Virtually There: Estimating the Potential of Teleconference to Reduce Travel within and between Megaregions in the Aftermath of a Global Pandemic

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16. Abstract This study seeks to understanding the extent to which teleconferencing could replace some intercity travel and travel through and within megaregions. Researchers take a mixed methods approach and focus on a single category of institutions – Universities across selected megaregions. In this study researchers interview a diverse and representative sample of faculty and staff on their actions and thoughts on their cancelled travel during the COVID-19 Travel Bans instituted at Universities. They use this information to estimate the quantity and characteristics of travel that could be reduced with teleconferencing going forward, and the environmental and delay impacts such a move could inspire.			
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Teleconferencing Technology – Potential Substitute for Travel

To: University of Pennsylvania
From: Gabriela Newell, Han Qiao, Chelsea Zhang
Date: April 29, 2020
Re: Teleconferencing

Introduction:

This memo serves to identify key uses for teleconferencing technology on the University of Pennsylvania's campus and the potential for its use as a substitute for air travel in an effort to reduce carbon emissions. Throughout this document, the research team will discuss how the platforms were used prior to the Covid-19 pandemic and during the pandemic. These differences will highlight how teleconferencing can be used to facilitate in-person meetings, events, and conferences, but will also call attention to some of the challenges associated with using this technology.

Platforms Pre-Covid:

Before the initiation of 2020 and the Coronavirus pandemic, the University of Pennsylvania had access to platforms such as Bluejeans and Zoom, however usage was minimal and used only for a few reasons. For the year of 2019, 65,418 meetings took place over Bluejeans.The carbon emissions saved associated with these meetings is 19, 036 metric tons.

The norm on campus was that usage mainly took place in the event that an in-person interaction would be difficult or impossible. For instance users would teleconference due to scheduling conflicts, interactions that involved short term projects with extreme distances, and work-from-home activities. According to Dan Alig, CIO of The Wharton School, usage of Bluejeans was mainly internal, especially on teams with work-from-home policies, however year over year usage had doubled every year over the past six to seven years.

As previously mentioned, the two platforms used at the University of Pennsylvania include Bluejeans and Zoom. Contracts with these providers are highly customized for the university. Estimated pricing is as follows: Zoom costs $5-$10 per user for a limited featureset while Bluejeans costs $25 for faculty and staff and $2-$3 per student. While the differences between both platforms diminishes as they evolve, Zoom is better suited for consumer enterprises, but is functional for other types of businesses.

Many members of the university do have access to these platforms, but do not use them due to adoption and usage challenges. The major challenges Dan Alig has encountered which hinder the use of teleconferencing include meeting quality, lack of comfort, changing behavioral norms, and users not knowing they had access. He explained that these onlinet meetings are only as good as the weakest connection, therefore if one user has weak connectivity, it can compromise the entire virtual engagement. With regard to comfort using the technology, many on campus do not feel qualified to use these tools and are much less used to seeing themself on camera, which can lead to embarrassment. It is a matter of changing behavioral norms to combat this issue and making it a tool implemented regularly in order to increase and encourage usage. Additionally, the university must market access to these platforms as many did not know they had the option to use the teleconferencing tools offered to them.

While it is clear that now the use of teleconferencing has become more regular, even before the current pandemic, the Bluejeans data usage demonstrates that teleconferencing is a viable substitute for air travel. The challenges previously outlined are the main barriers preventing the University of Pennsylvania from further reducing carbon emissions.

Platforms Post-Covid:

Due to COVID-19, the university has announced to move instructions online on March 11th. Different schools were assigned either Bluejeans or Zoom as the main teleconference platform. The updated Bluejeans user activity report for March 1st to April 18th showed that the Bluejeans usage has increased drastically since the week of March 16th. All meetings through Bluejeans added up to 33,400,655 minutes of teleconferencing, which was more than four times of the total usage in the year of 2019. The number of active users have also more than tripled and almost reached 800 thousand. More importantly, the total carbon emission saved summed to 31,071 metric ton, which was equivalent to 165.3 million miles of aviation trips and 6.5 million car trips. The total Bluejeans usage during the one and a half month saved over 28.5 million dollars.

The teleconferencing team has talked to different people who were responsible for planning past or future events. Kate Daniel, the Department of City Planning Coordinator at the Weitzman School of Design, shared her thoughts on planning the annual Spring Master of City Planning Admitted Students Open House. According to Kate, having an online open house attracted more people to attend, including candidates with geographical and financial constraints. However, the virtual format made it hard to track the specific number of attendees and have any personal-level conversations without knowing the crowd. Some individual sessions ran overtime, which affected the punctuality of following sessions as well.

