of energy a building uses, it does decrease the carbon emissions of that energy production. Currently, the renewable energy source in place on Emory's campus is solar energy. There are several solar panels (arrays) in use on the roofs of two buildings on Clifton Road and North Decatur Road. New initiatives include the use of geothermal energy for the new Campus Life Center and installation of a co-generation turbine that produces both steam and 1 MW of power for a variety of buildings on campus.

3. **Behavior Change**
   An important aspect of energy conservation that goes beyond the physical structure of buildings and other energy sinks is how those facilities are being used. Emory is a leader when it comes to educational outreach, raising awareness, and building consensus concerning energy utilization. The university relies on behavior change as another way to decrease overall energy use on campus. Future goals include working to increase energy awareness among students and behavior change associated with conservation.

Energy Efficiency

Emory has a variety of initiatives geared toward energy efficiency and decreasing energy use on campus. These initiatives were key elements responsible for Emory achieving its energy reduction goal of 25% per square foot, set in 2005. Several of these initiatives came about through the efforts of a staff group that sought to address energy-related projects on campus. Currently, the Energy and Water Task Force, a staff, faculty, and student group guides future initiatives relating to energy and water usage at Emory.

Utility: One of the critical first steps for Emory was to establish a utility, which is a way of organizing the management of water and electricity. When Ciannat Howett, Director of Sustainability Initiatives, first arrived on campus, Emory was not "tracking and accounting for who used how much energy and billing them for it. So the incentive for a dean to reduce energy consumption just really was not there" (Howett 2017). Creating the utility allowed Emory to bill individual units for their energy usage, which increased the incentive for each unit to work diligently towards reducing its bill.

> It's like students, for example. If you live on campus, you never pay attention to your energy and water usage, probably because you were never billed for it. The first time you have an apartment or have to pay that bill, trust me, you pay attention. You start turning off lights and stop hanging out in front of the refrigerator trying to decide what to eat. It's a huge motivator (Howett 2017).

Re-commissioning and Sustainable Performance Program: Re-commissioning is an important part of Emory's ability to reduce energy usage, as is continuous commissioning under the Sustainable Performance Program. Joan Kowal, Senior Director of Energy and Utilities, describes the process as "when a building is built, it has an initial efficiency, and as things degrade it starts using more energy. The SPP group comes in after approximately 5 years, revisits the building's operations, and tries to bring it back to the original level of efficiency" (2017). Eric Gregory, Emory's Commissioning and SPP Manager, submitted a proposal for and

developed the Sustainable Performance Program in 2011. Continual monitoring is conducted to assure buildings maintain their functionality and energy efficiency.

Chiller/Steam Plants: Emory has taken a number of other steps toward improving the efficiency of the steam and chiller plants on campus. Each of the three chiller plants features the most efficient equipment so the baseline energy consumption is already much lower than average plants. In the 2015 Annual Energy Report, Campus Services reported that "great effort has gone into optimizing the operation and sequencing of the chillers. In 2015, software logic changes to the central chilled water plants have improved efficiency over 20%" (Campus Services 2015). In addition, the chiller plants make use of plate frame heat exchangers, which have significantly improved the efficiency of the heat transferring system used in the chiller plant process. The use of variable-speed motors allows for more control over how much energy is being used in the plant. The speed can be set slower when less energy is needed, such as during off-seasons for the university, which has greatly decreased energy usage. The chiller plants also utilize a water-cooled system that is more efficient than air-cooled systems.

Turndowns: Turndowns on weekends and evenings was one of the first initiatives suggested to units that were interested in decreasing their energy bills. Turning down heating, ventilation, and air conditioning (HVAC) systems during low occupancy times can lead to significant savings as described in the 2005 Campus Services Utility Reduction and Energy Conservation Plan. "Conservative estimates put an HVAC system's consumption at 40% of a building's total energy use. Therefore, if a building's HVAC system is shut down for 6 hours during the night approximately 25% of that building's HVAC expenditure could be saved for that day. The total savings would equal 10% of the building's total energy usage" (Campus Services 2005). Although this idea was originally met with some resistance from a few of the units, all schools at Emory now employ building turndowns on evenings, weekends, and holidays. This strategy reduces energy use in buildings at times when they are not being used. Usually lab buildings and residential halls are not turned down, but residence halls do get shut down over winter break.

Temperature Policies: In 2011, Campus Service and OSI established a new temperature policy, which outlines the temperature at which buildings should be maintained during the different months of the year. All classrooms, administrative buildings, and other controlled areas such as residence hallways are set in a range that allows ambient air to be between roughly 68°F and 76°F depending on the seasons and method of heating or cooling for the building. This policy has helped buildings to be more efficient during the summer and winter seasons. Howett described how behavior change on the part of building occupants was necessary to make this initiative successful. "We [OSI in collaboration with Campus Services] did a ton of education and outreach on our temperature policy. It was a big effort and it led to big results" (2017).

