Supply Chain and Waste Stream

Contents

Introduction

The charge of the Supply Chain and Waste Stream working group of the CAP Taskforce was to assess how these closely interrelated systems can be modified to reduce the institution's GHG emissions and overall environmental footprint. Supply chains are complex, being comprised of a large network of entities responsible for the conversion of raw materials into products, and the transportation and delivery of these products to their end users. Thus, calculating the GHG emissions associated with a diverse supply chain (termed Scope 3- indirect emissions) can be a highly complex undertaking full of uncertainties. BU's supply chain analysis started with the assessment of expenditure areas of the University, which can be broadly classified into 9 distinct categories. Facilities Management & Planning (e.g. construction, furniture, real estate), Financial Services (e.g. benefits, insurance) and Information Services & Technology are the three highest spend categories, containing some of the highest spend by subcategories. The other spend categories include Food Service, Scientific & Medical, and Professional Services, Travel, Administrative Spend, and Library Resources.

In deciding upon appropriate recommendations for supply chain action as part of the CAP, the working group considered 1) the impact of each category on overall GHG levels (which is difficult to assess for Scope 3 emissions); 2) the feasibility of meaningful action on a given category; 3) the broader impact of action, not only on GHGs but also on environmental footprint, community education, and institutional reputation. For example, it was clear at the outset that Financial Services was a category that, while representing a large proportion of addressable spend, was not amenable to alterations as part of a CAP. A more detailed explanation for the basis of our recommendations is provided below. We propose impactful and significant actions related to 3 components of the BU supply chain—construction, consumables, and food (including significant reduction of waste in these categories)—as well as to the overall Waste Stream.

In these introductory pages, we first describe Scope 3 emissions associated with each of these categories, the methodological challenges associated with accounting for them, and the current basis for recommendations in general terms. This is followed by a brief, bulleted list of our overall recommendations. Finally, we provide examples of what BU's peer institutions are doing with regard to Supply Chain and Waste Stream actions. The Supply Chain categories of Construction; Consumable and Durable Goods; Food and the Waste Stream are discussed in detail in the body of this report.

Background on Indirect Emissions

Emissions from the supply chain, waste and food are categorized as Scope 3 emissions. Scope 3 emissions refer to all indirect emissions. In other words, emissions other than Scope 1 (fuel burnt on campus for building heating and fleet transportation) and Scope 2 (emissions from off-campus sources to produce electricity and steam used on campus). According to the Corporate Value Chain (Scope 3) Accounting and Reporting Standard of the GHG Protocol, Scope 3 is comprised of 15 categories[1]. For the purposes of the Supply Chain and Waste Stream working group the 3 most important categories to consider are:

[1] http://www.ghgprotocol.org/standards/scope-3-standard

- Category 1: purchased goods and services (which includes food)
- Category 2: capital goods (construction and other real estate assets)
- Category 5: waste generated in operations.

While calculating emissions from Scope 1 and 2 is relatively straightforward and offers several benefits related to tracking progress and informing decision-making, Scope 3 accounting presents enormous methodological challenges and offers somewhat limited insights to decision-makers.

There are two major barriers to accurate quantification of Scope 3 emissions; first is data availability, and second is boundary-setting, that is decision over which embedded emissions of a particular good or service should be included or excluded from ownership. Very limited data is available on the number and type of goods and services purchased by the University. While it is possible to retrieve high-level costs for classes of expenses, there is no system that allows precise assessment of the quantity and characteristics of all products purchased by every department across the two campuses. That said, more detailed data is available for food sourcing and food waste diversion efforts. As for general waste, the tonnage of waste, recyclables, compostables, and donated items is known. However, there is little data available on the number of trips required by the waste management companies to transport the waste from campus to its final point of disposal. Waste composition is unknown.

Even if data on quantity and characteristics of products was available, boundary setting presents a second major barrier. The University must decide how far back into the supply chain emissions related to goods and services used on campus should be calculated and "owned" by the institution. In other words, there needs to be an agreement at the University level with regard to where to set the boundaries. A shared vision on the matter is very important because it determines which emissions the University is responsible for. Moreover, setting boundaries helps to indirectly identify the leverages that the University can use to reduce its emissions. For example, if the University decides to own emissions from deliveries of all goods, then limiting deliveries is one of the tools available to reduce emissions.

Given the depth, complexity, and absence of data required to determine GHG emissions from the supply chain and waste stream, the working group devised recommendations based on environmental or sustainability goals that are in the interest of the University to achieve—largely to reduce its waste and environmental footprint—but for which the impact on carbon emissions cannot be quantified.

Recommendation Summary

In brief, our **Recommendations** are the following:

- Construction: Attain LEED Gold Certification for all major new construction and renovation projects on both the CRC and BUMC campuses, while diverting at least 90% of construction waste from landfills. A goal regularly achieved on LEED projects at BU.
- Consumable and durable goods: Work with current and future suppliers to enhance the sustainability characteristics of current and future consumable products. Develop awareness and engagement programs for employees to manage demand.
- Food: Build on strong current efforts on food, including reducing post-consumer waste and increasing sustainability
- Waste: Establish a goal of "Zero Waste" (90% diversion of non-hazardous waste from incinerators and landfills)

Peer Institutions

Peer and aspirational peer institutions that have established CAPs that were influential to the working group's considerations include the University of Pennsylvania, the University of Maryland, Syracuse University, Duke, MIT, and Cornell University. Most of these institutions developed their CAPs in 2007-2010.

Construction: LEED (Leadership in Energy and Environmental Design) certification in new construction and renovation of buildings is a common means of addressing GHGs associated with construction. Institutions that have proposed or committed to a minimum level of LEED certification include: MIT (LEED Gold), the University of Pennsylvania (LEED Silver), the University of Maryland (LEED Silver), Duke University (LEED Silver), Cornell (LEED Silver), and Syracuse (LEED Certification). In addition, a number of peer universities have considered supplementing LEED standards with specific energy efficiency targets. Cornell's CAP proposes a requirement that all new construction and renovation projects over $5 million achieve LEED Silver certification and a minimum of 50% energy savings over the industry standard baseline (ASHRAE 90.1[2]), while the CAPs of Duke University and the University of Maryland recommend implementing LEED standards for energy efficiency that go beyond those required for LEED Silver status. Finally, as at BU, some individual construction projects at our peer institutions have far surpassed their respective universities' minimum requirements. Cornell, for instance, has four buildings which are certified as LEED Platinum, and is currently constructing an academic building which is designed for net zero energy usage[3].

Construction waste diversion: Though the CAPs of several peer institutions acknowledge the role that construction waste plays in their overall campus waste streams, few attach specific numbers to either current or target landfill diversion rates for this category of waste. The University of Pennsylvania, for example, has achieved a diversion rate of over 80% for construction waste, but has not identified a concrete goal for future progress. Thus, establishing

[2] https://www.ashrae.org/resources--publications/bookstore/standard-90-1

[3] http://www.sustainablecampus.cornell.edu/buildings

a specific, ambitious target on the order of 90% for construction waste diversion would set Boston University apart from its peers in this area.

