University Perspective

In 2007, JHU committed to reduce its greenhouse gas emissions (GHGs) by 51% by 2025. Data was baselined at 2008. This includes emissions derived from electricity, natural gas, heating oil, and gasoline and diesel fuels consumed by university owned properties and vehicles. In addition to carbon dioxide: methane (CH4), nitrogen dioxide (N2O), and refrigerants are measured and normalized based on their global warming potentials as metric tons of carbon dioxide equivalent (MTCO2e). Grid purchased energy, electricity and natural gas, uses the local PJM emissions factors. PJM is the interconnection manager and wholesale energy market for the Northeast and North-central USA.

Raising the Profile.

The presence of “Hopkins Eco-Smart,” the umbrella of environmental sustainability efforts at Johns Hopkins University, is growing. More and more, sustainability is ingrained into processes and initiatives across the University. For the first time, the Idea Lab included a sustainability challenge alongside community and diversity. Not only is the emblematic Acorn appearing more frequently at JHU, it’s a visible seed of change in the community. In October, Johns Hopkins was a sponsor for the annual Association for the Advancement of Sustainability in Higher Education (AASHE) conference that was held in Baltimore. From workshops, panel presentations, keynotes, tabling, tours and social outings, JHU connected and empowered sustainability officers from peer institutions across the country.

Total Energy:
JHU is growing. This is seen in the building footprint, up 11% since FY08, and the total energy consumption, measured in MMBTU, up 4%. Total energy consumption is on a downward trend, dropping 3% since FY15.

Energy Density:
Given this considerable growth - by nearly 1.3M square feet - energy use per square foot tells an important story, normalizing energy consumption with growth. This highlights that JHU’s buildings are becoming more efficient, though still above the average EUI for colleges, 131 kBtu/sq ft.

Greenhouse Gas Emissions:
Even with increasing energy use, GHG emissions have been steadily decreasing, down 6.4% from FY15 and 35% from the FY08 baseline. While showing progress, when comparing effects attributed to internal efforts as opposed to grid improvements, this uncovers a need for a more robust analysis and implementation plan.

Social Cost of Emissions:
The social cost of emissions is the estimated economic cost of damages caused by climate change, such as decreased agricultural productivity, diminished human health, and property damage. Early estimates from the EPA show expected costs at $40/MTCO2e, in 2016 dollars, which is the figure we used. However, more recent studies, such as by Stanford, value carbon much higher. Stanford calculated $220/MTCO2e. This values our FY16 carbon footprint at $62,685,480.
by the numbers:

**Total Energy Consumption**
In FY08, APL consumed 409,165 MMBTU, and in FY16 it consumed 428,137 MMBTU, a 4.6% increase from baseline, but a 3% decrease from FY15. While many energy conservation measures have been undertaken, the campus has grown significantly in size since FY08, which has led to additional energy demand.

**Energy Density**
In FY16, APL consumed 173 kBTU/sq ft, following a downward trend from 209 kBTU/sq ft in FY08 and 178 kBTU/sq ft in FY15. For comparison purposes, ENERGYSTAR provides benchmarking data for EUI. APL has a mix of spaces that include technical facilities, offices, and support space. The benchmarks range from office space, with a benchmark of 67.3 kBTu/sq ft to physical laboratory facilities at about 300 kBTu/sq ft.

**Greenhouse Gas Emissions**
APL’s emissions have dropped by 31% since FY08, from 85,150 MTCO2e to 59,080 MTCO2e. This is also a 11% reduction from FY15. This is equivalent to the carbon captured by 24,678 acres of forest, or half the area of Acadia National Park.

**Waste Diversion**
APL had an estimated diversion rate of 36% in FY16, which was down slightly compared with previous years. By comparison, the average rate for the entire university was 43%.

**Domestic Water Consumption**
Domestic water consumption was approximately 59,507,000 gallons in FY16. This is over 24.5 gallons per square foot. The university consumed an estimated 316,500,000 gallons in all of its owned buildings, or about 22 gal/sq ft. With its lab intense facilities, APL accounts for about 15% of all energy use and 19% of water use.