Professor Roger Smith, who is working on moving the 2020 Annual American Political Science Association (APSA) Conference online, has more concern in terms of the scale of the event. The annual APSA conference is scheduled for September 10th to September 13th, and it is expecting around 7,000 attendees. Although the conference has a number of plenary sessions, the majority of the format relies on break-out sessions that can have 180 sessions happening simultaneously. The annual conference also acts as a career fair for job seekers, and completely moving the conference online could make it hard for them to network and ask questions. Currently the council is also planning for alternatives that include meeting partially online and partially in person, but more details are to be discussed.

Guidelines on Virtual Conferencing:

The team researched on the current guidelines on helping organizers to move conferences online. On April 13th, the Association for Computing Machinery's Presidential Task Force on What Conferences Conferences Can Do to Replace Face-to-Face Meetings published *Virtual conferences A Guide to Best Practices*[1]. The team was formed in March 2020 to provide advice to event organizers who are facing the challenges for hosting virtual events due to the COVID-19. The Kule Institute for Advanced Study has been hosting virtual conferences, *Around the World,* since 2013, as an attempt to model affordable, accessible and environmentally-friendly forums for research dialogue. Their published guideline, *E-Conferencing Toolkit*, involves their experiences and tips for virtual conferences accumulated throughout the years[2]. In addition, 100% virtual ATIDES (Avances en Tecnologías, Innovación y Desafíos de la Educación Superior) conference was held successfully between October 15 and 31 in 2018. Their organizers provided a guideline on *Ten Simple Rules for organizing a non-real-time web conference*,

[1] Virtual Conferences A Guide to Best Practices https://www-acm-org.proxy.library.upenn.edu/virtual-conferences
[2] E-Conferencing Toolkit https://www.ualberta.ca/sustainability/research-teaching/econferencing.html

which is an addition to the previous guidelines for concurrent virtual meetings which introduces a new way of communication that does not require every participant to be online at the same time[3]. Last but not least, the organizers for *Librarians Building Momentum for Reproducibility* conference in January 2020 also published a guideline, *How To Run A Free Online Academic Conference,* with essential questions that conference organizers should ask themselves in a collaborative format[4].

The Teleconferencing team summarized the following key points for adopting these guidelines to the context of University of Pennsylvania. Events are divided into classes, departmental events, and school-wide conferences.

Classes at Penn

Virtual classes usually involve a smaller number of people compared to other kinds of events. Although there are different forms of classes, including lectures, seminars, and workshops etc., classes usually involve professors conveying information and students' discussions. There are two key suggestions for preparing a virtual class:

1. Professors should be provided with instructions on using the technology, including how to mute all participants, responding through the chat box, and assigning breakout groups for smaller group discussions.
2. If class is in a lecture format, with a large number of students, the professor should have a teaching assistant online helping address the questions in the chat box and assist other students' needs.

Departmental Events at Penn

Departmental events, including open house events, town hall meetings and department happy hours usually involve more people to people interaction. Not too different from a class, the two key suggestions are:

[3] Ten Simple Rules for organizing a non-real-time web conference
https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1007667
[4] How To Run A Free Online Academic Conference
https://docs.google.com/document/d/1EABkSzEdJk5cmMLETpSbXaeDXmFwcTz7SUXP_C3dN9k/edit#

1. Hosts should be provided with instructions on using the technology, including how to mute all participants, responding through the chat box, and assigning breakout groups for smaller group discussions.
2. Since participation is essential in this kind of setting, hosts should come up with a way to organize the order of participation or speaking among the audiences. Possible ways include using the "raise hand" function in platforms such as Zoom or asking participants to type in the chat box and call out their names to indicate that it is time for them to speak.

School-wide Conferences and beyond

These virtual conferences involve more people and more serious settings. Conference organizers need a more thorough preparation as well as a more well-rounded planning committee including roles at traditional conferences and beyond such as hosts, session chairs, information support, technology support, and volunteers etc.

1. Preparation: Before the meeting, the planning committee needs to find a suitable time for the virtual meeting taking considerations of time-zone differences. At a traditional offline meeting, participants usually have a map and an agenda for navigation. After moving conferences online, organizers still need to prepare a navigation for different sessions, with descriptions and links to different virtual rooms.
2. During the conference: Technology support will be taking a larger responsibility after meetings moving to a virtual platform. Recording might be needed for meetings with audiences who cannot attend in real-time. Question and answer channels for these non-real time sessions should also be planned and organized. In addition, online poster sessions require posters to be in a virtual space in advance, so that attendees could create a thread below to comment or discuss any questions they find. Organizers can also prepare private chat rooms with the author for more personal interaction.
3. After virtual meetings, feedback is valued. Since virtual meeting organizers do not have as much experience as planning for traditional meetings, organizers should highly encourage participants to provide any feedback for a better future meeting.