Consumables: Our peer universities' approaches to consumables vary significantly; some do not address this category at all, while others outline detailed strategies for working with vendors and campus communities both to reduce the overall level of consumption, and to ensure that the products which are consumed are more environmentally sustainable. Current or proposed policies include: requiring ENERGY STAR certification for all pertinent appliance purchases (University of Maryland and Cornell), imposing minimum purchase amounts from office suppliers to reduce the number of deliveries on campus (University of Pennsylvania and Cornell), and incorporating sustainability requirements explicitly into vendor contracts (University of Maryland and University of Pennsylvania). Cornell has been a leader in this area, having either proposed or implemented measures such as: charging a small fee for single-use plastic bags in campus retail outlets, "fast tracking" sustainable products in the University's online procurement system, and coordinating with local vendors to consolidate their campus shipments.

Food: Source reduction initiatives are at the forefront of waste reduction strategies in Higher Education institutions. In fact, Boston University's peer institutions have developed robust and model source reduction programs. A number of institutions have implemented reusable to-go containers with the complete removal of disposable containers. In addition to source reduction strategies, Syracuse, Duke, Cornell, University of Pennsylvania and University of Maryland have focused on increasing the composting of organic waste. Composting organic waste helps divert organics from landfills and incinerators, ultimately reducing their impact to the environment. In terms of peer institutions strategic approach to food and beverage procurement, the idea is to bolster and increase local and regional purchases as much as feasibly possible. In order to support local purchasing, peer institutions have implemented on-campus farms and gardens. Most importantly, the education of the community of students, faculty and staff around sustainable dining has and will play an important role here BU as it has at our peer institutions. For example, programs such as Cornell's "Beyond Ramen" food literacy program and the establishment of the "Water and Food Security Lab" at MIT are breeding grounds for sustainability innovation, engagement and progress. Education about sustainable dining presents a key opportunity for enhancing sustainable practices, driving successful outcomes and ultimately sensitizing the community.

Waste Stream: Most of our peer institutions have committed to significantly reducing waste on their campuses through increased recycling and composting, and reduced purchasing of disposable items such as dining ware. Recognizing that a waste audit is the first step in reducing waste, Cornell University, University of Pennsylvania and Syracuse have all engaged in extensive waste audits and assessment of GHGs associated with their waste. For the most part, peer institutions have taken a more incremental approach to reducing waste as part of their CAPs. For example, the University of Pennsylvania's CAP seeks to increase their recycling rate from 24%, to 30% by 2019, and continue to reduce overall municipal solid waste. Furthermore, the Office of the President committed to zero waste administrative events, thereby demonstrating feasibility and leadership at their institution. By establishing a Zero Waste goal, Boston University would become among the leaders of our peer institutions in waste reduction.

In the following pages, we address each of the four Supply Chain and Waste Stream categories for which recommendations are made. In each of these four sections we discuss: the current status of the category at BU or, "Where We Are"; our overall assessment of key goals or, "Where We Want to Be" and a list of explicit recommendations or, "How To Get There".

Buildings and Construction

Where We Are

The construction and operation of buildings accounts for over 40%[4] of annual carbon emissions in the United States, while construction waste constitutes approximately 25% of the annual municipal waste stream. Accordingly, Boston University has prioritized the implementation of sustainable design and construction strategies in new construction projects, renovations, and building operations overhauls alike, using the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) standards as a guiding framework. These standards highlight best practices in transportation, site development, water efficiency, energy efficiency, waste reduction, materials and resources, and indoor environmental quality, all of which play a role in the direct and indirect emissions associated with the building life cycle. Different certification schemes are available for different types of projects (e.g. Building Design + Construction, Interior Design + Construction, Existing Building Operations + Maintenance, Neighborhood Development, and Homes), but the basic system remains the same for all project types. Project teams must meet project-specific LEED prerequisites across a range of categories (e.g. Water Efficiency, Energy and Atmosphere, and Materials and Resources), plus earn LEED credits by meeting additional standards in each of these categories; these credits, in turn, determine the total number of LEED points that a project receives, and thus its certification status (LEED Certified, Silver, Gold, or Platinum).

Substantial progress has been made to date. 654,335 square feet of the University's total building space is LEED Certified, of which 86% has achieved LEED Gold (the second highest possible ranking), and over 300,000 square feet of space is LEED Registered for Building Design + Construction, Interior Design + Construction, and Existing Buildings Operations + Maintenance. The University's Sustainable Cleaning Program also adheres to LEED standards, with over 96% of all cleaning and janitorial products used on the Charles River Campus meeting the highest industry standards for sustainability in FY2016. In addition, several recent construction and renovation projects successfully diverted 90% or more of their construction waste from landfills, including one project with a diversion rate of over 95%. Furthermore, much of the University's growth during the 20th century occurred by way of "adaptive reuse," in which existing buildings were adapted and repurposed for the University's needs rather than demolished to make room for new construction, thereby avoiding the significant energy expenditures and carbon emissions associated with demolition and construction. Finally, a number of important sustainable building strategies have been implemented for individual campus projects, including a "green" roof, a

[4] https://www.c2es.org/technology/overview/buildings

geothermal building, heat recovery, chilled beam technology, and a living-learning residence dedicated to teaching students about sustainable living.

Where We Want to Be

Maintaining and strengthening the University's current commitment to LEED certification for campus construction, renovation, and building operations alike will be critical for meeting any future emissions reduction targets in the buildings and construction sector, and will enable the University to continue to build its national and international reputation as a champion of sustainability. Nevertheless, there are several other gaps and areas for improvement that the University should work to address as well. For instance, recent efforts to increase construction waste diversion rates have been focused around projects for which LEED certification has been sought; moving forward, however, efforts to divert construction waste from landfills should expand to encompass all construction and renovation projects on campus, regardless of their LEED certification status.

In addition, the University's future architectural planning and design efforts would benefit significantly from more accurate estimates of the embodied carbon emissions associated with different types of construction materials and processes over the building life cycle. A number of life cycle analysis software packages are currently on the market, and range significantly in terms of price, complexity of use, and level of granularity. Such tools could provide Facilities Management and Planning staff with valuable information on the economic and environmental costs and benefits of various construction options, and thus contribute to both project and program cost decisions, and campus-wide embodied carbon accounting efforts. At present, however, the University lacks faculty, staff, and student expertise in the use of these programs. They therefore represent an important medium-term opportunity from an educational standpoint as well as from a campus sustainability standpoint, since hands-on experience with cutting-edge life cycle and embodied carbon analysis software would enhance the value of our curricular programs in sustainable development and design for our students.

