FutureVU SUSTAINABILITY

VANDERBILT UNIVERSITY

ZERO WASTE MASTER PLAN

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EXECUTIVE SUMMARY

In September 2015, Vanderbilt embarked on a strategic planning process FutureVU[1] to create a holistic and sustainable long-term vision for the physical development of the campus over 20 to 30 years. Emphasis was placed on green spaces, connectivity, inclusion and sustainability. On Earth Day 2019, Vanderbilt publicly declared a Carbon Neutrality goal[2] and net positive energy goal for Scope 1, 2 and 3[3] greenhouse gas (GHG) emissions along with specific actionable steps to reach these goals by 2050, illustrated in Figure 1.

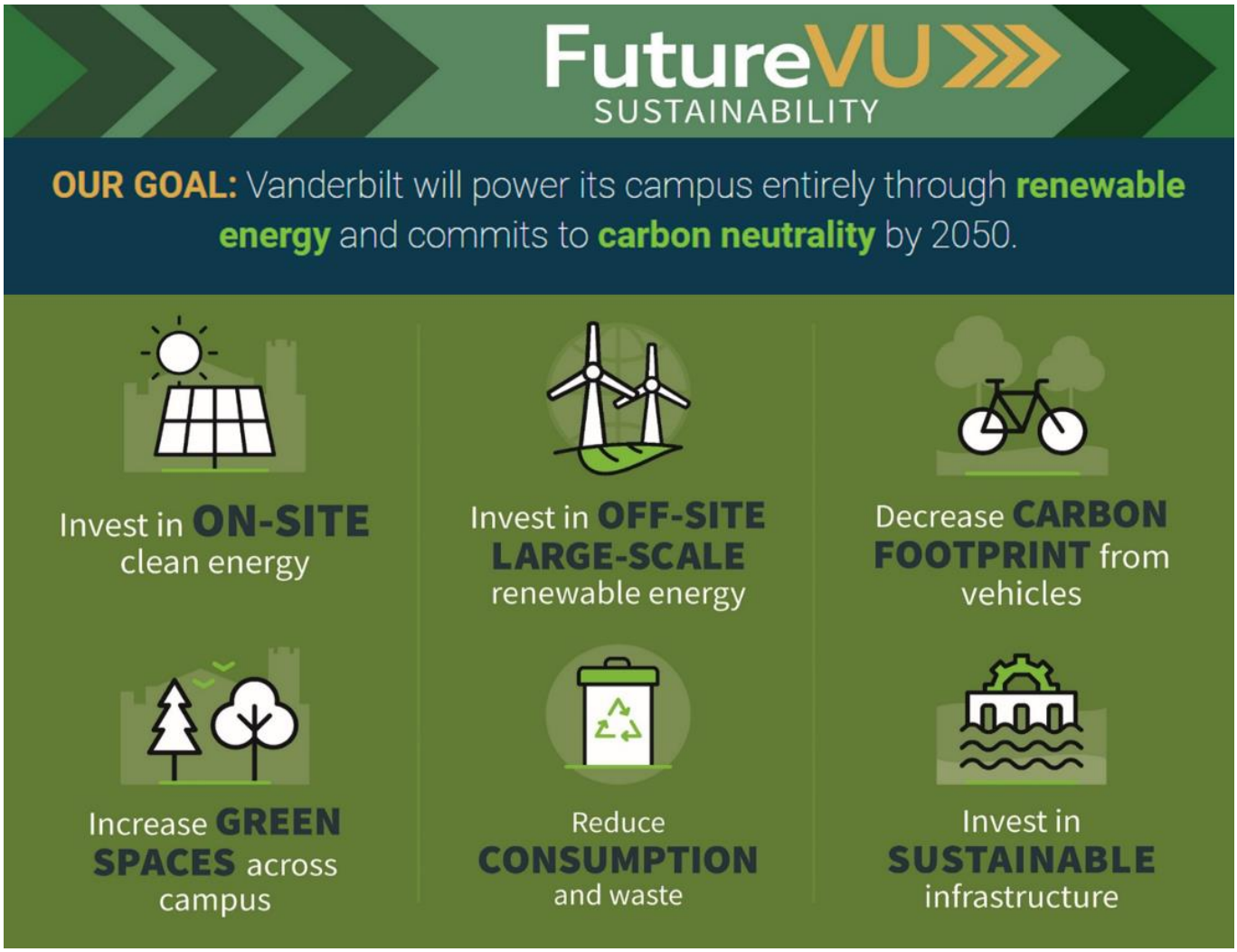

Figure 1: Vanderbilt's carbon neutrality goal and actions, 2019

[1] https://www.vanderbilt.edu//futurevu/plandocuments/
[2] https://www.vanderbilt.edu/sustainability/2019/04/vanderbilt-outlines-major-plans-to-reduce-environmental-footprint/
[3] https://www.vanderbilt.edu/sustainability/annual-sustainability-report-2017/

FutureVU's Guiding Principles were developed with extensive input and feedback from the Vanderbilt community and have been used to guide all planning efforts. The full text can be found at this link. In brief, these principles state[4]:

Vanderbilt is an internationally recognized research university with strong partnerships among its schools	Placement of functions core to VU's mission; Fostering trans-institutional collaboration and research; Careful placement of academic buildings
Vanderbilt believes that diversity and inclusion are integral to its mission	Embracing diversity and inclusive through careful space design; Promoting a community environment; Reviewing accessibility of current and future designs
Vanderbilt is a community of neighborhoods	Expand the social infrastructure of the Vanderbilt community; Improving the connectivity between neighborhoods
Vanderbilt is a historic, multi-layered and vigorous campus	Strengthen Vanderbilt's unique campus character; Remain sensitive to resources and history
Vanderbilt is a university that resides in a unique and distinctive park setting	Preserve, strengthen and expand Vanderbilt's unique character
Vanderbilt is a walkable and sustainable campus	Emphasize Vanderbilt's walkable campus and enhance the connectivity of all areas of campus; Achieve highest standards of sustainability through environmental, social and economic responsibility
Vanderbilt is a citizen of Nashville and the region	Contribute to the intellectual and cultural life of the region, and promote sustainable behavior and practices

The FutureVU strategic planning process has evaluated four key facets to address Vanderbilt's carbon footprint through extensive study: the BlueSky Energy Vision Study[5], The Renewable Energy Study[6], the Transportation Demand Study[7] and this Zero Waste Study.

This Zero Waste Study and Master Plan has been developed by the Zero Waste Advisory Committee (the Committee) to address the portion of Scope 3 emissions related to waste disposal and recycling and to help progress towards Vanderbilt's carbon neutrality goal. The master plan aligns with FutureVU Sustainability Guidelines[8]. Of Vanderbilt's Scope 3

[4] https://www.vanderbilt.edu/futurevu/framework/
[5] https://cdn.vanderbilt.edu/vu-wp0/wp-content/uploads/sites/69/2019/05/20111538/20190502_VU_BlueSky_ExecSummary_Accessible.pdf
[6] https://www.vanderbilt.edu/sustainability/lsre/
[7] https://www.vanderbilt.edu/futurevu/mobility/
[8] https://cdn.vanderbilt.edu/vu-wp0/wp-content/uploads/sites/289/2019/07/29154341/FutureVUSustainabilityGuidelines.pdf

emissions, waste is responsible for 4,683 metric tons of CO2 equivalent (MTCO2E) or 3 percent of the total GHGs that Vanderbilt emitted in FY2017-18 as shown in Figure 2.[9]