Key Takeaways:

During the past few weeks, teleconferencing has proved its great potential in fostering communication between people at different ends of the world without traveling as well as creating opportunities to push traditional class and conference settings to a more flexible, accessible, equitable, and environmentally-friendly form. The biggest concern for teleconferencing is a lack of face-to-face interaction. However, after the 2016 UCSB virtual conference, speakers were polled on the question "Did you meaningfully 'connect' with people in the Q&A sessions?" 73.3% of those responded "yes," 26.7% responded "not sure," and 0% responded "no."[5] Furthermore, teleconference opens up a wide variety of new forms of interaction, including non-real time comments which involves more deliberate thinking before each reply and more people engagement. Another challenge for virtual conferences is conference preparation which requires more planning and familiarity with the technology. However, with more thorough guidelines being published, future virtual conferences will only become easier. The teleconferencing team believes that teleconferencing has a huge potential for reducing air travel. Moving conferences online will not only reduce carbon emission but getting ideas spread on a larger scale.

[5] A Nearly Carbon-Neutral Conference Model, White paper / Practical Guide
http://hiltner.english.ucsb.edu/index.php/ncnc-guide/#details

Carbon Offset Program Research and Recommendations for the University of Pennsylvania

ESE 550 – Final Report

Aren Raisinghani, Chandni Sharma, Curie Shim

University of Pennsylvania

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Note 1: This document includes an "Executive Recommendations" section near the beginning of the document rather than a "Conclusion" section at the end. This is intentionally done to increase speed-of-readability since the document will be provided to different departments at Penn.

Note 2: This document follows APA Citation format, except for in-text citations which are provided as footnotes at the request of Dr. Ryerson. Wherever links are included in the document, hyperlinks are maintained for ease of source access.

Abstract

This document includes research and recommendations for the University of Pennsylvania (Penn) to aid in the development of a carbon offset program. The research contains — and the recommendations are derived from — information about carbon offset programs that select universities that have developed or are in the process of developing.

Introduction

In October 2019, Penn presented its Climate and Sustainability Action Plan 3.0 (CSAP 3.0) — a document delineating its most recent environmental sustainability goals. To introduce the document, President Amy Gutmann wrote, "We launched our first sustainability plan in 2009...Penn continues to set its sights ever higher, and this newest plan will challenge our ingenuity and commitment as we move purposefully toward our commitment of a 100% carbon neutral campus by 2042."[1]

A robust carbon offset program can serve as an effective medium to mitigate the impacts of carbon emissions, enabling the university's net total emissions (defined in CSAP 3.0) to decrease. Penn is cognizant of the impacts of carbon offsets and has already leveraged them to offset its steam emissions through a partnership with local steam supplier Veolia.[2] Our recommendations are intended to further leverage and build an established program around Penn's carbon offsets initiatives.

In determining the most salient recommendations, the researchers first met with Mark Mills, Penn's Chief Procurement Officer. At a fruitful first meeting, it was determined that the most useful research would include recommendations derived from carbon offset programs at institutions that have similarities to Penn. The reasoning is as follows: components of carbon offset programs at similar institutions will likely be more seamlessly integrated.

Hence, the institutions studied were all colleges or universities: Duke University, Brown University, Yale University, and Swarthmore College. Duke was selected due to its similar size to Penn, Brown and Yale were selected due to their Ivy League affiliations, and Swarthmore was selected due to its similar location to Penn.

[1] https://www.sustainability.upenn.edu/sites/default/files/downloads/CSAP_3_Final%2010%2031%202019_0.pdf
[2] https://www.sustainability.upenn.edu/sites/default/files/downloads/CSAP_3_Final%2010%2031%202019_0.pdf

Executive Recommendations

Following are our final recommendations based on our extensive research of peer institutions. We have compiled a list of actionable, feasible, and diverse initiatives that Penn can undertake in order to work towards its goal of carbon neutrality, based on what has already worked in the past for others. This document is a small snapshot of everything we were able to explore, and more in-depth information is in the document following this sheet.

Carbon Charge: Penn should establish a carbon charge, which has dual benefits of providing an incentive for more environmentally friendly behavior and habits, as well as acting as a potential source of funding for a number of projects which work towards the goal of carbon neutrality. With the proceeds from a carbon charge, Penn could either bolster their current sustainability funds or create a new one with different or more specific goals from currently existing funds. In addition, there is the possibility of using the carbon charge proceeds to create a self-sustaining fund to provide loans for infrastructure improvements on campus, which would pay back investments as savings on utility expenditures are realized.

Penn Carbon Offsets Group: Penn should establish a committee similar to the Duke Carbon Offsets Initiative, composed of a diverse group of people from all areas of the University. This would provide a dedicated group of people who are committed to researching, planning, and analyzing carbon offset initiatives. We recommend that Penn imbue the values of DCOI as much as possible, including but not limited to "*prioritiz[ing] the creation of academic value through its projects and collaborates extensively with students and faculty*". As an academic research institution, Penn should prioritize the creation of academic value through its projects and collaborate extensively with students and faculty to produce meaningful reports that expand general carbon offset understanding.