How To Get There

In order to meet the medium- and long-term priorities outlined above for the University's construction and building operations sector, we propose that the following steps be taken over the near term:

2018-2019

1. NEW CONSTRUCTION/RENOVATION STANDARDS: Set a campus-wide standard for LEED Gold for new construction and major renovation projects (Building Design + Construction)

2. INTERIOR FIT-OUT STANDARDS: Set a campus-wide standard for LEED Gold for interior fit-out projects over a $300/sf threshold (Interior Design + Construction)

3. CONSTRUCTION WASTE DIVERSION STANDARDS: Set a campus-wide standard for at least 90% of construction waste diverted from landfills for all new construction, renovation, and interior fit-out projects (regardless of LEED certification status)

2020-2025

4. ANALYTICAL/CURRICULAR CAPACITY BUILDING: Develop the capacity on campus for research and curriculum in life cycle and embodied carbon analysis, in conjunction with existing architecture, engineering, and/or earth and environmental sciences faculty

5. ANALYTICAL PILOT PROJECT: Build on the curricular foundation outlined in Recommendation #4 to pilot the use of life cycle and embodied carbon analysis tools in University construction and renovation decisions by 2025

Consumable and Durable Goods

Introduction and Background

This section of the report addresses strategies to reduce emissions from the supply chain of consumable and durable goods. Consumable and durable goods refer to those goods that the university purchases to run its operations and fulfill its education mission. It is a very large category that encompasses a variety of items, such as office supplies, computers and audiovisual items, medical and lab supplies, furniture. Thousands of different products are purchased every semester, each one with different life spans, from different vendors, delivered at different times. No university has tackled this domain yet and Boston University has the opportunity to develop a meaningful framework to address the environmental impact from consumable and durable goods. As previously stated, even if data were available, there is no established, recognized method to calculate and account for supply chain emissions of goods in institutions of higher education. Moreover, while calculating the magnitude of carbon emissions from the supply chain is a useful exercise, it carries limited value in informing future decisions. Ultimately the university needs furnished spaces, computers, medical and scientific supplies, nutritious food, and more to fulfill its education mission and house offices and residences. Thus the overall approach to lower the environmental impact from procurement reflects sustainability goals, for which GHG impact is unknown. Sustainability goals revolve around supply and demand management. On the supply side, the top recommendation is to establish a formal collaboration between Sourcing & Procurement and sustainability@BU. The goal is to expand on existing overlap of their missions to coordinate effectively with regard to the engagement of vendors on sustainability issues. Areas of work include a) the evaluation of end-use products, their processes and deliveries b) discussion of sustainability initiatives at each quarterly review and c) addition of a sustainability component as part of each category of sourcing. On the demand side, the recommendation is for the University to design and implement programs to engage the thousands of BU employees who make purchases on a daily basis. A critical key to success is the ability to identify and reward virtuous behaviors that lower overall consumption levels.

For furniture, a policy recommending the reuse and refurbishment of existing items already exists. The recommendation is to reinforce that policy in two ways: make the reuse, refurbishment or the purchase of used furniture the norm while creating a separate, exception process for approving the purchase of new furniture.
Finally, these recommendations provide ample opportunities for research and education that can enrich students while informing the University's decisions. The recommendation is to build the analytical and curricular capacity for embodied carbon, life-cycle and supply-chain analyses.

Where We Are

Although no policies exist to mandate the purchase of green equipment, there are standards we direct all customers – especially in the printer, copier, PC world where green certifications play a role in the selection process. In fact, Boston University purchases energy star copiers, kitchen equipment, and computers. In addition, 90% of BU purchases are qualified for certification under Green Seal, Environmental Choice certified, or biorenewable cleaning products. Furniture for student residences is made in Vermont, usually last a few decades, and, at the end of their life, are donated. Office furniture, on the other end, are purchased on a per-need basis and are recycled when replaced.
In 2004 BU Procurement& Sourcing launched the Green Purchasing Initiative in an effort to reduce the University's environmental footprint through the products and services in procurement. Actions were taken to choose products and services with a smaller environmental impact, consolidate ordering and deliveries so products arrive in bulk, and reduce supplier packaging material to decrease waste. In addition, BU Sourcing & Procurement has developed primary contracts with vendors including W.B. Mason and Fisher Scientific who offer alternative products for use in both office and laboratory. Recently, Hewlett Packard was also engaged to discuss low-ink toners and printers.

From a data perspective, there is no centralized system to track any kind of data on consumable goods. The only data available is expenditures on procurement through the Strategic Sourcing Initiative (SSI). In February of 2016, senior leadership engaged a third-party consultant to evaluate Boston University's spend data for the calendar year 2015. The goal was to identify actionable and measurable areas of spend through a Strategic Sourcing roadmap so as to achieve cost savings. Eighteen sourcing areas were identified and projects will be implemented over the next two years. Some of the selected sourcing areas are commercial print, small parcel, laptop/desktop, IT Peripherals, Scientific Distributors, Servers/Storage, Janitorial Supplies, Mobile Phones, Promotional Products. This is an important effort as sustainability goals can be coupled with savings to the University. An example of the collaboration between Procurement & Sourcing and sustainability@BU is the Commercial Print Program. This was a vendor consolidation project (to cut list of suppliers from over a 100 to 11) and sustainability@ BU was very engaged in selecting preferred suppliers that have sustainable production processes and use sustainable consumables in their process (like soy-based inks).

Where we want to be

For durable goods, that is dorm and office furniture, it should be the University's standard practice to prioritize reused and refurbished items for small projects within the university. Such policy already exist within the University but it is largely ignored. Thus the recommendation is

to give executive sponsorship to the policy with the goal of institutionalizing the use of refurbished or used items. For large projects, that is major renovations and construction of new buildings, the recommendation is for BU Sourcing and Procurement to work with vendors in identifying and procuring sustainably-sourced items. Such strong signal would incentivize designers to think more strategically on how to incorporate sustainability in their products and services. Moreover, a third recommendation is to develop furniture guidelines to be included in the appendix of the Project Planning and Delivery document. Finally, a fourth recommendation is to revisit the current platform where administrators view and acquire used items. Such internal, digital marketplace already exist but it remains a niche tool. Part of the process should include creating visibility for the platform, facilitating access, and raising awareness to administrators and other employees.

For consumable goods (office supplies, medical and scientific equipment, IT devices just to name a few) the effort should focus on both supply and demand. On the supply side, the recommendation is for a closer collaboration between Procurement & Sourcing and sustainability@BU. The University should expand on current vendor engagement by:

a) adding a sustainability and climate change component to each category of sourcing
b) when appropriate, have sustainability@BU representatives attend quarterly meetings with key suppliers
c) as part of the evaluation, establish with vendors a set of sustainability indicators not only for end-products but for processes, packaging and delivery
d) identify opportunities to purchase products and services that are produced and sold by businesses with strong environmental management standards, policies, and practices
e) leverage key suppliers to help Procurement & Sourcing perform green assessments, given their expertise and insights into best practices across higher education and other industries. For example, Thermo Fisher performed an onsite assessment of BU's campus labs to measure energy output from equipment such as freezers and hoods.