New Construction: In 2001, the Board of Trustees passed a resolution that, at a minimum, all new construction at Emory must meet the requirements for certification at the silver level for LEED (Leadership in Energy and Environmental Design) from the U.S. Green Building Council. Establishing LEED buildings on campus was an early step in Emory's sustainability history. To learn more about the origin of LEED at Emory see "Constructing a Movement, One Building at a Time: The History of Green Buildings at Emory University" by Micah Hahn. In 2000, Whitehead Biomedical Research Building was certified as the first LEED building in the

Southeast. This was a springboard for many other energy-related initiatives on campus. Howett stated that she "really can't say enough about how the early commitment to LEED certification was so critically important. Emory really was among the handful of first innovator institutions" (2017). When she started working at Emory the university "had more square footage of LEED certified buildings than the states of Maryland, DC, Virginia, and Delaware combined" (2017). While Emory no longer has the most LEED certified buildings, LEED continues to be an important aspect of construction on campus. Moving forward, new construction aims to reduce energy use intensity (energy use per square foot) by 25% as compared to 2015 energy use levels.

Kowal discussed how these initiatives relate to the energy goals Emory has established. "When you look at some of the other goals [which are per square foot reductions], that's great, but we are still building new buildings. Even with growth, you are supposed to be reducing. Now new efforts are trying to reduce overall consumption footprint even with new buildings" (2017).

Lab Energy Usage: The cycling of air in campus laboratories is another recent change that Emory has made in order to conserve energy. Previously, new air was cycled through a lab ten times an hour, which required large amounts of energy, and the air was only being used for a small amount of time. The Energy and Water Task Force and Emory's Environmental Health and Safety Office addressed this concern after careful analysis. A new system was implemented to cycle only eight times per hour, which follows the required safety precautions while significantly decreasing energy usage.

Computers: Computer energy requirements are an important component of the total energy use on campus. Recently, there are many initiatives to address this topic. There are three main areas of focus for reducing the energy use of computer systems on campus, explained Deputy Chief Information Officer, Marc Overcash. The first is desktops. As newer models come out, desktops are replaced with new models that have a variety of beneficial features, including the ability to turn off monitors when not in use. The second is computer labs. Each school has at least one computer lab, and the computers in them now have sleep features for when they are not in use. This is also true of computers that are used on the podiums in conference rooms and classrooms. The last and most important area of focus is the data center. "Think of the data center as a highly specialized room where we keep all of our servers, and it has to be at a certain temperature, and these servers generate heat" (Overcash 2017). Library & Information Technology Services (LITS) has been looking at ways to reduce the energy usage of the data center because, "four to five years ago we started running out of power. That is, [the North Decatur] building didn't have enough power at the rate of growth we had for the server rooms to sustain them" (Overcash 2017). The first initiative LITS looked at was virtualizing servers. Typically, servers are stored on a rack, and each server is designated to a single task. Virtualizing "takes that server and creates little virtual units associated with it, so you create a slice and specialize that slice specifically to a service" (Overcash 2017). This allows a single server to do the tasks that would have previously taken six servers, thus decreasing the number of servers necessary in the data center.

The university has also considered a variety of smaller projects, such as fuel cell usage and re-starting hydroelectric power at Lullwater Preserve. However, many of these options did not prove to be an effective use of funding nor the best alternative for campus energy use. Rob

Manchester, Director of Engineering, describes how many of the initiatives Emory employs are "energy with business sense" (2017). This balance is important to consider, as well as which initiatives work best for the climate and other environmental factors in Georgia.

Renewable Energy

Emory currently has several solar arrays and is pursuing other means of renewable energy. The solar projects really took off beginning in 2015, when two solar arrays were installed on 1762 Clifton Road and the North Decatur Building (Figure 2). A small array was also installed at the WaterHub at Emory and an even smaller array is next to the Few and Evans Residence Halls. An additional array was installed on 1762 Clifton Road and became operational in January 2017. The university is presently working on an installation at the Library Service Center. While the university does not directly use the energy produced by these solar installations, it is still an important contribution to reducing Emory's energy footprint. Emory's solar panels to date were installed under Georgia Power's Advanced Solar Initiative, which allowed Emory to retain renewable energy credit for panels that Hannah Solar corporation installed and maintains as described in an article by Office of Sustainability Initiatives.

> Georgia Power Advanced Solar Initiative is a solar energy purchase program designed to spur growth within the solar community of Georgia. The program allows entities like Emory, to partner with a solar developer to produce renewable solar energy. In this case, Emory is the host of rooftop space for Hannah Solar, the solar developer responsible for the associated costs. Hannah Solar will then sell the solar power generated from these campus buildings directly back to Georgia Power. In turn, Georgia Power will sell this power at a premium to customers desiring electricity from a renewable source. Although the panels are not providing solar energy directly to these buildings, Emory does receive a renewable energy credit created as a result of the solar power generated, which helps the university offset its total carbon footprint (Kenny 2015).