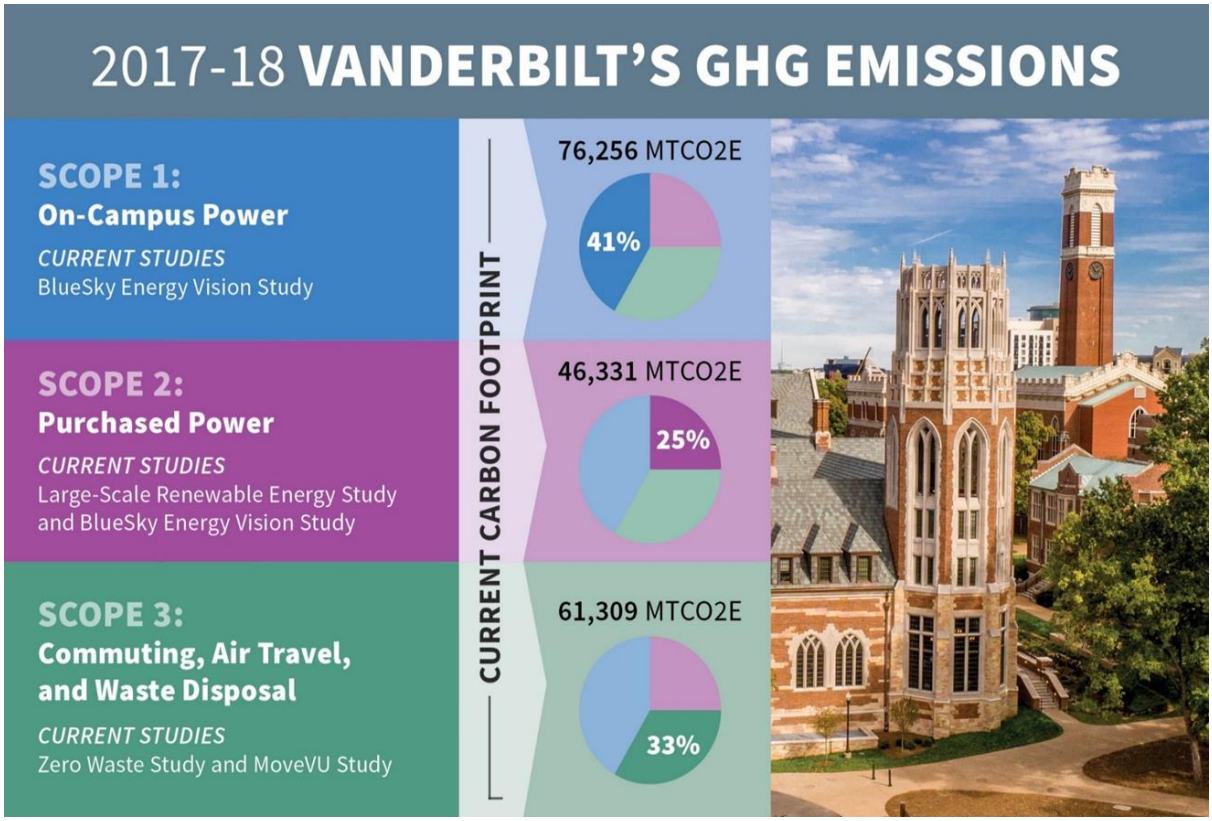

Figure 2: Vanderbilt's FY17-18 GHG emissions by scope

Vanderbilt's 30-year history of recycling has expanded in recent years to include food and material waste reduction. The Zero Waste Master Plan continues this forward progress to attain a higher standard of waste prevention, reduction, reuse and diversion. Zero waste is defined by the U.S. Green Building Council (USGBC) as at least 90 percent diversion from the landfill, but it is much more than that. The zero-waste hierarchy as discussed in Figure 3 includes:

- **Redesign** – avoid purchasing products/materials or redesign processes or spaces to reduce material use and provide use flexibility.
- **Reduce** – reduce existing waste streams. If waste is not created, the greenhouse gas (GHG) emissions and cost associated with that waste will not occur.
- **Reuse** – find new ways to reuse or upcycle materials instead of recycling or disposing of them.
- **Divert** – recycle and compost waste streams when possible to divert waste from the landfill.
- **Landfill** – landfill remaining waste as the last option.

[9] Vanderbilt Annual Sustainability Report, 2017, https://www.vanderbilt.edu/sustainability/annual-sustainability-report-2017/.

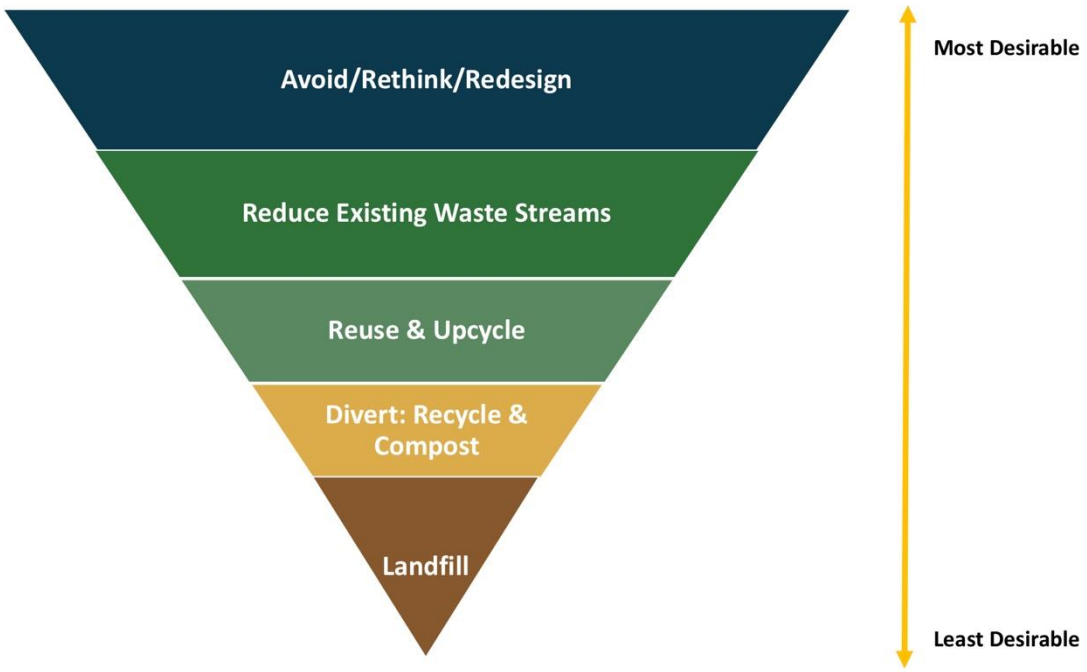

Figure 3: Vanderbilt's waste management hierarchy prioritizes avoiding waste and rethinking/redesigning processes over sending waste to the landfill.

Such a strategy also benefits Vanderbilt's triple bottom line by reducing purchases, waste-related greenhouse gas (GHG) emissions and VU's environmental impact. The amount of solid waste sent to landfills in the U.S. is approximately 4.5 pounds per person a day[10], almost three times the 2016 global average of 1.6 pounds[11]. This waste leads to an increase in landfill gases, which are responsible for 18 percent of all human-induced atmospheric methane, a greenhouse gas with 25 times more global warming potential than CO_2. To support Vanderbilt's goal of carbon neutrality by 2050, Vanderbilt has created this Zero Waste Master Plan to positively influence the GHG impacts of both operational waste and construction waste.

Advisory committee

The Committee was convened in November 2018 and charged with developing the Zero Waste Master Plan. The Committee focused on ensuring that the plan supports Vanderbilt's carbon neutrality goals, aligns with Metro Nashville's new zero waste strategy, and builds a culture of reducing consumption and waste. The Committee included 55 stakeholders from Purchasing Services, Office of the Vice Chancellor for Administration, Dining, Facilities, Athletics, Dean of Students, Commencement, Events, Graduate schools, faculty and student groups.

The Zero Waste Master Plan process began with the Committee being asked to respond to the following questions:

[10] USEPA, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials

[11] https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management

- ✓ How ambitious do we want to be? What should our goals be and when would we want to achieve them?
- ✓ What do you see in each of these areas that could be improved?
- ✓ Where are the barriers to waste reduction or recycling within each group, area or department?
- ✓ What waste reduction or reuse practices in your areas could others copy (best practices)?
- ✓ What peer programs might we emulate?
- ✓ How do we build a new culture of zero waste at Vanderbilt?

The Committee explored what is meant by zero waste as well as examples from Metro Nashville's solid waste master planning process and from peer universities. Many campuses across the U.S. have set goals for zero waste, which is defined as 90 percent diversion of waste from the landfill[12], and for waste reduction. The Committee reviewed historical trend data about Vanderbilt's past diversion and waste generation rates. Vanderbilt has averaged an improvement of 5 percent annually for the past decade for waste diversion (recycling) but waste generated has increased an average of 12 percent annually since 2012 (see Figures 5 and 6).

Zero waste master plan

Based on past data, the Committee recommended that the university consider the following two goals, along with two supporting actions:

GOAL 1: Achieve Zero Waste (90% diversion rate) by 2030
GOAL 2: Achieve 30% waste generation reduction from 2017 levels by 2030

Supporting Actions:

- End institutional single-use plastic purchases by 2025, except in laboratories*; and
- Expand food waste collection to include all dining areas and residential halls by 2025

* Laboratories are exempt due to lack of available alternatives and safety concerns.

The Committee also examined current waste streams, waste generation activities, existing strategies, challenges and opportunities for improvement throughout campus. Data and feedback were gathered from almost 100 stakeholders through a series of meetings with various groups from across the university. This plan contains suggested paths for reducing or eliminating waste streams, increasing diversion rates with more recycling and food waste collection and reusing or repurposing specific waste streams. Strategies for outreach and education are also included.