Potential Project Ideas: Penn can work with the Morris Arboretum of the University of Pennsylvania and develop a course for students where they work to understand how carbon neutrality can be achieved and how this information can be relayed to the greater Penn community. Additionally, the Procurement Office can work with the Student Sustainability

Association at Penn (SSAP) to initiate a Urban Forestry plan that would focus on planting trees around West Philadelphia. The program can be extended and involve partnerships with other universities in Philadelphia such as Drexel University and Temple University.

Bundling Offsets: We recommend Penn develop a strategy to bundle its offsets. Rather than investing in only a few projects, bundling offsets means that the offset portfolio is diversified and subject to less variance in outcome. Ultimately, this means that Penn can be more secure in its investments in carbon offset projects.

Duke University

Duke University has committed to becoming climate neutral, reducing its contributions to the atmosphere's levels of greenhouse gases to zero or below, by 2024. The university is leading the pack in the pursuit of carbon neutrality. We believe that Penn should draw inspiration from Duke since the two schools are similarly sized and Duke has dealt extremely well with the size factor while fighting global warming. In 2007, Duke signed the American College and University Presidents' Climate Commitment, dedicating the University to carbon neutrality by 2024. Internally, Duke University is switching to cleaner fuel sources and improving energy efficiency to reduce emissions, but Duke estimates it will still need to offset 185,000 tons of carbon dioxide equivalent-emissions per year, starting in 2024. In 2009, to meet this goal, Duke established a comprehensive set of sustainability recommendations called the Climate Action Plan (CAP).[3]Upon comparing the CAP put forward by Duke University with the Penn equivalent, we recommend the following:

Recommendation 1 for Penn: While Penn has its own "Climate and Sustainability Action Plan" written by the Student Sustainability Association at Penn (SSAP), we recommend this plan be recrafted as a joint venture between administration, professors, facilities management, the athletic center, and students.[4] The current plan voices the opinion of a few members of the Penn community and does not encompass the myriad of views the represent Penn.The more focused purpose of this plan will be to provide recommendations to reduce emissions from energy used on campus and emissions from transportation-related activities (employee commuting, air travel, and Penn-owned vehicles) to finding ways to reduce waste during Penn football games. Next, it will provide recommendations on carbon offsets and focus on ways to improve sustainability across Penn by creating recommendations for education and campus-community outreach. Additionally, while Penn aims to be carbon neutral by 2042, more concrete plans need to be put into place to make this date a reality. We recommend explicitly stating key activities that need to be undertaken to ensure timely implementation.

[3] https://sustainability.duke.edu/metrics/climate
[4] https://www.sustainability.Penn.edu/sites/default/files/CSAP_3_Final2.pdf

Next, understanding that carbon offsets will play a significant part in reaching climate neutrality, the Office of the Executive Vice President established the Duke Carbon Offsets Initiative (DCOI) in June 2009. The DCOI is responsible for developing and implementing the University's strategy for meeting its neutrality commitment by 2024, and focus on projects that both reduce emissions levels in the atmosphere and provide significant local, state and regional environmental, economic, and societal co-benefits. The DCOI engages in purchases of offsets from existing projects as well as implementing and documenting projects for which it acts as the project manager. Carbon offset projects are evaluated based on their ability to definitively document their climate impact, to provide economic, social and environmental co-benefits beyond greenhouse gas reductions, and their replicability throughout North Carolina and within the academic community.

Recommendation 2 for Penn: Penn should establish a committee similar to the DCOI. First, we recommend that the committee be integrated with and be a subgroup of the Purchasing Services Office at Penn. This will allow for transparent fund allocation, seamless bureaucratic processes and facilitate easier project implementation. Second, we recommend that the committee consist of university professors and administration including facilities services from various schools in Penn, members from the purchasing services team, and students at large. This may be members of the currently existing SSAP. Third, we recommend that Penn imbue the values of DCOI as much as possible, including but not limited to "*prioritiz[ing] the creation of academic value through its projects and collaborates extensively with students and faculty*". Operating within an academic research institution, Penn should prioritize the creation of academic value through its projects and collaborate extensively with students and faculty to produce meaningful reports that expand general carbon offset understanding. Lastly, we recommend that Penn undertake a portfolio approach to generating and purchasing carbon offsets. This would provide the insurance to achieve climate neutrality even if one type of project fails to impact climate as stated.

Further, Duke University has initiated projects that work closely with students and the North Carolina community at large. These include the Swine Waste-to-Energy Project, a Residential

Energy Project, and a Urban Forestry Project. A summary and a critical review of each of the three projects is provided below:

Swine Waste-to-Energy (Loyd Ray Farms): Loyd Ray Farms (LRF) is an 8,600-head feeder-to-finish swine operation located in Yadkinville, North Carolina. The farm has the capacity to produce approximately 2,500 offsets annually, the project registered with Climate Action Reserve, and can generate approximately 300 Renewable Energy Credits (RECs) annually. While DCOI mentions that an innovative waste management system was installed at the farm, it does not provide information regarding the logistics and nature of the farm. Project co-Benefits include providing faculty and students with research and touring opportunities through the Pratt School of Engineering, Nicholas Institute for Environmental Policy Solutions and other partners.