If the supply side of procurement is fairly centralized, the demand for consumable goods is spread out through the various departments of the University. Thus a critical piece will be the engagement of the community in making informed, sustainable choices. The recommendation is for sustainability@BU and Procurement & Sourcing to design awareness and engagement programs to effectively nudge administrators and other employees towards sustainable products and/or lower need of supplies. This can be accomplished through a number of projects. For example, in the next few months a new feature will be introduced on the purchasing platform, where administrators will be able to filter for sustainable products based on WB Mason designation. Once sustainability@BU reviews and verifies the criteria for deeming a product sustainable, the item will be highlighted with the sustainability@BU green leaf logo. Other ideas for engagement include trainings and gamification. Competitions can be created across departments based on various sustainability indicators (fewer printed sheets, lowest number of items purchased, highest share of sustainable products purchased and so on). Another idea is to offer monthly seminars to departments covering one set of items each time and presenting sustainable options: for example discussing office supplies in January, kitchen and coffee supplies in February, IT computers and printers in March and so on. Lab supplies should be discussed as part of the combined safety and sustainability training.

How To Get There

2018-2019

1. FURNITURE: Institutionalize policy to prioritize used and refurbished furniture. Develop furniture guidelines to be included in the Project Planning and Delivery document.
2. CONSUMABLE GOODS- SUPPLY SIDE: BU Procurement and sustainability@BU to work with individual vendors to enhance the sustainability characteristics of products and services
3. CONSUMABLE GOODS- DEMAND SIDE: create demand management programs such as awareness and engagement initiatives targeting departments and administrators
4. ANALYTICAL/CURRICULAR CAPACITY BUILDING: Develop the capacity on campus for research and curriculum in life cycle and embodied carbon analysis

Food

Where We Are

Sustainable Food Supply

A sustainable food supply chain strategy considers the environmental, social and economic impacts of all food and beverage purchases as well as products that directly support the operation, including the use of disposable/compostable utensils, tableware, and napkins. The University and BU Dining have standardized sustainability reporting efforts utilizing the Sustainability Tracking, Assessment & Rating System (STARS)[5] developed by the Association for the Advancement of Sustainability in Higher Education (AASHE).

BU Dining currently works with its suppliers and distributors to prioritize sustainable purchases and the University has made a commitment to make 25% of all food local and sustainable by 2020 (utilizing AASHE STARS 2.1 criteria). BU Dining also produces an annual report on its sustainability efforts – just over 23% of total food and beverage purchases were sustainable in fiscal year 2016. Opportunities to increase the local and sustainable supplier network include leveraging regional crop yields and aggregating product amongst like institutions to create economies of scale. Some additional progressive solutions include procuring quick frozen produce to take full advantage of a shorter growing season, and exploring the possibility to cultivate low impact produce on campus using vertical or container gardens.

[5] https://stars.aashe.org/

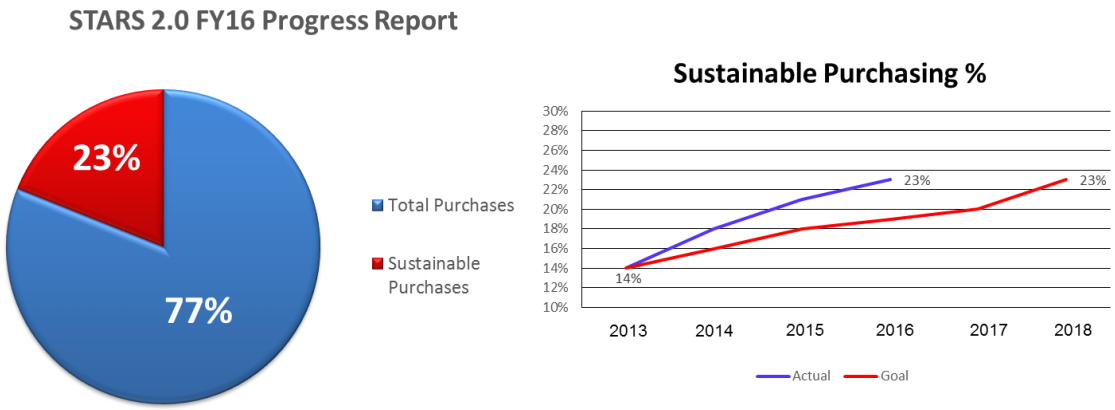

Figure 1: BU Dining Sustainable Purchasing in FY16 (Source: BU Dining AASHE STARS 2.0 Report)

BU Dining should continue its efforts to source produce and proteins that are humane, equitable, organic, or certified by a third party such as Marine Stewardship Council, USDA, Fair Trade and/or the Rainforest Alliance, to name a few. An overarching principle should include sourcing food locally as practical, from within a 250-mile radius, by partnering with local farms, producers and distributors that are capable of consistently meeting the University's pricing, volume, quality and service standards.

In addition, BU Dining should continue to use the Green Restaurant Certification as a basis for internal restaurant certifications and on-going sustainability audits. The Green Restaurant Certification supports a Design for Environment strategy, as noted below, and further bolsters the University's effort to improve the sustainability of each dining operation. In December 2012, BU became the first University in the country to have 4-Star Certified Green Restaurants® (Fresh Food Company, Rize and Late Night Kitchen at Marciano Commons). Moreover, Boston University's Union Court at the GSU is the only Certified Food Court ® in the country with 3 stars.

Food Waste Reduction

Food waste reduction is the fundamental guiding principle for BU Dining Services. The principal approach to minimizing food waste at BU is aligned with the Environmental Protection Agency's (EPA) Food Recovery Hierarchy, which clarifies the most responsible means by which food should be procured, processed and subsequently rendered for reuse, donation, recycling or disposal.

BU Dining Services prioritizes waste reduction through a transparent food management process. The ultimate goal is to reduce risk and cost. The source reduction process includes controls and directives that guide the procurement, processing, production and service of food to students, faculty and staff. BU Dining employees receive robust training on purchasing, production standards, consistency, quality, portioning and post-production analysis.

Figure 2: EPA Food Recovery Hierarchy (Source: www.epa.gov/foodrecovery)

In addition, food is tracked through production and service from the moment a delivery is received to the point at which it is served to a customer or deemed as waste. A rigorous receiving program is in place to inspect incoming product to ensure the University is receiving the product it has paid for. After product is received, waste is tracked and analyzed at three points of the production process to better inform decision making, guide employee training and aid in forecasting and menu planning decisions. The three types of waste that are tracked over time and by production space and origin are: production, service, and storage waste.