Figure 2. Solar array on 1762 Clifton Rd. (Source: Office of Sustainability Initiatives)

Unfortunately, Georgia Power changed the program so that it retained the renewable energy credit, thereby removing the benefit of the program. For a non-profit like Emory that cannot directly enjoy tax incentives since it does not pay taxes, third party financing is the best way to bring down the cost of solar, and Emory is currently exploring additional options for installing

solar. Unfortunately laws and regulations in Georgia make third party financing of solar more limited than in most other states, and it was prohibited until 2015.

Campus Life Center Case Study

Joan Kowal described how there is great momentum around the construction of the new Campus Life Center (CLC) and many initiatives are occurring, including the use of geothermal as an energy source for the building. She described how we are "replacing a building, so we want to make sure the new building uses less energy than the building we are demolishing, so that we are continuing to lower our overall energy use" (Kowal 2017). This is one of the main challenges facing the new Campus Life Center construction, since the total square footage will be larger.

The CLC will feature several renewable energy and energy efficient measures, including the use of LED lights and chilled beams, as well as the geothermal heating and cooling. Although geothermal will not provide all the conditioning the building needs year-round, heating and cooling for most of the "shoulder months" (that occur between summer and winter) will be basically all geothermal.

Another challenge is the balance between energy efficient features and the aesthetics of the space. One of the reasons the current dining center is ineffectively utilized is because it is not a space that appeals to the university community. One of the goals for the CLC is to create a space for students where they will want to spend time and interact. One of the ways this inviting feel is being accomplished is through large glass windows; however, this design challenge comes with an added challenge for energy efficiency. Manchester described how this challenge is the question of "how to balance productivity with appeal" and is an important aspect of this new construction (2017).

Co-Generation Plant

Steam generation of power has an efficiency of around 86%, while electrical power generation has an even lower efficiency at around 40%. Recently, Emory installed a co-generation unit, which produces both steam and power. This process is very efficient, increasing the combined efficiency of the power production process. By producing the steam needed for heating at a higher pressure, the plant then puts the steam through a turbine allowing for the production of a relatively small, yet significant (one megawatt), amount of power.

"We've been looking at different ways to reduce our energy consumption for a long time, so it's the not the first time there was a feasibility [study] done on co-gen. Like everything, these things are dynamic because pricing changes" (Howett 2017). Another reason that Emory was able to test out this system was because the university "got a $500,000 dollar grant from the Kendeda Fund to create a sustainability revolving loan fund. Campus services matched this grant with one million dollars. The first project was to provide some funding for that co-gen. We had already been looking at it, but the fact that we were able to get some external money to make it happen was great" (Howett 2017).

Behavior Change

While Emory is taking strides to reduce energy use on campus, many of these initiatives have another component that is critical to success—the behavior of those using the energy. "You can build a green building, but if your occupant behavior is bad, you no longer have a green building" (Howett 2017).

Two of the largest initiatives involving behavior change were the temperature policy and building turndowns. The weekend, holiday, and evening building turndowns have saved a considerable amount of energy, but it was also one of the longest initiatives to get started in the university's units. Howett described how the law school is one such example. "It took years to finally convince them to do the turndowns that other units were doing on evenings and weekends, and it was because of culture. There had been a culture that you go to the law library, and you could be there till the middle of the night, and the building would be acclimatized for you. And we just had to shift that culture and expectation" (2017). The other change came around with adoption of the temperature policy. "We had to help our folks understand we needed to limit the range of temperature from 68°F to 76°F, and that they were going to have to dress appropriately, and we really needed them not to use space heaters" (Howett 2017).

After these initiatives were in place for a while, they began to become integrated and are now an important part of decreasing energy usage. They "are low, almost no-cost initiatives, all about culture" (Howett 2017), and as such they are a great option for the university to help reach its reduction goals. Behavior change contributed to a portion of the reduction that was achieved in 2015. "What was so exciting to see was they could account for non-behavior change, and then there was this inexplicable piece that was really thanks to sustainability reps, student ambassadors, and all the education and outreach" (Howett 2017).

Emory's Climate Commitments

Emory's Climate Action Plan

In 2010, Emory University began taking strides toward addressing climate change by developing a Climate Action Plan (CAP). The plan built on the greater public awareness of climate change and specifically on campus awareness, which was due to the combined efforts of students and the faculty. Dr. Hiram Maxim, a German Studies professor and faculty member on the Climate Action Plan Committee, describes the plan's beginnings as a "desire by various bodies on campus to lay out a plan to address carbon emissions. In general, it was Emory's response to this global phenomenon" (Maxim 2017).