[12] GBCI True Zero Waste, https://true.gbci.org/true-zero-waste-certification-program

VANDERBILT WASTE SYSTEM OVERVIEW

A. *Waste generation and diversion history*

In 1990, Vanderbilt University began actively reducing waste through recycling. Formally established in 1992, the Vanderbilt University recycling program has grown through the active involvement and participation of the student body, staff and faculty. The program was initially under the guidance of the Resource Conservation Advisory Committee, a forum for student leaders and Vanderbilt faculty and staff. In 2002, Vanderbilt Recycles was established as a student-led organization. In 2004, the organization was renamed Students Promoting Environmental Awareness and Recycling, and in 2008, changed its name again to Students Promoting Environmental Awareness and Responsibility (SPEAR). SPEAR partnered with Facilities Plant Operations, the Sustainability and Environmental Management Office (SEMO), the former Student Government Association (SGA) and the former InterResidence Hall Association's (Interhall) environmental committees to actively promote existing environmental awareness programs and to develop and implement new initiatives. SPEAR now continues to work with student government in its current form, Vanderbilt Student Government (VSG), but no longer manages or staffs the Vanderbilt recycling program.

Facilities Plant Operations became fully operationally responsible for the University's recycling program in 2008, providing building recycling services to campus staff, faculty and students and managing special event recycling such as athletic games and move-in/move-out.

Vanderbilt University is home to over 12,000 full- and part-time students and employs more than 6,000 faculty and staff. With such a large community, Vanderbilt generates large quantities of waste daily, which is discussed in detail below. Vanderbilt faculty, staff and students are encouraged to find ways to reduce waste and recycle to reduce the institution's impact on the environment.

Materials from campus to be recycled are collected first by Facilities Plant Operations, and then by vendors and taken to a recycling center where they are sorted, cleaned and processed into new materials. Recycling has several benefits at Vanderbilt. Fiscally, it costs the university more money to dispose of a ton of garbage than it does a typical ton of recycling. Also, Vanderbilt earns rebates for many of its recyclable goods, which help pay for the recycling program. Civically, recycling is a responsible way to keep the landfill in our area from filling up, which is considering worsening concern as Metro Nashville does not have a landfill and the nearby Middlepoint landfill in Rutherford County is scheduled to close in 2027 or 2028[13]. Environmentally, it helps protect the finite resources of our planet.

[13] https://www.tennessean.com/story/news/2019/04/22/nashville-recycling-middle-point-landfill-rutherford-county/3505677002/

Between 2007 and 2017, Vanderbilt's recycling poundage increased almost 42-fold to 10,432,000 pounds and Vanderbilt's diversion rate was 47 percent. In addition to recycling programs, Vanderbilt has developed several surplus programs to encourage reuse and

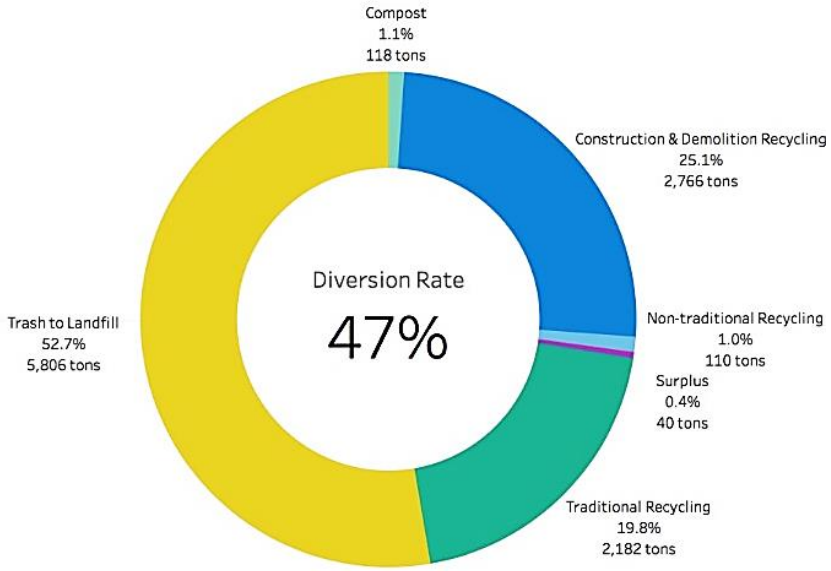

Figure 4: Breakdown of waste and material recycling streams in CY17[14] [15]

upcycling of used furniture and other items. The Vandy FreeSwap program allows Vanderbilt students, faculty and staff to post free usable, unwanted items on Vanderbilt Classified, rather than throwing them in landfills. The VU ReUse program repurposes Vanderbilt furniture and equipment for reuse on campus or donation to local nonprofits.

A portion of construction and demolition waste (C&D waste) is also recycled during building projects. The current recycling rate of C&D waste from construction and renovation projects varies from project to project but is within a range of 40 percent up to 75 percent or more for LEED projects.

Additional waste reduction efforts are underway by various groups across campus. For example, the Vanderbilt Child and Family Center (VCFC) is reducing waste through creative reuse of materials, limiting one-use packaging for snacks and drinks, and evaluating other ways to eliminate waste streams. This year, Commencement used 20 percent fewer single-use water bottles and has plans to eliminate even more in future years. Several other significant initiatives already underway in Dining, Printing and Purchasing, as well as SEMO's education and outreach, are discussed in section B.

[14] Annual Sustainability Report, FY2017-2018, Vanderbilt Sustainability and Environmental Management Office, https://www.vanderbilt.edu/sustainability/annual-sustainability-report-2017/
[15] Chart includes numbers from Vanderbilt, Vanderbilt Real Estate and C&D Waste streams

1) Waste generation

In 2018, Vanderbilt's per capita annual waste generation, including landfill trash and recycling and excluding C&D waste, was 660 pounds or 1.8 pounds per day, which is substantially lower than the national average of 4.5 pounds per day per person.[16] However, waste generation on campus, including both trash and recycling, increased an average of 12 percent per year from 2012 to 2017. Vanderbilt was able to reverse this trend in 2018 with a reduction of 354,000 pounds, or 2.7 percent.

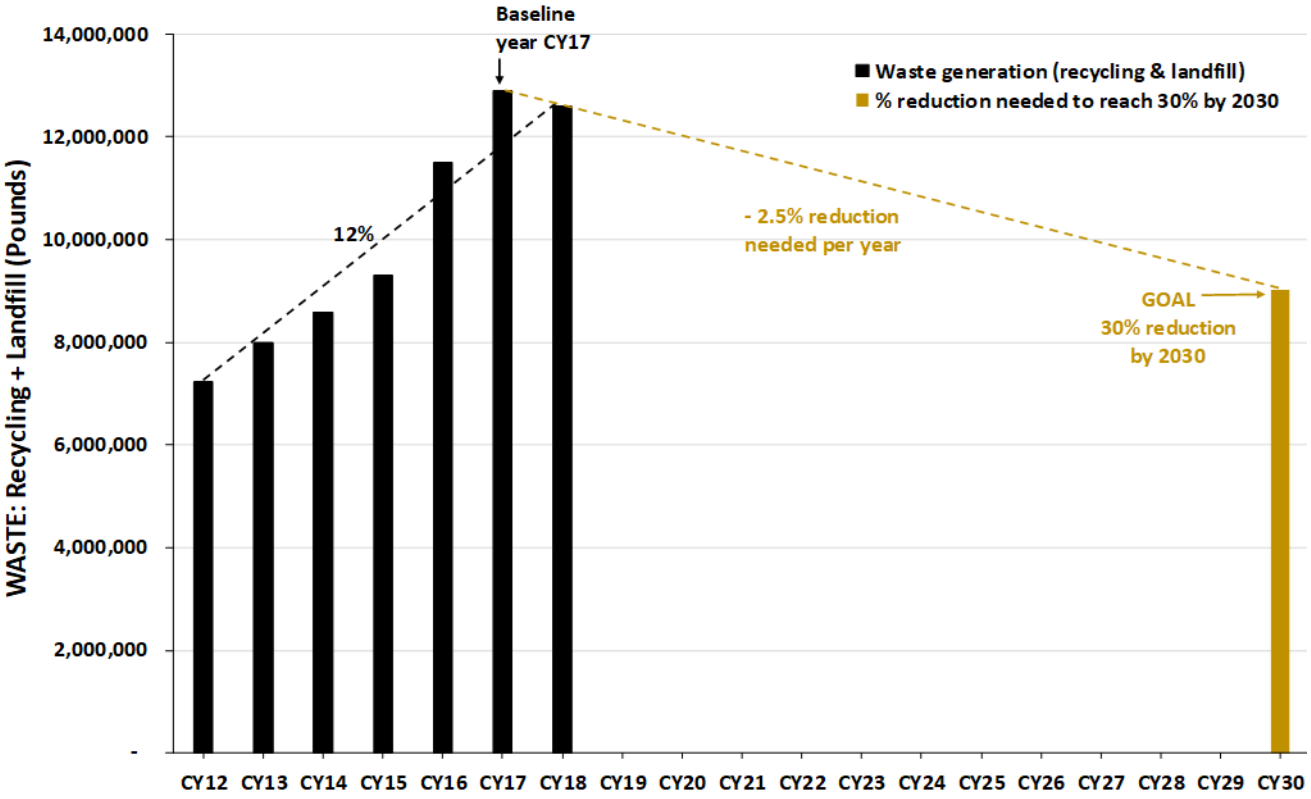

Figure 5: Vanderbilt main campus and real estate annual waste generation (recycling and landfill trash) trends[17]

2) Waste diversion

Waste diversion (recycling rate) has been increasing yearly by 5 percent, with a combined diversion rate of 47 percent in CY17, including both traditional material and Construction & Demolition (C&D) waste recycling. Continuing this 5 percent per year improvement trend would allow Vanderbilt to achieve 90 percent diversion by 2030.