Residential Energy: The DCOI pioneered a pilot program starting in 2012 to help Duke employees reduce home energy use and increase renewable energy use through education, incentives, and discounts. The DCOI co-led a student research team to design and implement the Solarize Duke campaign. Through educational workshops, Solarize Duke assisted employees in receiving residential rooftop solar installations to reduce emissions that result from grid supplied electricity. Building on the experience gained through these pilot programs, the DCOI has charted the path to scalable change by connecting Duke employees and other employers across North Carolina to Home Energy North Carolina (HENC) who continue to present these educational workshops. Project co-benefits provide opportunities for Duke students to learn about residential energy usage, conduct surveys and market research, and develop materials for educational workshops.

Urban Forestry: In 2013, the DCOI began developing partnerships to plant trees in our immediate community of Durham, NC. The DCOI expanded to plant trees throughout the state, and in 2015 created an Urban Forestry Protocol[5] for carbon offset generation. The protocol is designed for use by institutions interested in tree planting projects and simplifies documentation requirements to better fit the scale of these projects. Duke University partnered with Arizona

[5] https://sustainability.duke.edu/sites/default/files/UrbanForestryProtocol_v2.2.pdf

State University, Elon University, Davidson College, Pace University, and Green Mountain College. DCOI has written recommendations[6] for how to quantify on-campus trees and forests to ensure additionality.

Recommendation 3 for Penn: Given that Penn has a city campus, it may be hard for the university to initiate a program like the Swine Waste-to-Energy Initiative due to lack of space. However Penn can draw from the Residential Energy and Urban Forestry Projects. Together, these projects offer a good balance that involves faculty members, administration and students. Similar to Duke, Penn can work with the Morris Arboretum of the University of Pennsylvania and develop a course for students where they work to understand how carbon neutrality can be achieved and how this information can be relayed to the greater Penn community. Additionally, the Procurement Office can work with the Student Sustainability Association at Penn (SSAP) to initiate a Urban Forestry plan that would focus on planting trees around West Philadelphia. The program can be extended and involve partnerships with other universities in Philadelphia such as Drexel University and Temple University.

Bundling offsets is a unique strategy used by Duke University and is designed to decrease risk, improve flexibility, and allow universities to fully leverage their research and academic resources. Bundled offsets couple inexpensive, low-risk, 3rd party verified credits with urban tree planting projects that have significant co-benefits but can be costly.

Recommendation 4 for Penn: We recommend Penn develop a strategy to bundle its offsets. A guide provided by Duke University is available here.

Since 2009, Duke has made significant progress. These include total emissions reduction of 24%, development of alternative transportation programs, an experiential Certificate in Sustainability Engagement, and strong communication and outreach plan that engages thousands of students, staff, and faculty every year. While Duke has done a lot of good in the sustainability area, many critics are very skeptical that they will be able to achieve this goal by 2024. When the University

[6] https://sustainability.duke.edu/sites/default/files/UrbanForestryProtocol_v2.2.pdf

initially set the CAP in 2009, Duke envisioned a reduction of campus emissions by 45% and used carbon offsets for the remaining 55% by 2024, with a goal of reducing emissions after this time as well[7]. As of 2018, the University has seen a 24% reduction in carbon emissions since 2007[8]. Now, CAP has 78% carbon neutral by 2024 through purchasing the third offset. This number arose due the realization that investments rise and fall, legislation change, and campus needs shift. However, even with an aggressive push to reduce on-campus carbon emissions, Duke will need to find ways to offset the remaining campus emissions through the purchase of carbon offsets from off-campus initiatives. To prepare for its fast-approaching carbon neutrality commitment, Duke has invested in carbon offset pilot projects that it considers most promising in terms of volume, cost-effectiveness and benefits to the local, state and regional community. However specific information regarding the nature of these offsets is not easily found. We gather that the types of projects have ranged from methane capture projects to carbon sequestration through forestry and land conservation-based projects[9]. Most recently, the University has investigated using investment in community energy efficiency projects – specifically in residential buildings – as a way to invest in locally generated carbon offsets[10].

While the Procurement Office at Penn should draw inspiration and key aspects from the extensive and well developed Carbon Offset Program at Duke University, it should also veer with caution while making lofty goals, since these can be hard to achieve. Duke University's shortcoming is an example of this.