In 2010, Ciannat Howett and Bobby Jones Scholar Rebecca Petford began spearheading work for the CAP. The timing for the project was right because there was a critical mass of people interested and willing to make this idea a reality. Ciannat Howett and Peggy Barlett were the primary organizers of the process as drafting of the plan began. Two presidentially appointed committees jointly took on the task of writing the plan. In the fall of 2010, the Climate Action Plan Committee was formed to educate the Emory community and develop a policy commitment

to the reduction of greenhouse gas emissions. The committee was composed of students, staff, and faculty, "people who had no technical knowledge, but who were really interested and wanted to help Emory create some goals around climate action" (Howett 2017). The second committee, the Carbon Reduction Taskforce, was composed of staff members from Campus Services, and it focused on assessing the feasibility of implementing the reductions called for by the Climate Action Plan.

The committees entered a period of research after they were initially established, the results of which concluded that a Climate Action Plan was both feasible and desirable for the campus community. After this research was completed successfully, the drafting phase of the plan began. Maxim describes determining the goals for the plan as one of the greatest challenges faced by the committees:

> What do we want our targets to be? How bold do we want to be? What's reasonable and what's feasible? It's one thing to say we want to be net zero energy or net zero-emissions, but how realistic is that? And then finding that happy middle spot where it was bold, ambitious, but not unrealistic. You can only anticipate to a certain degree what's possible. Having some expertise in the group was very helpful. We knew what was done [at other schools], so we knew what's possible. In the end, the targets we established were pretty realistic (Maxim 2017).

A final draft of the plan was reviewed and vetted by a range of campus groups who would potentially be affected by its content. Throughout the fall of 2011, the plan was presented in a series of four town-hall style meetings consisting of a presentation, followed by a question-and-answer session, to gather feedback and recommendations. One challenge of these presentations was the lack of knowledge concerning climate-related issues of the groups they were presenting to. Maxim describes that, "a lot of the data we had dug up for the Climate Action Plan was largely unknown" (2017). As a result, these town hall-style sessions also became an opportunity to further educate the Emory community on climate-related issues.

Overall, these sessions demonstrated what campus groups wanted to be reflected in the plan, and also what they did not want to be reflected. There were some topics, such as university-supported travel, that generated more conflict than the other goals. Maxim describes that, "in the end, one of the big goals that more or less didn't change, was the desire to reduce Emory's carbon footprint. The specifics of how that was done, we left a little less clear and up to each individual school or unit" (2017). The plan was then presented to the university president and cabinet in December 2011. After a few suggestions and revisions, the plan was approved and put into place that month.

Individual Units' Climate Action Plans

Once the campus-wide plan was created, it became a model for each of the university's units to create their own individualized Climate Action Plan. This strategy ensured that goals and requirements fit the needs of each particular unit. This idea "came out as an attempt not to straightjacket a unit, but allow them to make it work for their particular situation. [The University Climate Action Plan] in 2011 was a framework for the units to then draft their unit-

specific plan" (Maxim 2017). The deans originally brought this idea forward while they were reviewing the Climate Action Plan because they "didn't want to see one central climate action plan that said 'this is the reduction and this is how you have to get to the reduction.' The preference was voiced by the deans to say here's the goal but how you get there can look different based on what school you are in" (Howett 2017).

Emory is unique in that no other university has a separate climate action plan for each unit. It has allowed Emory to hold each unit more accountable for the goals they set for themselves because it "makes it come home to people, if you have a broad general thing, it's too easy to think someone else is going to work on that, someone else is going to get us to that reduction level. When it is tailored to your academic unit, then you realize you have to do things to move the needle on this" (Howett 2017). The individual unit plan has also led to "some wonderful creativity and seeing the personality of each unit emerge" (Howett 2017). Each unit developed goals that related to the challenges of their school. For example, the Rollins School of Public Health relies greatly on air travel, so their climate action plan focused on goals to offset this footprint. The Candler School of Theology used their plan as an opportunity to increase education about sustainability and climate issues in particular. The School of Medicine created a space consolidation plan, limiting energy usage to a single wing after hours, which also required a huge behavior change for students who might have previously studied in other wings. According to Howett, the unique idea of individualized action plans, which was originally an area of concern brought forward during the approval process for the campus-wide plan, has become a very positive and important aspect of Emory's climate initiatives that has contributed to its success.

Emory's Carbon Footprint

Emory began gathering data on its greenhouse gas emissions in 2005, using the Clean Air-Cool Planet's Campus Carbon Calculator, now administered as a program of the University of New Hampshire. It is the standard tool used by higher education institutions to calculate greenhouse gas emissions < http://sustainableunh.unh.edu/calculator>. This allowed Emory to establish a baseline for its projected emissions between 2005 and 2010, which provided a source of data during the development of its Climate Action Plan. Knowing where the university had been in the past in regards to emissions, and how that impacted where they could go in the future, was an important step toward determining which goals were important to outline in the plan. Emory's emissions have stayed fairly constant over the past few years, despite increases in campus square footage and a growing student population. Changes in transportation, for example, have led to a 3% decrease in emissions from 2005 to 2010.