[16] USEPA, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials

[17] This data is for Vanderbilt main campus and Vanderbilt University Real Estate landfill waste and recycling, not including construction and demolition waste.

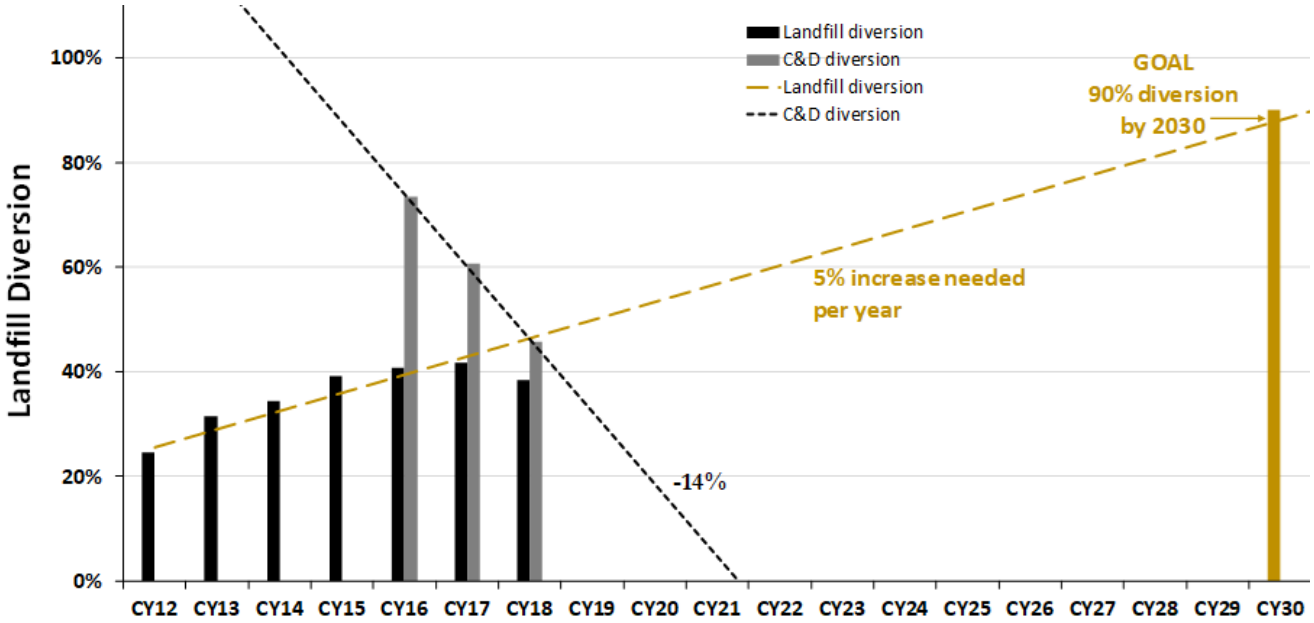

Figure 6: Vanderbilt waste diversion trends

C&D waste diversion has been decreasing by 14 percent over the last two years. A portion of this decrease is due to two large building demolitions that have occurred in this period, generating a larger volume of non-recyclable materials.

B. *Existing approaches to waste, diversion, recycling, food waste collection and reuse*

1) Dining

Vanderbilt Campus Dining offers numerous sustainable food choices to Vanderbilt students, employees, and campus visitors. Campus Dining is a member of the Menus of Change University Resource Collaborative (MCURC), a working group of leading scholars, food service business leaders and executive chefs from invited colleges and universities who are accelerating efforts to move Americans toward healthier, more sustainable, plant-forward diets. The MCURC principles of healthy, sustainable menus provide guidance to campus dining menus. In 2019, Vanderbilt Dining initiated a MCURC advisory committee with three working groups: Single Use Plastics Elimination Working Group, Food Waste Reduction Working Group and a Community Garden Working Group.

Vanderbilt Dining has recently implemented the following major waste reduction efforts:

- Eliminated plastic straws, lids and bags.
- Transitioned all to-go cups, plates and cutlery to compostable in Vanderbilt Dining facilities.
- Planned to add dish room at Kissam in Fall 2019 to support the conversion to reusable dishware and to-go containers.
- Started to phase out plastic bottles throughout Dining operations and Commencement in AY19-20 by reducing amount of plastic water bottles used at

Commencement in Spring 2019 and removing all plastic water and soda bottles from markets in Fall 2019.

- Increased hydration stations around dining centers over summer 2019 to support reusable water bottle usage.
- Provided a free reusable water bottle to all undergraduate students in collaboration with the Green Fund.
- Formed a "Single use plastics elimination" working group and will begin single-use water and soda bottle phase out in Fall 2019.
- Implemented Fusion menu management system and food production processes, which allow Campus Dining to only buy what they will use, thereby reducing food and transportation waste at the source.
- Partnered with Vanderbilt football player, Mo Hasan, to donate unused food to Second Spoon Food Truck, which then distributes the food from the truck to those suffering from hunger.
- Removed meal periods, modifying when and how students use their meal plan, ultimately reducing food waste by introducing more choice and flexibility.

Campus Dining, Plant Operations and SEMO implemented a new food waste collection program in 2017 to collect food waste generated across Dining operations and bring it to a food waste collection site to be converted into organic materials. In 2018, Vanderbilt University and Vanderbilt University Real Estate combined generated 4281 tons of trash, of which roughly 15 percent or 642 tons was food waste. 143 tons of Vanderbilt's food waste was composted in 2018, which means that in the first year of Vanderbilt's composting program, approximately 22 percent of Vanderbilt's total food waste was captured and composted. Food waste collection locations currently include back of house areas at dining facilities. Post-consumer food waste is also being collected at the McGugin Center, Rand Hall, Commons Center, E. Bronson Ingram College and McTyeire Hall.

Several other programs are helping Vanderbilt better manage food waste:

- **The Organic Refuse Conversion Alternative (ORCA)** machine at Rand aerobically digests food wastes from kitchen food prep.
- **A pulper at the Commons Center** removes and collects solid material from the wastewater stream so it can be diverted to compost instead of going to wastewater or landfill.
- **LeanPath**. All pre and post-consumer waste is weighed using Lean Path system which records the information in a cloud base system allowing for department wide analytics and waste analysis.
- **Mayor's Food Saver Challenge**. Vanderbilt joined this challenge in December 2018. The Mayor's Food Saver Challenge's goal is to reduce the amount of food sent to Middle Tennessee landfills, while helping to relieve hunger by donating wholesome, edible food to local nonprofits serving over 100,000 food-insecure residents in Davidson County. Priority is on food saving practices and waste prevention. As a participant, Vanderbilt agreed to implement the following five food-saving practices and report progress every 6 months:

- Adopt new practices for food purchasing, storage and right-sized cooking quantities to minimize waste – Dining is implementing LeanPath software.
- Engage staff through training on food waste reduction and food donation and through recognition of staff innovations in reducing food waste.
- Educate consumers by participating in the Save The Food campaign.
- Set up a donation partnership with a local charitable donation and make and track regular donations – Dining's "Donate a Side" program.
- Donate or sell food scraps for animal consumption – Leftovers from Commencements' Strawberries and Champagne are donated to Walden's Puddle and Nashville Zoo each year.

2) Printing services

Many sustainable printing options are now available to the Vanderbilt community through VU Printing Services. These include post-consumer waste recycled-content papers, papers certified by the Forest Stewardship Council (FSC), vegetable-based inks, papers processed without chlorine, and products made with renewable energy.

Printing Services debuted a new operating mission and strategic plan in 2015 with an expanded emphasis on environmental stewardship. In collaboration with SEMO, Printing Services also earned Forest Stewardship Council chain-of-custody certification and offers FSC certified printed products.

The Vanderbilt CampusPrint initiative is the new university program for document management. This initiative leverages industry-leading technology to support institutional goals around sustainability and resource stewardship, while supporting operational needs. This new fleet copier/printer program provides several benefits to Vanderbilt University departments, including:

- On-demand printing.
- Campus-wide access, giving you the ability to send and release your print job at any CampusPrint-enabled device.
- Energy-efficient machines stocked with environmentally friendly FSC® certified paper.
- Multi-function devices, combining copy, print, scan, and fax (most devices) in one machine.