Figure 3: Three Primary Types of Food Waste (Source: Aramark Higher Education)

Production waste is produced as a result of the menu preparation and production process (i.e. cores, stems, seeds, trim, etc.). Service waste is waste that has been transformed into a consumable product, but has not been served for a variety of reasons. These can be products that fall on the ground, have been unintentionally over cooked or have been overproduced. The last type of waste is storage waste. Storage waste is purchased product that has expired prior to production during the storage process. Tracking back of the house waste precisely and accurately ensures that BU Dining can better inform and improve consistency and repeatability throughout the purchasing and production process.

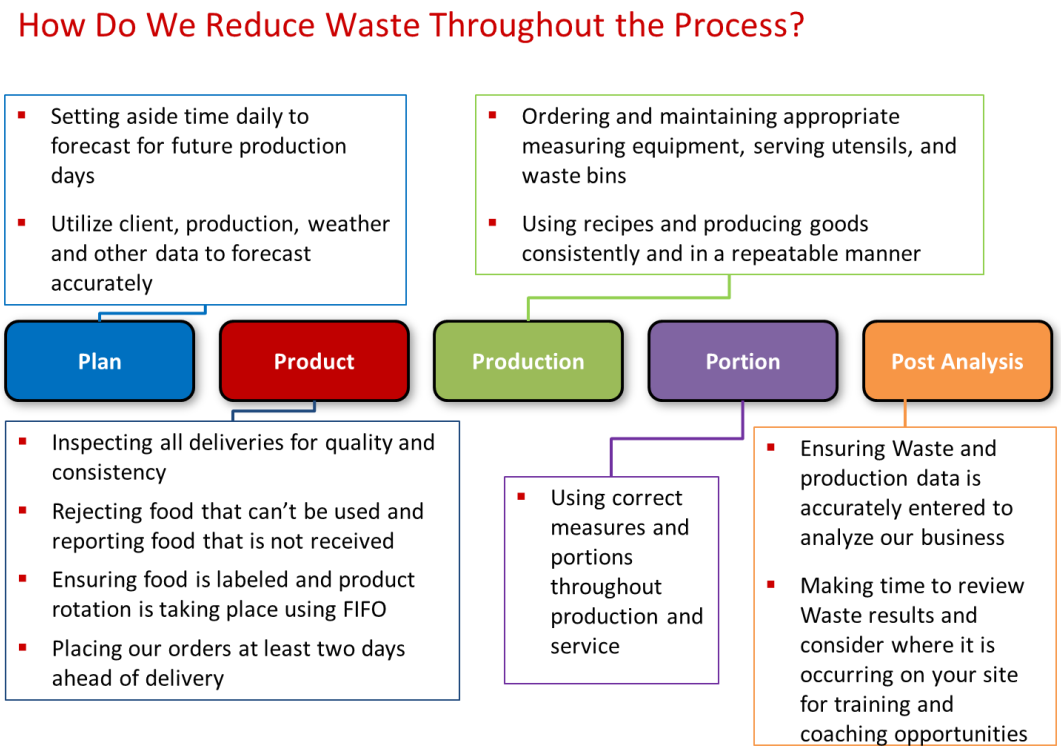

Figure 4: Waste Reduction Strategies (Source: Aramark Higher Education)

Following source reduction, any excess food is then repurposed and if safe under proper food safety controls, is donated to the University's food partner in support of underprivileged and undernourished communities in the greater Boston area.

After repurposing and food donation, food should be used if possible for animal feed or for industrial uses. All waste cooking oil at the University is rendered and recycled into either animal feed additives or biodiesel fuel. If animal use is not possible, all food organics are commercially composted for residential and commercial uses in New England.

Where We Want to Be

Food and Packaging Waste

Reducing food and packaging waste from the front of the house (FOH) represents both an opportunity and challenge for BU Dining. The introduction of tray-less dining in 2008 was a great step in reducing post-consumer food waste by approximately 33% (not to mention positive impacts on energy and water conservation). An April 2017 audit in two of three dining halls revealed that the average amount of food served that was not consumed by students was approximately 2.75 ounces per meal. Extrapolating that data utilizing the number of meals served in 2016 (2,983,199) equates to approximately 256 tons of organic waste annually, which represents approximately 23% of the organics rendered from BU. Clearly there is work to do.

Food-related Organics (2016)	**Material Type**	**Quantity**
Save That Stuff	Food Waste	736 tons
Waste Management	Food Waste & Biodegradable Packaging	362 tons
2016 Total Food-related Organics		1,098 tons

Figure 5. Food-relate waste.

Additional food waste audits are being scheduled in the fall of 2017 to confirm and track ounces of waste per meal over time and across all menu types. Moreover, BU Dining should enhance its communications and marketing to inform students, faculty and staff of practices that drive both negative and positive outcomes associated with food waste. Making zero food waste relatable and personal to drive active participation will be key to enlisting support from the entire community.

BU Dining should evaluate the implementation and feasibility of reusable to-go containers and reusable cups and mugs from a safety and sanitation, economic and environmental standpoint. In addition, BU Dining works proactively with suppliers, vendors and distributors to minimize the impact of single use packaging and transportation miles of the food and beverage supply chain. For example, working with suppliers to use reusable totes and packaging reduces incoming single use cardboard packaging.

As the commercial composting industry in New England evolves, BU Dining will need to align and continuously evaluate (via cost benefit analysis) all packaging for commercial processing capability and value. All compostable packaging should be composted and rendered for soil amendment, not landfilled to biodegrade with time or incinerated.

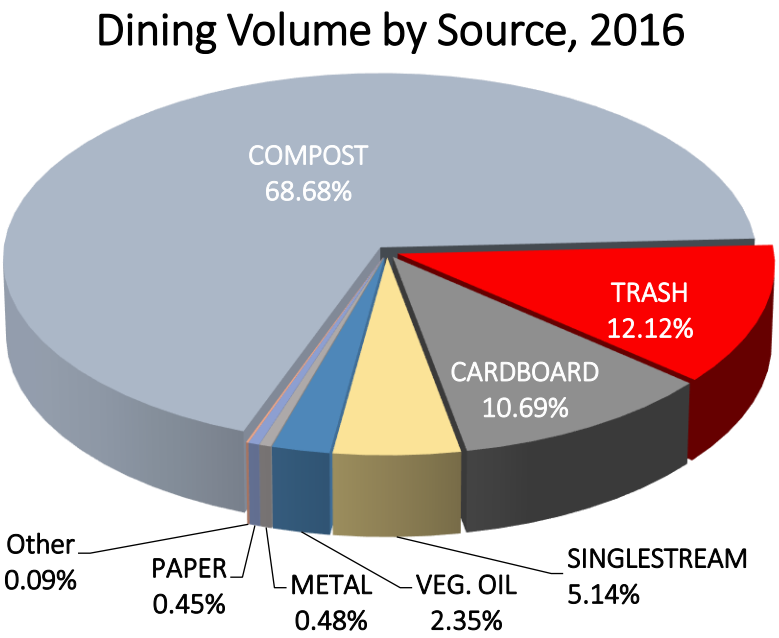

Figure 6: BU Dining Compost by Source Analysis for Fiscal Year 2016

The BU Dining composting effort diverted almost 88% of materials (as measured by weight) from incineration and landfill in fiscal year 2016. Continuing to meet and exceed this rate is essential to achieving an overarching goal of Zero Waste, which represents a diversion rate of 90% of materials from incineration and landfill.