[7] https://sustainability.duke.edu/metrics/climate
[8] https://www.dukechronicle.com/article/2019/12/duke-university-carbon-neutrality-2024-offsets
[9] https://www.dukechronicle.com/article/2019/12/duke-university-carbon-neutrality-2024-offsets
[10] https://www.dukechronicle.com/article/2019/12/duke-university-carbon-neutrality-2024-offsets

Brown University

Brown University's Office of Sustainability encompasses most non-academic sustainability efforts on campus. The Office of Sustainability charts the University's progress toward greenhouse gas reduction and waste reduction and includes updates about related courses, initiatives, research, community projects and the work of student groups. As an educational institution, Brown offers a unique role in contributing research, fostering innovation, and providing a model for environmental sustainability to the community and beyond. Teaching environmental stewardship both by example and through concrete learning will ensure Brown's contribution to a cleaner, sounder global environment. Brown has set an aggressive goal to cut its campus greenhouse gas emissions by 75 percent by 2025, and to achieve net-zero no later than 2040[11]. Its plan focuses on five main sustainability challenges — greenhouse gas emissions, nutrient pollution, water impacts, biodiversity loss and human health impacts — and sets a goal for each. The University also hopes to "expand upon its already diverse range of educational opportunities," according to the plan. To achieve this goal, the university planned four phases of achievable actions and engaged students and faculty in finding solutions through coursework and co-curricular activities.

The first phase of efforts, a pair of renewable energy agreements with providers of solar and wind power, is already in motion. Brown has partnered to create a 50-megawatt (DC) solar facility on a former gravel pit in Rhode Island. This first project is a collaboration with Constellation, a national competitive energy provider, and Providence-based Energy Development Partners (EDP), and will create Rhode Island's highest-capacity contiguous solar generation project across a 240-acre field on a former gravel pit in North Kingstown[12].

Additionally, the university also has a separate agreement with a Texas-based wind farm. Together, the projects are said to offset 100 percent of Brown's on-campus electricity use[13]. The university also began a thermal efficiency project in 2017 to convert Brown's central heating

[11] https://www.brown.edu/news/2019-02-11/emissions
[12] https://www.brown.edu/news/2019-01-17/renewable
[13] https://www.brown.edu/news/2019-01-17/renewable

plant from steam to hot water, and through these emissions the university hopes to cut campus greenhouse gas emissions by approximately 27,000 metric tons per year by the early 2020s.

Recommendation 1 for Penn: Taking into consideration the lack of space in and around Philadelphia, it may not be possible or desirable for Penn to have an initiative similar to the gravel pit program that Brown University is undertaking at Rhode Island. However, Penn can partner with Wind Farms or alternatives to offset its on-campus electricity use in particular. Diving up the carbon offset program, wherein, certain university activities will be offset by respective programs may be more effective than having a broader umbrella offset program.

The second phase of the net-zero efforts, scheduled for 2022, is to convert the heating plant to post-consumer bio-oil as a primary fuel, with natural gas as a backup. According to Brown, this is not a permanent solution- recycled bio-oil, which is derived from waste cooking oil discarded after food preparation, enables a large decrease in emissions in the near term, and they are taking steps to prepare for a more permanent fuel solution that relies on renewable electricity.

The later phases of the plan involve further upgrades to the University's central heating loop and buildings connected to it, enabling lower-temperature water to meet the heating needs of the campus, and ultimately the conversion of Brown's heating plant to renewable electricity, with bio-oil as a secondary fuel.

Recommendation 2 for Penn: Penn should take on the approach of dividing their climate action plan into phases. Each phase should involve the appropriate stakeholders. Every project plan should itself be subdivided into a number of key milestones. This helps to provide continual delivery and makes sure progress is measured regularly, and will make the process of becoming carbon neutral more seamless.

Recommendation 3 for Penn: Penn can take inspiration from Brown University and work with its Facilities Management Team to plan a joint project around the minimizing carbon footprint of the university by updating technologies around the campus. The goal of the plan would be to create a path to net-zero with meaningful changes to our infrastructure, and without overreliance

on buying carbon offsets and other indirect measures. It involved extensive and careful study, and a critical component of the University's plan would be to reassess it continually to ensure that Penn is making use of the most efficient and effective technologies.

Next, Brown University has set up The Green Lab Program, formed in fall 2016. These initiatives are a collaboration between Facilities Management's Office of Sustainability, Biomed Facilities Planning & Operation, Environmental Health & Safety, and members of the Brown community. Under this program is the Unoccupied Lab Ventilation Initiative[14], which aims to reduce the amount of outside air required to be conditioned in order to make-up for ventilation required for fume hoods. The next initiative is the 'Shut the Sash' Reminders, which reminds students and faculty to shut the fume hood sash when it is not in use. Stickers are placed on the side of fume hoods to serve as friendly reminders. The third and last initiative is the Stoplight Stickers Program[15], which saves energy by encouraging lab users to turn off equipment that might otherwise be left on and protects research by ensuring that equipment that is being actively used is left on. A red 'stop' sticker placed on equipment means that this equipment should stay on at all times. A yellow 'caution' sticker placed on equipment means that lab users should contact the person whose name is written on the sticker before turning off equipment. A green 'go' sticker placed on equipment means that it can and should be turned off when not in use.