3) Purchasing and payment services

The Vanderbilt University green purchasing program was developed to assist Vanderbilt staff and faculty in finding alternative products and services that are more sustainable, whenever possible. This is a useful tool to assist those making purchasing decisions to factor in environmental and social considerations along with price, availability and performance criteria. Looking at alternatives to traditional purchases with the green purchasing program can potentially reduce the university's environmental impact.

Specifically, the program helps purchasers gather information on more sustainable alternatives where possible within the following product categories:

Ongoing consumables

- Office supplies
- Food & beverages

Durable goods

- Office, IT & AV equipment
- Lab equipment
- Landscape & maintenance equipment
- Residential & office appliances
- Furniture & furnishings
- Vehicles

The green purchasing program helps university purchasers assess product performance regarding environmental and human health impacts. Preference under this program is given to products composed of low-emitting, non-hazardous chemical ingredients that demonstrate reduced carbon footprints through life-cycle assessment. The program also tries to increase the use of manufacturers and vendors that demonstrate sustainable and socially responsible corporate practices. Products currently used in university laboratories do not always have sustainable alternatives for a variety of reasons. The intent of this program is to assist in making more sustainable purchasing decisions wherever it is possible across university departments.

4) Education and outreach

Campus engagement, education and outreach is a key component of the sustainability program at Vanderbilt. Many studies have shown that a 10-15 percent improvement in resource conservation can result just from low-cost education and outreach programs. The graphic below illustrates the annual number and reach of sustainability-related stories, MyVU articles, events, educational workshops and classes, social media outreach, and student internships by the Sustainability and Environmental Management Office and other partners across campus.

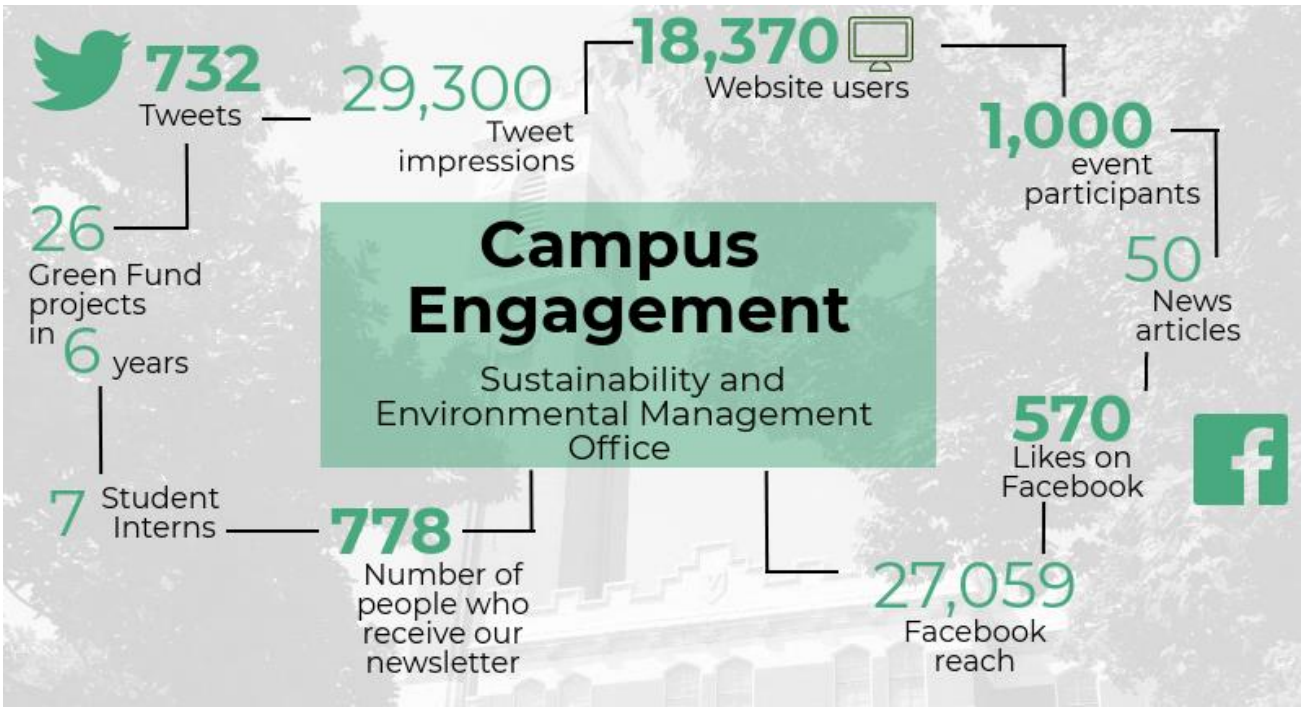

Figure 7: Vanderbilt University sustainability report campus engagement summary

RECOMMENDATIONS AND GOALS

The Committee developed potential waste and recycling-related goals to support achieving carbon neutrality by 2050.

A. *Recommendations*

The Committee advises that the university adopt the following:

GOAL 1: Achieve Zero Waste (90% diversion rate) by 2030

Diversion rate was 47 percent in 2017 with an average increase of 5 percent per year since 2012. Projecting a continued 5 percent diversion rate improvement will yield 90 percent diversion in 2030, excluding Construction & Demolition (C&D) waste.

GOAL 2: Achieve 30% waste generation reduction from 2017 levels by 2030

Waste generation has been increasing since 2012, a trend Vanderbilt began to reverse in 2018 with a 2.7 percent reduction. The university would need to continue reducing waste generation by 2.5 percent per year to achieve a 30 percent reduction by 2030.

Supporting Actions:

- End institutional single-use plastic purchases by 2025, except in laboratories*; and
- Expand food waste collection to include all dining areas and residential halls by 2025

* Laboratories are exempt due to lack of available alternatives and safety concerns.

Data collection systems will need to be developed to measure achievement of these goals.

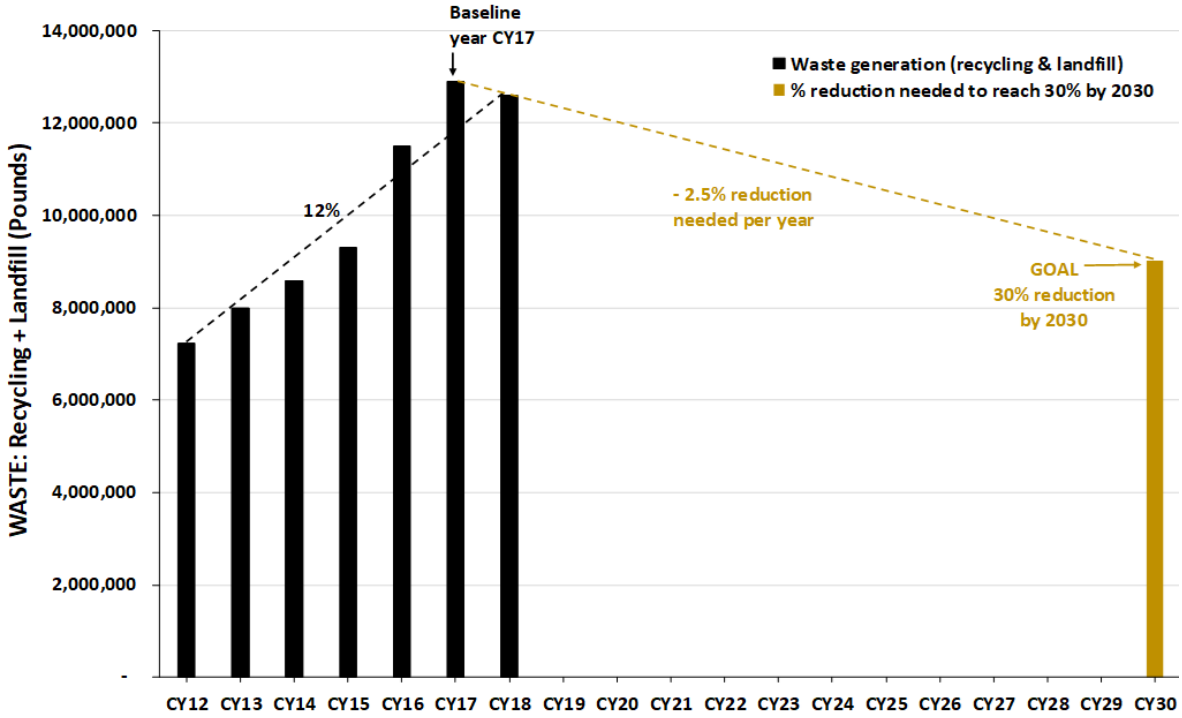

Figure 8: Vanderbilt main campus and real estate annual waste generation (recycling and landfill trash) trends

B. *Specific recommendations to meet goals*

In order to understand the full range of potential ideas and strategies, the Committee was organized into functional areas of the Vanderbilt community. These functional areas included:

- Student/residential housing, including student orgs and Greek life
- Dining/retail
- Academic spaces (classrooms, offices, research and teaching labs etc.)
- Events
- Commencement
- Purchasing
- Facilities (construction, housekeeping, grounds, staff offices)

Each functional area had a team leader, and teams were asked to engage in brainstorming sessions to develop area-specific recommendations covering the following opportunities for improvement:

1) Recycling and waste infrastructure process improvements;
2) Material tracking, adaptability, and reuse;
3) Reduction of waste streams and sustainable substitutes;
4) Reduced and sustainable purchasing;
5) Education and outreach; and
6) Data tracking and reporting.