Dining Facility Modernization

BU Dining facilities will require renovations and updates during the next 5-10 years. Design for Environment (DfE) is an approach created by the EPA in 1992 to reduce the overall human health and environmental impact of a product, process or service, where impacts are considered across the life cycle.

Figure 7: USC Teaching Garden. "The garden's output will be used in menu development for USC restaurants and residential dining." (Source: USC Sustainability News & Photo/Jorge Negrete/USC Design Studio)

Utilizing DfE strategies and Green Restaurant Certification to standardize facility planning and renovations will assist with cost containment and reduce environmental impact while positioning

the University as a progressive leader in food and beverage management. Having the proper infrastructure in place will support the execution of processing and production throughout the dining operation.

The goal for Zero Waste will need to become embedded within the dining operations at all locations on both campuses and the services offered through catering.

BU Dining should use life-cycle analysis during design development to assess all contributing impacts to a product or service from the original materials to delivery of the final product. For example, one idea expressed by the BU community and Task Force members is the creation of campus gardens to supply fresh produce to the dining halls. The potential for vertical or container gardens located on the Charles River Campus will require an academic sponsor to complete a study to assess if an environmentally sound model can provide meaningful academic research and an equally meaningful (and economically viable) supply of produce for BU Dining.

Life-cycle analysis can also support decision-making that simultaneously leads to reducing transportation emissions and energy demand. The installation of on-site anaerobic digesters (AD) within individual dining halls during planned renovations or locating a centralized AD unit on campus would not only reduce the volume of organic waste hauling, but also has the ability to produce energy.

Retail Carbon Credit Program (Introducing Soli)

In the fall of 2017, Boston University expects to announce an agreement with Soli Points to provide a carbon credit program through 23 retail dining and convenience store locations. Soli acquires validated and numerically quantified tons of carbon offsets and credits as sold in regulated markets to create Points under its patent (US 8,527,335). Soli makes carbon purchases directly from Cap & Trade auctions such as are conducted by the Regional Greenhouse Gas Initiative (RGGI) and the Western Climate Initiative, as well as jointly with The Adirondack Council (a not-for-profit with a focus on the environment). Acquired carbon tons are retired from use as allowances for utilities to generate emissions above desired thresholds, and in the process fractionalized into redeemable coupon points in 2 pound denominations. Soli is completely free to BU students, faculty and staff and registered participants will receive exclusive deals and promotions with the added benefit of reducing 2 pounds of CO2 for every dollar spent. The only required step for participants is to register a credit card used for purchases at University retail locations.

How to Get There

2018-2019

1. SUSTAINABLE FOOD SUPPLY: BU Dining has made a commitment to make 25% of all food local and sustainable by 2020 (utilizing AASHE STARS 2.1 criteria). Opportunities to increase the local and sustainable supplier network include leveraging regional crop yields and aggregating product among like institutions to create economies of scale.

Cost: $250,000 - $300,000 annually through FY19. Incremental food cost will be funded through BU Dining annual operating budget.

2. FOOD WASTE REDUCTION: BU Dining should prioritize post-consumer waste reduction though a transparent food management process that enhances communications to inform students, faculty and staff of habits that drive both negative and positive outcomes associated with decisions around food. The waste reduction process should include controls and directives that guide the procurement, processing, production and packaging of food with a focus on reducing food waste from the front of the house.
   Cost: $0 through FY19. Incremental expenses associated with ongoing dining waste audits and analysis are expected to be recouped through savings associated with waste reduction.

3. RETAIL CARBON CREDIT PROGRAM (Introduction of SOLI Points): SOLI is a loyalty app that is completely free to BU students, faculty and staff. Participants will receive the added benefit of reducing 2 lbs. of CO2 for every dollar spent. The carbon credit offsets are made on behalf of BU and will be used to lower the University's carbon footprint.
   Cost: $25,000 annually through FY19. Incremental cost is associated with projected transaction fees and will be funded through BU Dining annual operating budget. BU will receive carbon credit offsets in exchange for retail participation through 23 on campus dining locations as well as other retail affiliates.

2020-2025

1. DINING FACILITY MODERNIZATION: BU Dining facilities will require renovations and upgrades during the next 5-10 years. Utilizing the EPA's Design for Environment (DfE) approach and Green Restaurant Certification, BU Dining will seek to reduce the environmental impact of its products and services.
   Cost: Conceptual estimates of approximately $32 million through FY25. Capital costs for modernization of dining facilities are typically part and parcel of overall capital planning and such renewal projects have been historically funded through a combination of University capital expenditure commitments.

Waste Stream

Where We Are

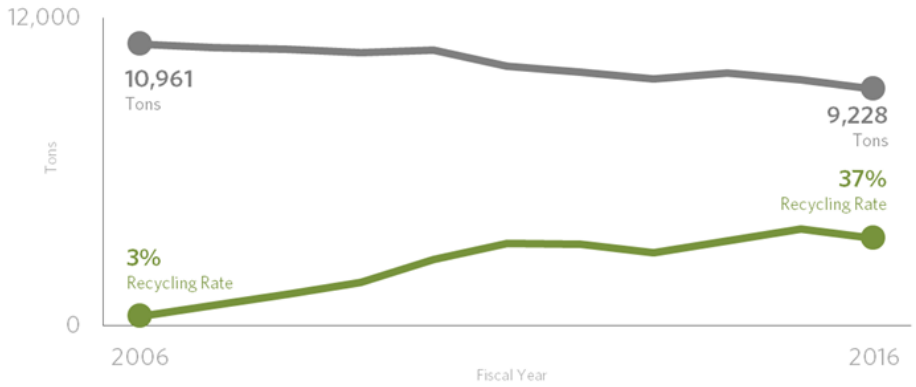

Figure 8. Boston University's progress in waste reduction and recycling over the past ten years.