Emory's carbon footprint is composed of three major sources, as described on the Office of Sustainability Initiatives website: "Scope 1 emissions include our direct use of fuels, such as to heat and cool buildings. Scope 2 emissions include those produced from the generation of the electricity we buy from utility companies to power our buildings; and Scope 3 emissions include indirect activities caused by us, such as miles flown or driven for business or athletic events and the decomposition of our trash that is sent to landfills" (OSI 2017).

Luckily, Scope 1 emissions have decreased drastically, as shown in Figure 3. Scope 2 and 3

create more of a challenge for Emory. While Emory does have a role in the amount of Scope 2 emissions, these emissions are also a result of Georgia Power and their carbon footprint. The more Georgia Power moves toward a reduction in coal burning, the lower Emory's footprint will become. Scope 3 is much more difficult for the university to control, and unfortunately, is often a result of Emory being an internationally renowned research institution, heavily involved with global public health. Emory works to offset emissions stemming from this category by decreasing emissions in the other two scopes.

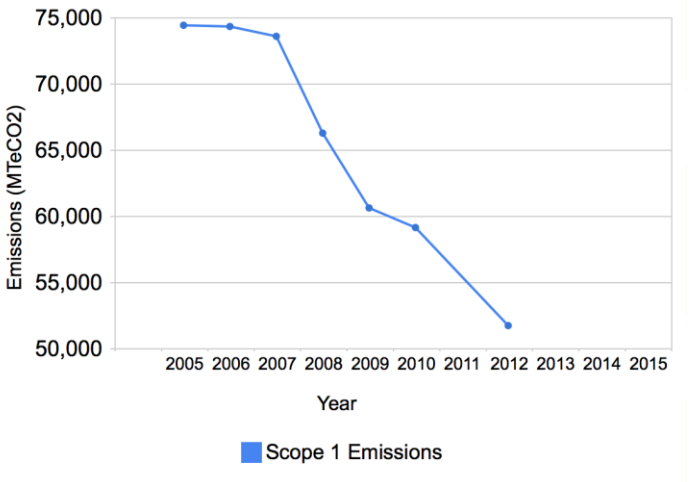

Figure 3. Scope 1 emissions for Emory University, 2005-2012 (Source: Office of Sustainability Initiatives)

Although recent calculations of Emory's Carbon Footprint reflect data from 2014, the university has been documenting and calculating greenhouse gas emissions and the associated carbon footprint every two years, with the hope of progressing to a yearly basis. Using data from the calculated 2014 footprint, Emory has shown a significant reduction in emissions from the 2005 level, which is right on track to meet the goal of 20% emissions reduction by 2020. One area that continues to be a large source of Emory's emissions is air travel. Ciannat Howett, Director of OSI, described that "we have seen 137% increase in emissions related to air travel" (Howett, 2017). Despite increases in this area, Emory is taking steps toward creative ways to offset this emissions increase through on-campus commuter options and other campus operations. For more information on Emory's efforts in transportation see "Alternative Transportation" report by Andrew M. Foote (2008)].

The major goal set by Emory's Climate Action Plan is to achieve an 85% per square foot reduction in greenhouse gas emissions by 2050. Both planning committees agreed that this goal would be feasible for the university to accomplish based on emission reductions through its own operations. In 2006, Emory was approached by Second Nature, a nonprofit organization that leads a higher-education sustainability effort to encourage university presidents to sign a pledge to be carbon neutral by a set date, usually 2050. Emory was faced with a very important decision, as described by Howett:

> Emory did not sign, and I was very comfortable with that at the time. Because in order to hit neutrality, everybody knew you would have to purchase carbon offsets, and at that time [2006] carbon offset markets were the Wild West. The tracking of it and the

> verification was just really not where it should have been. We could get onto the path for 85% reduction; we knew we could do that through our own operations and what Georgia power said they would be doing. We felt very confident about that. We decided that every dollar that Emory could spend, instead of going out of state and buying an offset, every dollar we needed to spend on efficiency and reducing our own emissions as much as we could (Howett 2017).

One issue that contributed to this decision was the fact that Emory had already made commitments and reductions, and was ahead of other universities by a few years. Asking the university to commit to a percent reduction from an already reduced value was a very difficult commitment for the university to agree to in good faith. James Wagner, Emeritus President of Emory University described this with the following analogy:

> If all you guys are driving minivans or muscle cars, and just on your own, you said you were going to try to drive Priuses, which would be wonderful, and then if I came to you and said, "Look, I want you to sign a commitment that you are going to reduce your fuel consumption or improve your gas economy by 50%." Well you are already driving a Prius, and so you have to say no, and they say "Wait a minute, don't you care about the environment?" And we say, "Yeah, we care enough to already be driving a Prius (Wagner 2017).

While Emory was not ready to consider carbon offsets at the time because of the state of the markets and other necessary interactions, carbon offset markets and verification systems have improved tremendously and the Office of Sustainability and the Sustainability Faculty Advisory Council have discussed ways to revisit offsetting emissions through a carbon offset program.