The group of resulting strategies, outlined under each functional area below, are meant to encourage discussion, collaboration, innovation, and creativity in departments around the university. Not all strategies will be useful for every department. As such, each department should arrive at a group of strategies that are workable and assist the university with attaining improved sustainability and waste reduction over time working towards carbon neutrality by 2050.

1) Recycling and waste infrastructure and process improvements

The Committee identified specific ways in which recycling, and waste infrastructure and processes could be improved.

Food waste collection

Vanderbilt has already made strides in starting a food waste collection program at dining locations. Work needs to continue to expand food waste collection to other areas of the university such as residence halls, at sporting events, in other academic buildings that hold events, and in on-campus food establishments not under Campus Dining, including Grins, Suzie's and Frothy Monkey. The university should also ensure wider use of other compostable products, including paper towels, particularly in restrooms. Food waste collection should be normalized in Vanderbilt's culture, making it the expected norm rather than the exception across campus.

Strategies

- Expand food waste collection to residential areas of campus, offices, and all food services areas.
- Consider future program implementations to be opt out, rather than opt in. This will gain a higher participation rate, particularly if combined with a strong educational component.
- Expand organic waste collection efforts to include paper towels in bathrooms.
- Add food waste collection capability to more buildings, including event facilities. This should be paired with changes in services provided by VU Facilities.

Recycling and waste infrastructure

Overall, the Committee highlighted the need for more education about what is and is not recyclable. Additionally, alterations to sizes and amounts of recycling receptacles throughout campus were recommended. More recycling for specialty items and emphasizing recycling over trash are also key to increasing the university's diversion rate.

Strategies

Process improvements

- Provide more recycling receptacles than trash receptacles at events.
- Provide housekeeping service for recycling in offices instead of only for trash. Housekeepers currently only collect trash in offices, and it is the responsibility of the staff or faculty member to walk the recycling to a central collection point. If this were reversed, recycling rates would skyrocket, and trash generation rates would plummet with the same level of labor and resources invested.
- Offer mobile recycling services for campus housing.
- Develop a recycling process for multi-material equipment at end of life (e.g. hand sanitizer cartridges that have batteries and plastic).
- Incorporate sustainable practices into vendor contracts when possible.
- Determine reuse potential or recycling protocol for specialty items (e.g. acrylic lenses) from renovations/demolitions.
- Assess process improvements for VU Catering and event management related to waste and recycling at events.

Educational improvements

- Provide clear labels showing what can be recycled and what is not and how to not contaminate the recycling stream.
- Ensure that easily understood and engaging signage is included on or above receptacles for all types of recyclable materials throughout campus, including outdoors and at construction and renovation sites.
- Educate staff, faculty and students on what is and is not recyclable on campus.

Infrastructure improvements

- Provide more recycling receptacles than trash receptacles throughout campus.
- Alter sizing and lids of recycling bins to allow a larger variety of items to be recycled.
- Create more collection points for specialty items, such as used refrigerants, scrap metal, electronics, pallets, etc.

2) Material tracking, adaptability and reuse

Vanderbilt can further reduce its environmental footprint through source reduction. Examples of source reduction include:

- Selection of products that contain more recycled content when possible.
- Reducing purchases by employing smarter design strategies in buildings or using data to understand where over-purchasing is occurring, as with Dining's food purchase reduction efforts.
- Conversion from heavier packaging to lighter packaging where possible, eliminating packaging, and bundling purchases to reduce packaging.
- Purchasing (when possible) higher quality materials that have a longer life and therefore reduce waste.[18]

More detail on specific strategies for Facilities' operations related to material reduction can be found in Appendix A.

3) Reduction of waste streams and sustainable substitutes

The Committee identified several materials and waste streams that can be reduced, eliminated or substituted over time with a more sustainable product. Many in the VU community support the elimination of single-use plastics whenever possible, beginning with straws, lids and now bottled soda and water. Elimination of single-use plastics is not currently possible in the laboratory setting due to lack of available alternatives and safety concerns. Other recommendations are below.

Waste elimination or reduction

Strategies

- Provide more recycling receptacles than trash receptacles throughout campus
- Eliminate use of plastic bags on campus and replace with reusable options. While this is being accomplished, investigate plastic bag recycling options/partnerships.
- Reduce and eventually eliminate Styrofoam cups, Styrofoam packaging materials except Styrofoam coolers used to transport laboratory materials, and Styrofoam food containers.
- Eliminate single-use products used in maintenance in favor of reusable when possible.
- Reduce paper waste where safe through a variety of strategies, including reducing or eliminating flyers and posters, publications, magazine purchases, paper towels, class packs and paper forms.
- Reduce printing waste by changing printing default to double-sided throughout campus.
- Continue expansion of the CampusPrint initiative.
- Reduce cardboard, shrink wrap, and other packing materials from shipments of products to the university by consolidating shipments, using reusable shipping containers, and educating shipping companies about the university's sustainability goals.

[18] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/source-reduction

Sustainable substitutes

Strategies

- Replace bottled water with reusable water bottles, water services, boxed water, and water dispensing units.
- Replace single use flatware and dishes with compostable equivalents (this is already in place in Dining operations).
- Replace boxed lunches with larger family-style food servings whenever possible.
- Use electronic versions for publications; use one subscription for each department if possible.
- Eliminate paper towels in bathrooms where feasible and use hand dryers instead. If paper towels remain in bathrooms, set up composting capability in those facilities wherever it is safe to do so that paper towels may be composted.
- Implement sustainable furniture purchasing using the checklist in Appendix B.
- Reassess one-use products, such as one-use air filters and ceiling tiles, and substitute for more reusable, sustainable options.
- Ensure that the university has a robust preventive maintenance program for equipment to extend use to the maximum expected life.
- Consider sustainable soap with smart dispenser cartridges with battery imbedded.

4) Purchasing and payment services

The committee recommends that purchasing collaborate with and support departments by developing more robust purchasing guidance and education for departmental and student buyers. This will support the university towards carbon neutrality and zero waste goals. Education is key to the broader adoption of sustainable purchasing throughout campus. Additionally, process and infrastructure improvements should be assessed in order to support the adoption of sustainable purchasing practices such as the following.

Strategies

- Discourage single use water bottles from being purchased through Purchasing's software.
- Assess potential inclusion of sustainability requirements in vendor contracts when feasible. Researchers can collaborate with lab suppliers when possible with support from procurement.
- Provide purchasers with the sustainable purchasing checklist to assess sustainability factors in purchasing decisions where possible. (Appendix B).
- Where feasible, source higher quality parts and reusable, biodegradable and sustainable products over single-use or less durable goods – these might be slightly more expensive on the front end but will last longer and reduce waste.
- Purchase paper products that are FSC certified and 100 percent post-consumer recycled content.
- Phase out purchase of Styrofoam cups, plastic bottles, and individually wrapped food.
- Create a "sustainable materials pipeline" for events. This would provide both partial funding towards the purchase of compostable supplies and assistance in setting up sorting, recycling & food waste at events.

Education and outreach for purchasers

- Provide training for all departmental purchasers on sustainable purchasing, use of portal, and use of the Sustainable Checklist for Products and Furniture (Appendix B) to ensure broader adoption of sustainable purchasing throughout campus.
- Promote zero waste/sustainability initiative in buyer webinars so that purchasers have the information needed.
- Clarify system for finding sustainable alternatives in the procurement system and direct users to these options first.

Contracts and vendor management

- Contracts and vendors specific to laboratories on campus will require a tailored approach and should be considered separately from the following strategies because some suppliers and materials purchased will need to remain as used currently due to lack of available alternatives and safety concerns.
- Incorporate sustainability goals and requirements in vendor contracts wherever possible. Focus initially on those that provide food, supply events and materials. Consider an incentive program for departments to use preferred companies.
- Give preference to vendors that will take back materials at end of life. Incentivize them to provide long-lasting products or to find sustainable alternatives (peat pots instead of plastic).
- Ask vendors to explain end of lifecycle programs and recycling efforts in bid responses.
- Encourage vendors, with the exception of laboratory-related vendors, to eliminate Styrofoam packaging wherever possible (biodegradable peanuts, e.g.)
- Specific to construction and renovation contractors:
    - Ask bidders to include waste management procedures and planning in their proposals.
    - Consider instituting a financial penalty for contractors that do not meet the university's diversion goals.
    - Specify takeback for surplus building materials to minimize over-purchasing (Campus Planning and Construction and Renovation and Small Construction)
- Select vendors whenever possible that have explicit and progressive sustainable practices.
- Require sustainable approaches to provision of food and drinks for events.