In ten years Boston University reduced its waste by 16% and increased waste diversion from 3% in fiscal year 2006 to 37% by fiscal year 2016, when the University produced a total of 9,228 tons of solid waste, enough to fill Marsh Plaza to the roofs of its flanking buildings every three months. BU accounts for both campuses' waste which is categorized by: trash, recycling, organics, and donation. Trash is the component of the waste that is sent to an incinerator. Recycling includes paper, cardboard, bottles, cans, metal, vegetable oil, white goods, and electronics. Organics (compost) are categorized into food waste, yard waste, and animal bedding. Donation consists of furniture donation and the clothing and residential items collected through the Goodwill Not Landfill program during move out. Diverted waste includes recycling, organics, and donation as they are diverted from landfill or incinerator.

Waste data is obtained after it is hauled by BU's vendors and is provided in the form of monthly invoices, either through the vendor's direct weighing or through estimates based on a container-to-weight ratio provided by the vendor. While this is accurate and direct in large trash containers, the weight of a portion of BU's waste is estimated based on size of container and its assigned container-to-weight ratio. Given the advanced technology now available for data capture and storage, it is possible to improve data accuracy in real time and enable more robust management of the waste stream.

Over the past decade, initiatives by *sustainability*@BU, BU Dining, and Facilities Management & Planning have led to significant progress in the effort to reduce waste.

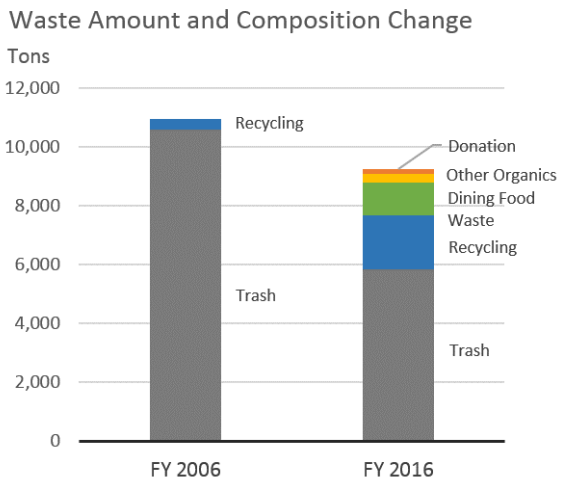

Figure 9. Waste reduction and diversion improvements.

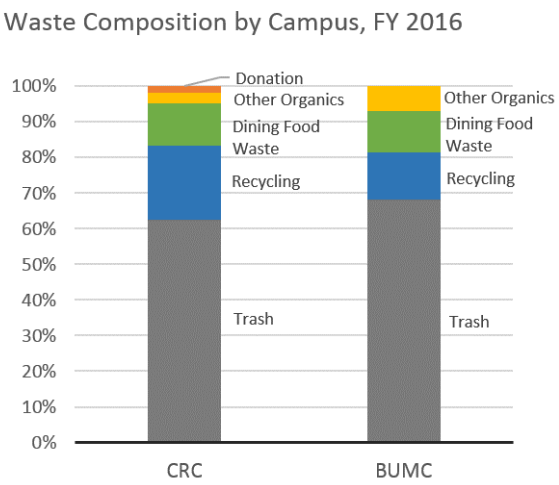

Figure 10. The diversion rates on the two campuses differ with the CRC at 37% and BUMC at 32% in FY2016. The diversion rate on BUMC becoming more aligned with the CRC as the TrashBuddy Program is also being rolled out on the BUMC.

Programs to address large sources of waste during the academic year have been implemented including cardboard recycling during move in and the Goodwill Not Landfill program during move out when students donate clothes, electronics and other goods they no longer need. Since its inception in 2011, the University has recycled 173 tons of cardboard during move in. If the boxes were flattened and stacked, they would reach ten times the height of Student Village II. During move out, students have donated a total of 596 tons of perfectly good stuff. At no cost to the University, Goodwill, founded by Rev. Edgar Helms, a BU alum, trucks these goods to its Boston facility where it is weighed and processed. These goods are sold in their stores with the proceeds supporting programs that provide exemplary job training and related services to help individuals with special needs and other barriers to self-sufficiency to achieve independence and dignity through work. This program benefits BU, Goodwill and the Greater Boston Community.

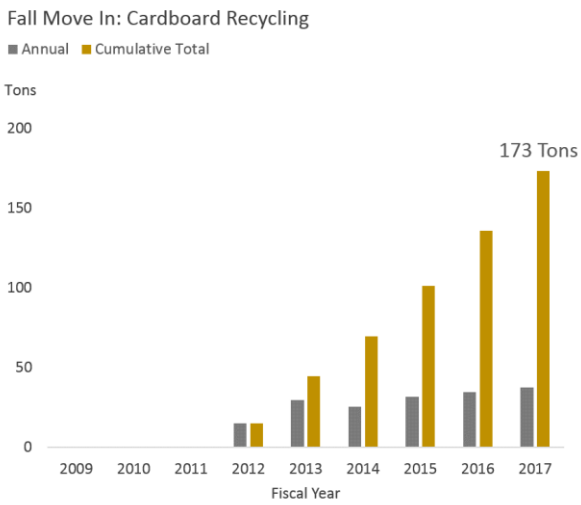

Figure 11. The collection of cardboard from students' moving in diverted 37.6 tons of waste in FY2016 -- more than 2.5 times the amount diverted in 2012, the year of the program's inception.

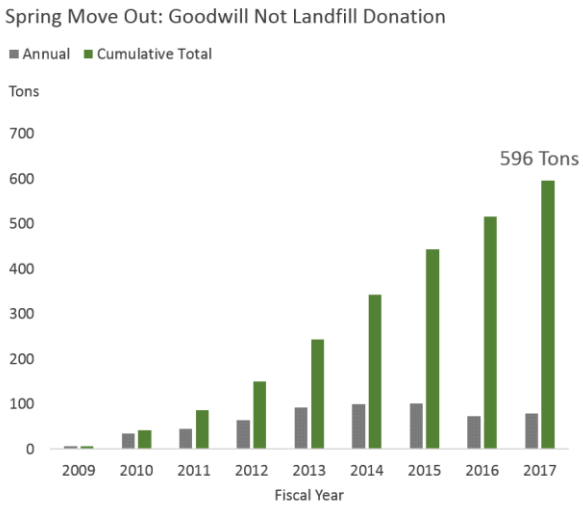

Figure 12. To date, 596 tons of waste have been diverted through the Goodwill Not Landfill program. From FY2010 to FY2017, an average of 74 tons are diverted each year.

At a cost for disposal of approximately $1,560,000/year, waste reduction provides an opportunity for cost reduction as well. While the GHG emissions associated with waste generation and disposal are difficult to quantify, it is clear that decreasing the volume of solid waste represents a mechanism for BU to reduce the size of its environmental footprint. Importantly, with proper planning and execution, this can be accomplished while saving fiscal resources over time. Over the past decade, initiatives by *sustainability*@BU, BU Dining, and Facilities Management & Planning have led to significant progress in the effort to reduce waste.