Climate@Emory

UN COP Delegations

The United Nations Framework Convention on Climate Change (UNFCCC) took effect on March 21, 1994. The main objective of UNFCCC is to lessen the impact of human interference that threatens the Earth's climate system. The Convention is sanctioned by 197 countries collectively called Conference of the Parties (COP), and they meet annually to discuss future plans that address climate change issues. Emory University attained official observer status for the UN COP talks in spring of 2014 and has since sent delegations of students, staff, and faculty to both COP21 held in Paris, 2015, and COP22 held in Marrakesh, 2016.

The idea to participate in the COP talks was first raised in 2013 by Cassandra O'Lenick, a Ph.D. student in Environmental Health advised by Dr. Stefanie Sarnat. She spoke with Sarnat, who consulted with Professor Daniel Rochberg in the departments of Environmental Science and Rollins School of Public Health, who then conferred with Dr. Eri Saikawa of Environmental Sciences. This group questioned why Emory was not accredited with observer status to the COP talks and put together a document for submission to request the official status. At the time, there were around 20 other universities that had that status. Cassandra O'Lenick, who had prior

experience with accreditation, helped with the application process. The university compiled a list of faculty doing research on climate topics, along with other information that told the story of Emory's commitment, which was submitted in a letter from President Wagner to the UN in December of 2013. This was the first time that a comprehensive list of climate research being done on campus was accumulated, and it provided a starting point for the creation of an academic learning community. A group of faculty began meeting to discuss strengthening Emory's research, teaching, and visibility in the issue of climate change, which led to Climate@Emory officially formed in January 2014. This group has evolved to include the support of the student COP delegation, whose accreditation was approved later that year in December 2014.

Part of the Climate@Emory plan included the idea of taking students to the climate talks. Dr. Eri Saikawa, Environmental Sciences, joined with Professor Sheila Tefft, Journalism and Professor Wesley Longhofer in the Business School, to co-teach a course on the topic of climate change, which culminated in the students being able to attend the COP. At the time, the Provost's Office had just started a new initiative called the Coalition of the Liberal Arts (CoLA) courses. This program provided funding for four classes that met specific requirements set forth by the Provost's Office. Saikawa, Tefft, and Longhofer applied to the CoLA program for support of the class for COP.

Fundraising to support student travel was a major hurdle. Before the CoLA initiative was announced, the delegation had received some funding from organizations like the Halle Institute; but it was the classification as a CoLA course that really allowed the COP idea to become a reality. Tefft described how establishing the COP delegation came at the perfect time and was considered an important step forward for the university and its role in the climate scene, both in the local community and globally. "There was growing awareness about climate. There was growing awareness about the importance of Paris. It was going to be a big deal, sending students to a UN conference as Emory delegates" (Tefft 2017).

The course designed by Saikawa, Tefft, and Longhofer focused on how best to prepare students to attend an event such as the Paris COP. Mae Bowen, one of the two TA's for the course and a 2016 Emory graduate, explains how a class like this is important because "you can't be prepared to observe something if you don't know what that something is" (2017). Students in the class studied a range of topics focusing on media, science, and policy, and how each of those components is utilized during COP. The first delegation of nine students and two faculty (Saikawa and Longhofer) attended the Paris conference for the full two weeks in December of 2015. This course had a second component that took place during the spring semester following the Paris COP, which focused on bringing Paris back to Emory. This class was a combined effort to investigate how the COP experience could increase climate literacy at Emory. There were other efforts to incorporate Emory students and expand the message about climate issues. During the COP, delegates Skyped with a media studies class back on the Atlanta campus to share a little of their Paris experiences, but this was only the beginning. Tefft described how this was an amazing opportunity for the students. "It got a lot of attention. There were other universities there, so the students could interact with them. They really got into the activism and excitement of it" (Tefft 2017). And they brought this excitement back to campus with them.

This initial CoLA course provided an amazing opportunity for students. Bowen describes how "It allowed students to meet people from other departments who were also interested in climate change issues. I met a bunch of people through that course that I had never worked with before" (Bowen 2017). The COP itself provided another important opportunity for students. Attending COP meant that students "got to shadow the people that are doing what they think they want to do, and really figure out what that means for them. For most people, you could come back [to campus] and use that somehow. The COP brings together basically every type of person that has an interest in climate change, so you're bound to figure out where you might fit in that puzzle" (Bowen 2017).

For Bowen, attending the Paris COP talks in 2015 was an important factor in determining her path for the future. She provided the following description of how COP affected her career choices.

> Going there made me realize I was more interested in the supranational level, and that I thought it was super cool that different countries had different reasons for wanting what they want. I learned that for me the process is more interesting than the policy. Which is huge, because that's what led me to [choose] law school over a PhD. I realized what I actually wanted to contribute to is how these people were interacting and talking about the issue and how that can then lead to the treaty and then to the smaller and smaller things (Bowen 2017).