5) Education and outreach

The Committee recommends expanded education and communication of priorities and goals, seeing these as being key to successful Zero Waste Master Plan implementation.

Strategies:

- Establish a global messaging platform, such as FutureVU Sustainability, to ensure unified messaging for the entire zero waste program, not just individual components.
- Develop more events, competitions and incentive programs to encourage behavior change and improve waste culture.

- Create animated short videos to provide information to students and staff on recycling/zero waste.
- Disseminate information on landfills, the scope of waste problem and how Vanderbilt's strategy is helping.
- Utilize educational opportunities at regular student gatherings, (e.g. Vanderbilt Visions, fraternity/sorority meetings, Impact Owen).
- Prior to move-in, educate student residents where the nearest recycling options are on campus.
- Improve RA and faculty education on recycling and zero waste
- Hold quarterly lunch and learns to demonstrate and talk sustainability and waste.
- Engage staff in recycling and reporting contamination of streams that they handle for events.
- Create a zero-waste university (modules on zero waste) as part of, or modeled after, "Facilities University".
- Create a green office certification program that would engage and assist departments in reaching zero waste goals.
- Develop a sustainability peer outreach program to engage with students, faculty, staff and visitors to provide peer education about Vanderbilt's zero waste goals and program and how they fit into the larger FutureVU vision.
- Create a zero-waste lab to provide consulting assistance to campus departments as well as off-campus companies and organizations needing help in attaining zero waste. Once projects are in the pipeline, students could be recruited to help on specific projects.

6) Data tracking and reporting

Dining has already implemented the Fusion and LeanPath software and is beginning to collect data for Menus of Change and other uses. Facilities collects data on waste and recycling food waste collection volumes. However, expanded data tracking and reporting will be needed to achieve zero waste goals moving forward.

Strategies

- Consider implementation of an annual waste audit program to track the types and amounts of waste streams going to the landfill.
- Consider using EPA's Waste Wise program to track progress.
- Develop a transparent data warehouse for waste and recycling data that the campus community can access.
- Improve food waste data collection. The Committee recommends this happen by 2020.

Action plan and timeline overview

2019

- Goals approved by senior leadership.
- Eliminate plastic bottles in all dining and market locations.
- Incorporate zero waste goals into A&E guidelines.

2020

- Zero Waste Master Plan will be launched.
- Ongoing Committee and working groups will be developed.
- Single-stream recycling pilot will be launched.
- Targeted working groups will be convened for Dining, Facilities, Events, Residential Housing, Vanderbilt Child and Family Center, graduate schools, academic, Purchasing and Payment Services to: 1) initiate periodic and continuous improvement to identify successes as well as additional opportunities for waste reduction, conversion to reusable & durable alternatives and diversion over and above those outlined in this plan; and 2) develop specific action plans for each opportunity.
- Phased-in improvements of education and outreach through development and launch of the Sustainability Leaders program will begin.
- Purchasing processes and education will be improved.
- Phased in improvements of recycling infrastructure will begin.
- Data warehouse and collection processes will be developed.
-

2021

- Plastic bottles at smaller events, student organizations and departments will be eliminated.
- Plan for green office certification program and Zero Waste University will be developed.

2022

- Plastic bottle elimination will be expanded to larger events.

2025

- Process of eliminating purchase of single-use plastics will be completed, except in laboratories.

2030

- 30 percent reduction in waste generation will be attained.
- 90 percent diversion from landfill to meet zero waste goal will be attained.

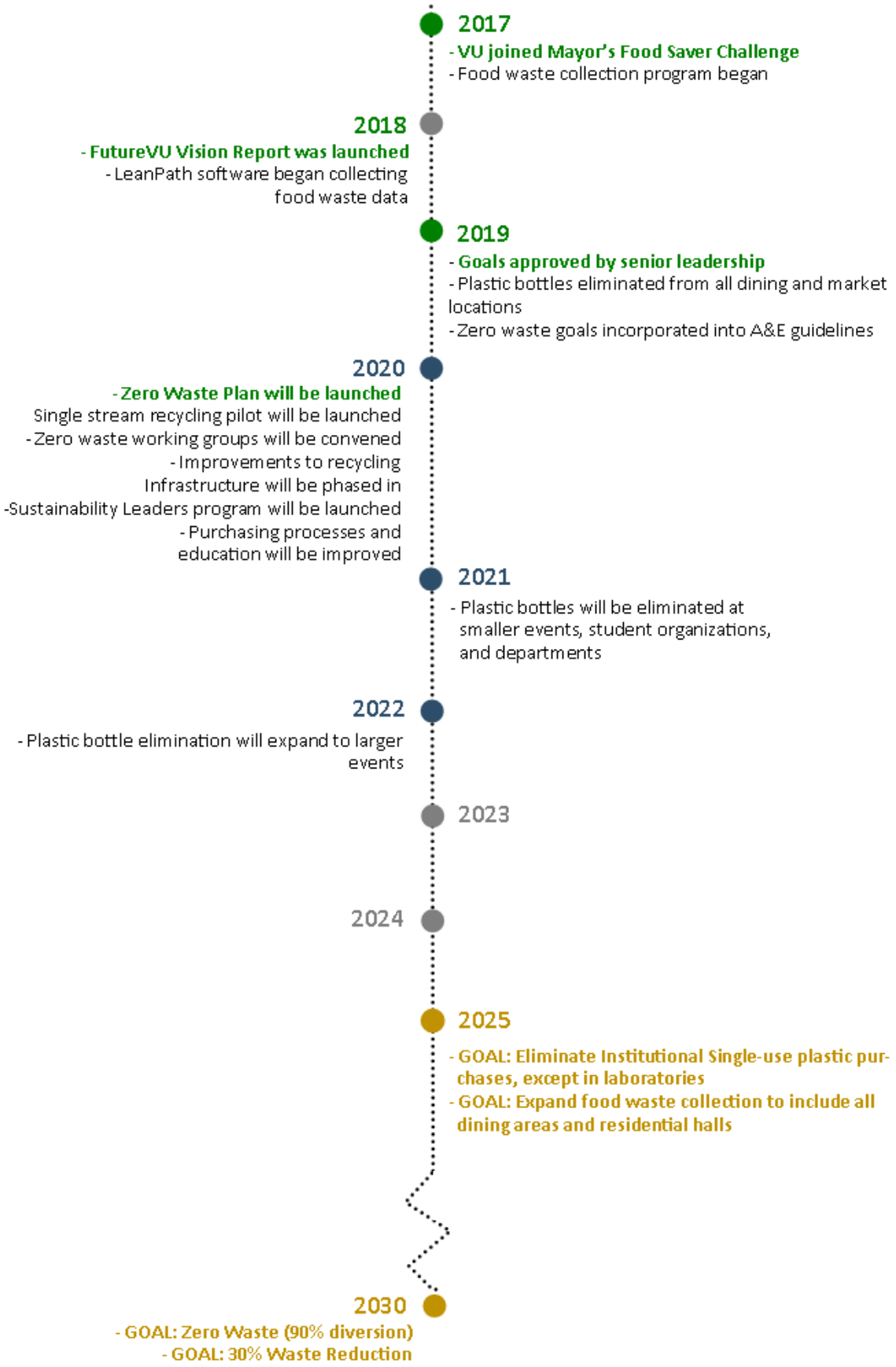

Figure 9: Vanderbilt zero waste timeline and action plan

DEFINITIONS AND ACRONYMS

A&E – Architecture and Engineering

ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers.

AIA – American Institute of Architects.

Anaerobic Digestion - A series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen" (American Biogas Council, 2017).

EPD – Environmental Product Declarations are internationally accepted, verified and published reports on the ways in which a product affects the environment throughout its life cycle, from material extraction through production, shipping, consumption and disposal.

C&D – Construction and Demolition (waste)

Compostable – Any material that biodegrades according to specified standards and expected rates in a managed composting environment.

Compostable-ware – Food service ware items that are compostable. Also referred to as compostable service ware.

Cradle to Cradle Certification – The Cradle to Cradle Certified™ Product Standard results from a continual improvement process that looks at a product through five quality categories — material health, material reutilization, renewable energy and carbon management, water stewardship and social fairness.