While reductions in waste and increased diversion have been impressive—and speak to the effectiveness of current sustainability initiatives at BU and to the improvements in Massachusetts recycling infrastructure—there is abundant opportunity for further progress. In FY **63%** of BU's solid waste (5,838 tons) went to off-campus incinerator facilities, with the resulting ash going to landfills. Over 90% of this solid waste can feasibly be diverted. Among our peers, BU is in the middle of the pack (6 of 13) in waste reduction and diversion based on STARS reporting.

Recycling is the first action that engages most people to move toward a more sustainable lifestyle. However, moving towards a significant reduction in solid waste requires implementation of the "5 'R's" of the Environmental Protection Agency's waste management hierarchy (figure 13). Waste reduction begins with source reduction and reuse even before enhanced recycling/composting, which lead to energy recovery and ultimately reductions in the required treatment and disposal of solid waste. If we intend to engage the BU community for action on climate, integrating robust waste reduction and recycling activities are central to a strategy for a comprehensive Climate Action Plan.

Figure 13. The EPA's Waste Management Hierarchy (https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy)

Where We Want to Be

At a broad level what is required of the University will be to establish a commitment to implementing an integrated approach to waste minimization and diversion that will improve the University's waste minimization and diversion efforts. The University should develop a more robust infrastructure to accommodate additional recycling and waste bins, as well as a behavioral change program to engage the Bu Community. Strategies other institutions have used to minimize waste and increase recycling rates include combinations of the following:

- Provide collocated recycling and waste receptacles only.
- Policies for online course materials, assignments, and testing to reduce printing.
- Provided paperless tools and workflows.
- Annual public waste audits as part of community education programs.
- Eliminating disposable to-go containers and tableware.
- Provide floor-by-floor recycling infrastructure as piloted at Warren to all the large dorms.
- Hand dryers in lieu of paper towel dispensers.

A Zero Waste Goal

A key component of the BU CAP should be the dramatic reduction of BU's waste output through participation in the Zero Waste certification process developed by the U.S. Zero Waste Business Council (USZWBC, see https://uszwbc.org/). Establishing a goal of Zero Waste has been shown to be an effective means to engage a community around an idea that generates action. Zero waste is defined as ***the diversion of 90% or more of non-hazardous waste from landfill and/or incineration***[6]. Zero Waste is increasingly recognized by businesses, cities & towns and academic institutions as a fiscally beneficial process to waste reduction and community engagement - a cornerstone of the culture shift necessary for the University to reduce its impact on climate change.

Given our current diversion rate of 37%, Boston University must increase solid waste diversion by 53% to achieve the Zero Waste goal of 90% diversion. Achieving a 90% diversion rate at an institution as large and complex as BU is an endeavor that will require time and concerted effort, and will best be undertaken in a step-by-step manner through the U.S. Zero Waste Business Council (USZWBC) certification process.

The USZWBC is the first and most highly-regarded third-party Zero Waste Facility Certification program for facilities that meet the Zero Waste Principles of the Zero Waste International Alliance (ZWIA). Under the auspices of the U.S. Green Building Council (USGBC), and together with Green Business Certification Inc. (GBCI), the USZWBC administers the Zero Waste Facility Certification program which provides a comprehensive verification of the Zero Waste achievements of institutions. The USZWBC has certified as Zero Waste a number of large businesses—including Microsoft, Toyota and Disneyland/Disneyworld—and is currently working to certify many colleges and universities in the U.S, including the University of California Berkeley, the University of Colorado, the University of Texas, and Georgia Tech.

Requirements for Certification are the following:

- Zero Waste policy in place
- 90% overall diversion from landfill and incineration for non-hazardous wastes
- Meet all federal, state/provincial, and local solid waste and recycling regulations
- Data provided to GBCI has been published formally
- Data documents a base year and measurements since the base year
- Commit to submit 12 months of data to GBCI annually
- Submit a case study of Zero Waste initiatives that can be published on the GBCI website
- Contamination is not to exceed 10% of each material once it leaves the site

An overview of "Certification Categories and Points" is provided in the table below.

- [6] "Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use.
- Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.
- Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health"

  -*Zero Waste International Alliance* (ZWIA)

From: www.uszwbc.org

Zero Waste Scorecard Categories & Points

Facility Totals (Pre Certification Estimates)			Points
Bronze: 31-37 points Silver:38-45 points Gold: 46-63 points Platinum 64-80 points			80
Overview of Categories & Points			
Redesign	4	Leadership	6
Reduce	7	Training	7
Reuse	7	ZW Analysis	5
Compost (Re-earth)	7	Upstream Management	4
Recycle	3	Hazardous Waste Prevention	5
ZW Reporting	4	Closed Loop System	4
Diversion (Min 90%)	5	Innovation	3
ZW Purchasing	9	Total Points	80

How to Get There

While the ultimate goal should be for full Zero Waste Certification of Boston University as an institution, this is neither fiscally nor logistically feasible on an immediate timescale. Instead, a sequential timeline for certification of individual facilities, buildings, programs and Schools should be approved and implemented. In addition to clear feasibility benefits, an advantage of this approach is that certification of individual sites will spur movement toward Zero Waste goals at other sites across the University.

2018-2019

BEGIN THE PROCESS FOR ZERO WASTE CERTIFICATION. This process will require the following specific actions to be taken by the University:

- Hire a dedicated Zero Waste Manager tasked with the implementation and promotion of the Zero Waste strategy and projects University-wide.
- Identify 3-4 sites at that will seek Zero Waste Certification. For example:
    - 100 Bay State Road Dining
    - Warren Towers
    - Classroom building
    - School of Public Health
- Waste audits before and at appropriate intervals consistent with certification.
- Register with USZWBC for Zero Waste Certification Advisory Site visit by USZWBC personnel
- Negotiate a Zero Waste contract with a waste/recycling vendor or vendors
- Develop a plan with Sourcing & Procurement to incorporate Zero Waste purchasing guidelines into negotiations and contracts with vendors and service providers.
- Implement construction and demolition waste diversion that meet LEED

criteria.

- Require real time, cloud-based waste and recycling data collection at the container level to report volume and weight to reduce pickup frequency, improve data accuracy, and systems management.
- Provide space, containers, and equipment as necessary to implement the program and integrate with guidelines for new construction.

Cost: $150,000 - $300,000 annually through FY19.

2020-2022

ACHIEVE ZERO WASTE CERTIFICATION FOR INITIAL SITES.

- Achieve Zero Waste Gold Certification for initial "prototype" sites. Publicize this across the University.
- Identify the next sites that will seek Zero Waste Certification and embark on the same process, making improvements as learned from prototype locations.
- Consider which other sites will seek Zero Waste Certification and establish a timeline for certification of the entire University.

Cost: $150,000 - $300,000 annually through FY19.

2030

BOSTON UNIVERSITY IS A ZERO WASTE INSTITUTION

Cost: $150,000 - $300,000 annually through FY19.