Recommendation 4 for Penn: Penn has its own great Green Labs program. The Procurement office already works closely with labs and can extend this relationship to include versions of three initiatives mentioned above. The Procurement Office can have a subgroup that works with faculty, staff, and students to increase the sustainability of Penn labs without compromising, and in some cases enhancing, learning and research outcomes. The subgroup can focus on reducing energy and water use, promoting sustainable lab purchasing practices, minimizing and divert waste from the landfill/incinerator, and promoting Green Chemistry[16] where appropriate.

[14] https://www.epa.gov/greenchemistry
[15] https://news.brown.edu/articles/2014/03/stickers
[16] https://www.epa.gov/greenchemistry

Note: In our research of Brown University Sustainability initiatives, we did not find anything else that is novel or something that Penn is not already doing (such as LEED Building Sustainable Designs).

Brown University's plan is a really good start, but they have a long way to go before they can operationalize it. The University has done a good job in ‘developing bold targets,’ but the plan is missing a framework of decision-making to help it move forward. The plan put forth by Brown University also lacks an emphasis on education and outreach to the student body since all students are going to have to make drastic lifestyle changes in order to increase sustainability. Moreover, the plan does not focus on how it impacts the health of the Providence community, as opposed to just the University community. Finally, there is no advisory committee overseeing the execution of the sustainability plan.

For Penn to avoid this, we suggested that a course-like setup, in which faculty and students meet weekly to discuss the plan as well as assigned readings, could be a beneficial strategy to keep progress on track.

Yale University

The Yale Sustainability Plan 2025[17] supports Yale's academic mission and envisions a Yale where sustainability is seamlessly integrated into the scholarship and operations of the university. The Yale Sustainability Plan 2025 is organized into nine ambitions: Leadership, Empowerment, Health & Well-Being, Climate Action, Stewardship, Built Environment, Mobility, Materials, and technology. Each ambition is supported by objectives, and measurable and time-bound goals. The structure of the plan invites participation from a diverse range of groups across Yale. Yale aims for carbon neutrality by 2050 and is committed to meeting its previous goal of a 43% reduction in greenhouse gas emissions from 2005 levels by 2020.

Note: The nine initiatives being undertaken by Yale University are not especially unique and Penn already has similar initiatives and plans in place.

Yale has established a network to foster connections between the university's scholarship and operations by 2019. The Carbon Charge Project[18] exemplifies how collaboration from a range of disciplines at Yale can lead to innovation in addressing climate change. The first of its kind at an institution of higher learning, the project is experimenting with the design and implementation of carbon pricing on Yale's campus. The project was piloted in 2019, with participation from Yale administrators, faculty, and students across Yale's campus.

Recommendation 1 for Penn: Penn should utilize carbon pricing. Carbon pricing could really be an effective way to encourage behavior change that helps drive investments in cleaner options.

The ambitions laid out in the new sustainability plan put more focus on how people are affected by sustainability, broadening the discussion around the concept. Yale groups are already offering opportunities that connect sustainability to personal health and well-being. In 2019, the Yale School of Nursing partnered with the Yale Landscape Lab through a Community Health

[17] http://sustainability.yale.edu/sites/default/files/sustainability_plan_2025.pdf
[18] https://carbon.yale.edu/

course[19], providing workshops that connected gardening and cooking to healthy lifestyles for patients.

Recommendation 2 for Penn: The Procurement office can form a subgroup that partners with Penn Nursing to initiate programs such as the Community Health course at Yale University. This program can be open to students, professors and administration alike.

The plan also calls for a more diverse and inclusive sustainability movement at Yale. Under the Empowerment ambition, Yale aims to launch an initiative promoting dialogue on sustainability, inclusion, and justice on campus and in New Haven, by 2018. In 2020, Yale hopes to develop a sustainability literacy initiative for Yale students, faculty, and staff. However, information about either of these initiatives was unavailable on the Yale sustainability page or the university website. This leads us to believe that the programs did not lift off the ground or that they were not successful, or a combination of the two. An alternative may be that the program(s) may have been halted due to the ongoing Covid-19 crisis.

Next, the Yale Sustainable Food Program and the Yale Center for the Study of Race, Indigeneity, and Transnational Migration are co-sponsoring events, including the Chewing the Fat Series[20]. The Yale School of Forestry and Environmental Studies (F&ES) offers Diverse Voices Series[21], a course with lectures from a diverse set of environmental leaders tackling sustainability challenges.

After the plan was launched, the Office of Sustainability at Yale continued collaborating with groups across Yale to update their Sustainability Action Plans. The Office also launched working group meetings and workshops on Fostering Collaboration.