EPD – Environmental Product Declarations are internationally accepted, verified and published reports on the ways in which a product affects the environment throughout its life cycle, from material extraction through production, shipping, consumption and disposal.[19]

FSC - The Forest Stewardship Council sets voluntary standards for responsible forest management. FSC uses the power of the marketplace to protect forests for future generations. FSC is the only system supported by groups such as WWF, Sierra Club, Greenpeace, Natural Resources Defense Council and National Wildlife Federation. More than 380 million acres of forest are currently certified under FSC's system, including more than 150 million acres in the US and Canada.[20]

[19] http://www.gbci.org/decoding-environmental-product-declarations
[20] https://us.fsc.org/en-us/what-we-do

FutureVU – A framework for the development of Vanderbilt's campus over the next 20 to 30 years. The initiative considers core themes – such as connectivity and community enhancement, diversity and inclusion, accessibility, environmental sustainability and preservation of the university's historic, park-like setting – in support of Vanderbilt's Academic Strategic Plan.

GBCI – Green Building Certification International is a certification and credentialing body within the green business and sustainability industry that administers project certifications and professional credentials of LEED, PEER, SITES, TRUE, WELL and other certifications.

GHG – Greenhouse Gases are gases that trap heat in the atmosphere causing overall temperatures to rise over time. The main greenhouse gases VU quantifies are: Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O) and fluorinated gases, including hydrofluorocarbons, perfluorocarbons and Sulfur Hexafluoride.

LEED – U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification program.

MCURC – Menus of Change University Research Collaborative is a working group of leading scholars, food service business leaders and executive chefs from invited colleges and universities who are accelerating efforts to move Americans toward healthier, more sustainable, plant-forward diets. The MCURC Principles of Healthy, Sustainable Menus provide guidance to Campus Dining menus.

PM – Preventive Maintenance

Pulper – A processing machine that grinds food waste into small, relatively uniform pieces and extracts liquids. Pulped waste is lighter in mass and smaller in volume than unpulped waste, making transportation of waste to compost facility easier and more efficient.

RA – Resident Advisor

SEMO – Sustainability and Environmental Management Office at Vanderbilt University

SGA – Student Government Association

Single stream recycling – Collecting recyclable materials in one container for sorting after the fact at a facility. This method often leads to greater levels of recycling due to the convenience of putting all recyclable materials into one bin. This method would also save money due to fewer containers and less complicated pick-up and space due to the need for one container versus several.

SPEAR – Students Promoting Environmental Awareness and Responsibility

USAC – Vanderbilt University Staff Advisory Council

USEPA – United States Environmental Protection Agency

VOC – Volatile Organic Compounds are "emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands."[21]

VSG – Vanderbilt Student Government

VU – Vanderbilt University

VURE – Vanderbilt University Real Estate

Waste Diversion – the percentage of total waste materials that are recycled, composted, or donated/reused. It represents how much waste is diverted away from landfills to more sustainable processes like recycling or composting.

Zero waste – 90 percent diversion of waste from the landfill.

Zero waste certification – GBCI's TRUE Zero Waste Certification involves meeting seven minimum program requirements in your operations, including: 1) having a zero waste policy in place, 2) achieving 90 percent or greater diversion from landfill, 3) meeting all federal, state and local laws regarding solid waste and recycling, 4) documentation of waste diversion, 5) submission of data to GBCI, 6) not exceeding 10 percent contamination for any materials leaving the site and 7) submitting a case study of zero waste initiatives.[22]

ZWAC – Zero Waste Advisory Committee, a group convened to tackle the goal of making the Vanderbilt's campus zero waste, as part of the larger Future VU strategic planning process.

[21] https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality
[22] https://true.gbci.org/true-zero-waste-certification-program

Appendix A: Strategies related to facilities operations

Buildings

Where possible, the university should prioritize adaptive reuse when accommodating its evolving spatial needs. Vanderbilt has already reused or reprogrammed several of its facilities. It should continue to do so by institutionalizing a project weighting process that favors building reuse over new construction. In addition to building reuse, projects at Vanderbilt should consider waste prevention at the material level. Preference should be given to any materials that can be salvaged and reused, easily repaired and maintained or recycled at the end of their service life. A&E standards should reflect these strategies.

Strategies

- Maintain documentation detailing disassembly processes and reuse potential.
- Develop tracking methods for material procurement to ensure buildings are designed with healthy, low impact materials.
- Require that a waste management plan be developed by project teams for each new building or renovation project and approved prior to breaking ground.
- Prioritize reuse of existing buildings over the construction of new spaces.
- Incorporate demountable partitions and movable walls that can reconfigure interior spaces.
- Prioritize low-environmental impact products from sustainable and ethical manufacturers, i.e. salvaged or reused products, FSC certified wood products, products with recycled content, bio-based products that meet the Sustainable Agricultural Standard, products with extended product responsibility (such as take back programs), etc.
- Enhance A&E specifications to include waste diversion requirements, on-site recycling procedures, and minimum requirements for recycled content in all building materials, reward reclaimed materials and improve content of concrete and admixtures.
- When using finish materials, make them multi-purpose (pin board that also dampens sound, for example).
- Design story heights to reduce waste (right-size for 4 feet by 8 feet drywall pieces, or typ. lumber lengths, etc.).
- Use reclaimed wood and other materials.
- Inventory large waste pieces on site (or relatively) for future use.
- Design more simplified building layouts. Eliminate complex framing conditions that require excessive structure (like transfer beams, for example). Standardize elements throughout building.
- Construct materials off-site whenever possible (higher quality control, lower cost and waste).
- Design facilities to be multi-purpose to eliminate redundancies and increase efficiencies.

- Use BIM coordination between all trades to eliminate errors and unnecessary waste.
- Design for ease of replacement in mind (replacing one carpet tile where needed rather than an entire floor of carpet).
- When building on existing building site, reuse existing materials to greatest extent possible.
- Reuse excavation material and balance cut and fill material on-site.

Landscaping waste reduction

To reduce the life cycle impacts of its landscape and to align landscaping practices with the zero-waste strategy, Vanderbilt should focus on resource use reduction (waste prevention) and product reuse before specifying plants and materials.

Strategies

- Consider salvaging and reusing materials and plants uprooted during construction to reduce campus waste and the greenhouse gases associated with it.
- When specifying materials and plants used in the landscape design, the university should prioritize products that are sustainably sourced and produced. At a minimum, the university should eliminate the use of wood from threatened tree species, opting instead for wood certified by the Forest Stewardship Council (FSC) which advocates for sustainable practices in wood production.
- Preference should be given to materials that disclose their environmental impact. The university can specify products for landscape design that include environmental product declarations (EPDs) and life cycle assessments (LCAs).
- Replace plastic plant containers with sustainable versions (peat, compostable) OR rebuild green house and grow our own plants (new location would be needed).

Appendix B: Sustainable checklist for products and furniture

When comparing products, choose product with most checkmarks			
Criteria	**Description**	**✓**	**Reason criteria not met**
Recycled Content	• Contains at least 25 percent recycled content • Is salvaged or reused		
Renewable Resource Content	• Contains at least 25 percent rapidly renewable material such as bamboo, acacia, etc. • Contains at least 50 percent FSC certified wood		
Locally Sourced	• Is sourced within a hundred miles of University (purchased, manufactured, or extracted) • Is Made in the USA if not locally sourced		
Reduced Environmental Footprint	• Contains a Type III Environmental Product Declaration (ISO 14025) or a self-reported Live-Cycle Assessment (ISO 14040 or 14044) • Cradle to Cradle certification • BIFMA level certified • SMaRT certified • Other footprint reduction methods: _____		
Content Disclosure	• Contains a publicly available Manufacturer Inventory or Health Product Declaration report disclosing the product's chemical ingredients to at least 0.1 percent • Living Building Challenge Certified Declare label		

When comparing products, choose product with most checkmarks			
Criteria	• **Description**	✓	**Reason criteria not met**
Non-Hazardous Ingredients	• GreenGuard Gold certification • SCS Indoor Advantage Gold Achieves credits 7.6.1-3 in BIFMA Level certification • Contains general emission evaluation report • Living Building Challenge Certified Red List Compliant • For furniture: meet all limits set by ANSI/BIFMA Furniture Sustainability Standard for VOC content (WELL Air Quality Standard Part 5) Use low or no-VOC paints and varnishes		
Durability	• Product will last for an extended period • Product can be repaired if damaged • Product can be reused or repurposed		
Reusable/ Recyclable/ Minimal Packaging	• Minimal packaging • Recyclable packaging • Packaging takeback program		
Sustainable Disposal Methods	• Manufacturer takeback program • Recyclable material/product		
Sustainable Corporate Practices	• Company has publicly available Corporate Sustainability Report, preferably in accordance with GRI, UN Global Compact, or ISO 26000 • Company has JUST label • Company uses sustainable transportation or manufacturing practices		