When they returned from Paris, the delegates established a new student organization on campus called the Emory Climate Organization (ECO). There are many sustainability-themed groups on campus, but this was the first climate-focused student group available to Emory College students, which was a critical motivation for the creation of the organization. Bowen describes how "many sustainability-oriented organizations were popping up." At first there was a worry there would not be enough interest in an organization like ECO, but soon Bowen and others in the class realized "there was clearly enough interest in what [they] were doing, there were people interested in continuing in the leadership of it, and a focus specifically on climate and not just sustainability that was important to tap into" (Bowen 2017).

In the organization's first semester (Spring 2016), they planned and carried out a campus-wide event aptly named Climate Week. ECO hosted a variety of climate-related events from film screenings, to a social justice panel, to an art display of photos from COP. Climate Week was an important event for those who attended COP because as Saikawa describes "we were very excited to be able to bring back what we experienced to campus" (2017). The program was hugely successful in its first year, receiving lots of attention and a high attendance, and it is now an important part of climate education on campus. Contrary to the students' original fears concerning the number of sustainability-oriented organizations trying to get chartered, ECO was chartered over the summer of 2016 and received funding that fall. ECO's membership remained vibrant in its second year, and it successfully carried out another Climate Week event during spring 2017. These events are informative as well as fun and are geared toward increasing student awareness of climate change issues and encouraging students to take action in their own lives.

The second UN COP delegation from Emory included six students, three staff, and one faculty who travelled to Marrakesh, Morocco, in November 2016 to attend the talks. Instead of attending both weeks of the conference, as the previous delegation had, delegates were this time split into two groups, each of which attended one week of the conference. In addition, Emory was able to get a booth as part of an event at COP and "we were actually able to present what we do on campus" (Saikawa 2017). Emory joined with the Research and Independent Nongovernmental Organization (RINGO's) group, and was able to get tickets to go to the Blue Zone where official negotiations took place for all students, whereas only a few students had access the previous year in Paris. Saikawa is planning a new preparatory course for students before they attend COP talks that will be starting in Fall 2017 prior to COP23 in Bonn, Germany. This new course seeks to advance the relationship between Emory and COP, while also enhancing the student's experience. In previous years, "it was more about the experience of going. I am hoping that we can team up with several NGOs throughout the city of Atlanta, so that we can create a project before we go and we can potentially present that at the COP" (Saikawa 2017).

It is exceptional that Emory University takes undergraduate students to attend the COP talks. Saikawa describes how "learning about how [climate] works in the real world hopefully will be inspiration for the students" (2017). This is "really valuable for students and as a university taking undergraduates, [it] especially shows how we are committed to undergrads. Most universities going to COP don't take students at all. They take faculty and researchers" (Bowen 2017). By extending this unique opportunity to students, Emory increases climate literacy and research on campus, as well as creating the world's "future climate leaders."

Academic Learning Community

Discussions related to obtaining observer status for Emory students at the UN COP talks spurred a group of faculty to come together to create an initiative with the goal of further promoting the education and study of climate change on campus. This initiative started out as an Academic Learning Community (ALC) called Climate@Emory when five key leaders proposed the idea in spring of 2014; they included Daniel Rochberg, Eri Saikawa, Stefanie Sarnat, Justin Remais, and Jeremy Hess. The plan was accepted by the Center for Faculty Development and Excellence and it became an established ALC, providing seed funding to the initiative as it began to shape itself into the organization it is now.

In its first year, Climate@Emory focused mainly on shaping the program and planning its direction for the future. Professor Daniel Rochberg, in the Environmental Science Department and Rollins School of Public Health, describes this as "exploring the space of who we have on campus interested in climate change, what we are interested in, and what we might do with ourselves" (2017). They knew they wanted to increase climate education and research on campus, but there was much discussion about how to achieve this and what would be the best way to undertake that mission. Discussion eventually settled with the establishment of three areas of focus for the ALC—research, teaching, and policy—and these ideas were defined and expanded upon in the coming years to develop the educational outreach group. This was an important step in the development of the initiative and not something that had been done before. As described by Saikawa, it "was very interesting to have the academic community and to have

actually people that are interested in climate change get together and to have a regular meeting to discuss classes, research, and the potential outreach" (2017).