While we believe that Yale University is doing a remarkable effort to reduce its carbon emissions and offset them, we also believe that the university is not undertaking any unique

[19] https://nursing.yale.edu/news/nursing-students-connect-west-campus-landscape-and-themselves-patient-care
[20] https://www.sustainablefood.yale.edu/around-world/speaker-series
[21] https://environment.yale.edu/content/images/00009823/DiverseVoices2016-OverallPoster-lg.jpg

initiatives that Penn has not encountered prior. The University of Pennsylvania and Yale University are as such ‘at par’ with one another in their efforts to achieve carbon neutrality.

Swarthmore College

Swarthmore College is working towards a goal of carbon neutrality by 2035, as outlined in their 2012 Climate Action Plan, which they are pursuing through a number of different routes.[22] We believe that they are an appropriate peer institution to examine due to their proximity to Penn– since localizing the impacts of sustainability and carbon offsetting efforts was mentioned as a priority, seeing how Swarthmore is able to accomplish emission reduction and offsetting on a local scale can inform Penn's actions moving forward.

Some of Swarthmore's efforts have to do with shifting their power consumption to renewable sources– there has been a major push to install solar systems on site, which they hope will cover "10 to 30 percent of the college's energy consumption."– with the remaining amount coming from "a consortium with other institutions which would actually enter into an agreement with a [renewable energy] developer."[23] In addition to that, they have made strides to reduce their fossil fuel consumption by making their systems more efficient.[24]

Despite these efforts, there are still carbon emissions that must be offset in order to achieve their goal of total carbon neutrality– Swarthmore has been purchasing Renewable Energy Credits (R.E.C.s) from Schneider Electric since 1999.[25] However, the aspect of their efforts that is most relevant to the problem at hand is their Carbon Charge Fund. The Carbon Charge Fund is raised by issuing a carbon fee and shadow price to all carbon emissions. Annually, it's funded to about $300,000 which is allocated to three pools. The first and largest pool is the Green Revolving Fund at about $200,000, which is used to fund energy saving projects on campus, such as switching to more efficient lighting or improving pipe insulation. The second pool at $90,000 is allocated to research and strategic planning projects such as installing electricity meters in

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22 https://www.swarthmore.edu/sites/default/files/assets/documents/sustainability/Swarthmore_College_Climate_Action_Plan.pdf

23 https://swarthmorephoenix.com/2019/09/26/moving-on-from-r-e-c-s-the-colleges-plan-to-reach-carbon-neutrality/

24 https://www.swarthmore.edu/sustainability/decarbonizing-swarthmores-energy-systems

25 https://swarthmorephoenix.com/2019/09/26/moving-on-from-r-e-c-s-the-colleges-plan-to-reach-carbon-neutrality/

campus buildings. Finally, the remaining $10,000 is allocated to education and community engagement, funding projects such as documentary screenings and lectures.[26]

Recommendation 1 for Penn: Penn should enact a carbon charge like Swarthmore. This has dual benefits for the goal of reducing Penn's carbon emissions– a carbon charge may act as a behavior modifier and encourage people and departments to adopt more energy-efficient habits. In addition to that, funds raised from a carbon charge could easily be allocated to productive projects which contribute to the goal of carbon neutrality.

Recommendation 2 for Penn: With funds from a carbon charge, Penn could dedicate those funds to the currently existing Green Fund. The Green Fund is funded by the Division of Facilities and Real Estate Services and issues grants for proposals by students, faculty, and staff on "ways to improve the University's environmental performance and reduce campus emissions."[27] Many of the Green Fund's projects resemble the Carbon Charge Fund projects from Swarthmore, but are not all necessarily tied to the goal of reducing carbon emissions. Additionally, the size of the Green Fund is unclear, as well as its current utilization, so it is unclear whether more promotion or more funding might help promote more sustainability projects.

Swarthmore's Green Revolving Fund is a self-sustaining fund which is funded by the Carbon Charge Fund, as mentioned above. It grants loans to projects specifically focused on reducing energy use on campus, and as cost savings from those projects are realized, the loan is slowly paid back until it has been fully replenished.

Recommendation 3 for Penn: An alternative idea might be to establish a fund specifically for projects which aim to offset carbon emissions or reduce fossil fuel consumption– this would be a distinct and specific goal which directly contributes to the ultimate goal of carbon neutrality, and distinguishes itself from the more general Green Fund. Additionally, like Swarthmore's self-sustaining Green Revolving Fund, this fund could also be a fully independent, renewable source of funding. Rather than being another expenditure, it could become a source of financial savings

[26] https://www.swarthmore.edu/sustainability/carbon-charge-working-group
[27] https://www.sustainability.upenn.edu/participate/penn-community/green-fund

as well as a valuable part of Penn's carbon neutrality strategy. Finally, to expand the impact beyond Penn's campus, this fund might even be able to fund off-campus projects for local community institutions, households, and businesses.

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