In 2015, the program transitioned from being an ALC to spending a year operating as a bottom-up initiative. During this year, the group built out their infrastructure and hosted a variety of events that included a speaker series and a day of scholarship featuring climate presentations from Emory and Georgia Tech participants. The group then began seeking explicit support from a bottom-up process and received resounding support from seven deans of Emory University. The original ALC was founded with the three main goals of research, teaching, and policy, and these continue to be the goals of Climate@Emory today. The Climate@Emory planning document (2016) states these three goals:

1. **Research (Scholarship):** Deepening our understanding of climate science, impacts, and solutions.
   The research component of Climate@Emory is composed of work currently being done by more than 50 faculty and staff from over 20 departments participating in the initiative, and the publications and events that are correlated with them. This goal now also encompasses the new US and China initiatives at Emory, which shows the international impacts of Emory's climate science through Emory and Nanjing University working together on climate research.
2. **Teaching:** Training and empowering today's students to be tomorrow's leaders.
   Climate@Emory is very engaged in training students who are interested in climate science to be the "future climate leaders of the world" (Rochberg 2017). Although Climate@Emory is a non-degree granting organization, they play an active role in this vision by offering climate-related courses, supporting undergraduate and graduate level programs offered in the university, and promoting study abroad opportunities for climate-related learning. An important focus of the organization is to create innovative ways to incorporate the three different types of student models—students currently at Emory who are interested in climate science and are looking for opportunities, students at Emory who are yet to discover their interest in climate science, and finally students interested in climate science who are not yet at Emory but are looking into what the university has to offer.
3. **Policy:** Advancing climate policy and practice at Emory, in Georgia, and beyond.
   Climate@Emory has also taken on several projects that seek to advance climate policy in a variety of ways. The first is sponsoring delegations to the UN COP conferences, which provides exposure to policy for the students involved, and also serves as an important aspect of Emory's direct involvement with climate policy. Climate@Emory is also involved with the Georgia Climate Project, a joint venture among many universities throughout Georgia with the mission that "when the state is ready to move on climate, we should be ready for when they turn to the scientific community" (Rochberg 2017). This group works to compile all current related research and studies within the state of Georgia, while also spreading awareness about climate change. Aside from these projects, Climate@Emory strives to lead through example "at Emory and beyond to what are we doing in Atlanta, Georgia, and the broader national, global environment" (Rochberg 2017).

Emory University has dedicated itself to being a leader for the student and faculty community, but its leadership does not stop at the campus borders. As the Climate@Emory website describes, this organization and the university as a whole, is "committed to fostering broad and deep collaboration within the university, and with other academic institutions" and they also strive to be leaders among "industry and community partners in Atlanta, and elsewhere, with government at all levels, across the region, and around the world." As Professor Daniel Rochberg describes, Climate@Emory has become

> Emory's response to one of the century's defining challenges, [and seeks to address] everything we can do to help deepen the world's understanding of this issue. We have an incredible breadth from public health to environmental science to physics, anthropology, law, medicine. All kinds of people doing different pieces of the puzzle (Rochberg 2017).

Emory Climate Analysis and Solutions Team (ECAST)

In the fall of 2016, Rochberg and Geoff Martin, an environmental science graduate student, started a new student/faculty organization called the Emory Climate Analysis and Solutions Team (ECAST). The pair got things started with the support of environmental science professor Shaunna Donaher and physics professor Justin Burton. This group started out as what Rochberg describes as an "organic experiment to see what's going to work—and learn as we are doing it—what works for students, with the hope of building towards an Emory climate leaders initiative" (2017).

ECAST is a joint program between faculty members and both undergraduate and graduate students. It provides a "forum for students from across Emory University to conduct climate-related analysis and advance climate solutions" (ECAST 2016). Even though the program only began in fall 2016, it has already done important work on campus and in the Atlanta community, including beginning research on determining the carbon footprint of a degree at Emory and incorporating health into Atlanta's Climate Action Plan. Geoff Martin, co-chair of the group, describes how he appreciates all of the work that has gone into ECAST over the past semester. "What's been awesome is people have just taken on projects and been motivated to do them" (2017). The group has grown to include 53 students (39 undergraduates, 14 graduates), 16 faculty, and 3 staff members, and is tackling a variety of projects ranging from a solar feasibility study for campus facilities to design of a Climate Action Plan for the city of Atlanta.

Other Student Climate Initiatives

A number of other student-led initiatives that seek to increase Emory's climate literacy. Around 2012, there was a student group that "got together with students from Morehouse, Agnes Scott, GA State, and GA Tech. It was such a great cross-institution student effort" (Howett 2017). This group helped to raise awareness on campus through fun climate-motivated activities, like a soapbox derby, to promote being carbon free. They also held a Climate Day for legislators to increase their awareness of climate issues and how these are important for students.

Another example is the divestment movement in which a group of students advocated against

fossil fuel investments in Emory's endowment portfolio. This effort led to a statement of non-investment in the recent Sustainability Strategic Vision for Emory. As Howett describes, "you will see in the new Sustainability Vision we have a statement of non-investment. That came about because of another student initiative" (2017).

In the few years since its creation, Climate@Emory has built relationships from the student level all the way to the international scope. Climate@Emory has achieved its goal of being an on-campus resource as it provides a list of all faculty members conducting research related to climate change and presents opportunities to learn more about the research studies that are taking place. It has allowed students to become a more integral part of the climate movement on campus through participation in such opportunities as the UN COP delegations and the newly formed ECAST student group. Climate@Emory has served as a leader at the national and international policy level, co-hosting events in the Georgia community and being an involved member of international climate science organizations.

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