**Rethinking Waste**
APL generates a variety of wastes. To promote diversion, they formed, the Conservation, Reuse, and Recycling Committee. From continuing their Earth Day tradition of collecting personal electronic and hazardous waste, to conducting a comprehensive assessment of bin infrastructure – determining the amount, placement, pairing and signage that will encourage participation in recycling – the CRR is connecting the mission of APL to provide “critical contributions to critical challenges with systems engineering and integration, technology research and development, and analysis,” with their day to day operations.
Bloomberg School of Public Health

**Total Energy Consumption**
Through energy conservation measures, BSPH has been able to decrease energy consumption over the last several years, even with an increase in the number of students and employees. In FY08, BSPH consumed 265,107 MMBTU, compared with 252,951 MMBTU in FY16, a 4.6% reduction from baseline and a 5% reduction from FY15.

**Energy Density**
While BSPH’s building area has remained the same since FY08, the school has used energy conservation measures such as variable frequency drivers and improved insulation to dramatically reduce energy density. In FY16, it consumed 243 kBTU/sq ft, compared with 255 kBTU/sq ft in FY08, nearly a 5% reduction from the baseline and FY15. For comparison purposes, ENERGYSTAR and the International Institute for Sustainable Laboratories provide benchmarking data for energy density. The U.S. national median for colleges and universities is 130.7 kBtu/sq ft and biological and chemical laboratory facilities are typically 375 kBtu/sq ft.

**Greenhouse Gas Emissions**
BPSH’s emissions have dropped by 29% since FY08, from 30,451 MTCO2e to 21,535 MTCO2e, and by 5% from FY15. This is equivalent to the carbon captured by 8,440 acres of forest, 10 times the area of Central Park.

**Waste Diversion**
In FY16, BSPH once again led all university divisions with a 60% diversion waste, though this is down from 73% last fiscal year. The average diversion rate for the entire university was 43%.

**Domestic Water Consumption**
Domestic water consumption was estimated at almost 40 million gallons in FY16, which was lower than in previous years, and significantly lower than the FY10 high of 76 million gallons.

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**by the numbers:**

- $861K: economic cost of BSPH’s FY16 carbon footprint
- Reusable water bottles: 1,060 given to each of the incoming students
- Bike parking spots: 114 on campus

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**Advancing Global Action**
Representatives from the BPSH’s Center for a Livable Future – celebrating its 20 year anniversary this year – contributed to the Paris UN Conference of the Parties Conference (COP21) through discussion on the degree to which agricultural emissions are warming our planet. Their research shows that without drastic reductions in global meat and dairy consumption, the most severe and irreversible climate change scenarios will be unavoidable. Taking the Meatless Monday campaign to its widest stage yet, these experts helped the world understand that what we eat matters for personal, public and planetary health.
**Total Energy Consumption**
Greater Homewood includes the Homewood campus and adjacent properties, Housing & Dining, the School of Education, and all Sheridan Library buildings. Energy consumption for these facilities has increased since FY08, which is due in large part to the significant growth in both people and buildings. In FY08, 925,001 MMBTU were consumed, compared with 1,015,914 MMBTU in FY16, a 10% increase from FY08 but a 1% decrease from FY15.

**Energy Density**
Gross floor area has increased by 178,000 sq ft, or 3.3% since FY08. Greater Homewood consumed 172 kBTU/sq ft in FY08, and 183 kBTU/sq ft in FY16. Although an overall increase since baseline, this is moving in the right direction, following a downward trend from 186 kBTU/sq ft in FY15 and the all-time high of 196 kBTU/sq ft in FY14.

**Greenhouse Gas Emissions**
Greater Homewood’s emissions have dropped by 36% since FY08, from 138,641 MTCO2e to 88,849 MTCO2e. This is a 10% reduction from FY15. This is the result of grid improvements as well as on-site power generation and other energy conservation measures. The 36% reduction is equivalent to the carbon captured by more than 47,000 acres of forest, an area covering 80% of Baltimore City.

**Waste Diversion**
In FY16, Greater Homewood achieved a 44% diversion rate, up from 42% in FY15 and 23% in FY10. This was due in part to the collection of compostable materials, which has increased five-fold since FY11. By comparison, the average diversion rate for the entire university was 43%.

**Domestic Water Consumption**
Domestic water consumption was almost 135,000,000 gallons, which was slightly higher than totals in recent years, but down from 157,780,192 gallons consumed in FY08.

**Award Winning Design**
In January 2016, the U.S. Green Building Council Maryland Chapter awarded Johns Hopkins Facilities & Real Estate and Ballinger Architects a Wintergreen Award for the state-of-the-art Undergraduate Teaching Lab. Newly certified LEED Platinum, the UTL is designed to use 40% less energy than a similar building through the use of chilled beams, occupancy sensors that control lights and HVAC, high-performance fume hoods, daylight sensors, and energy recovery wheels. From classes to conferences, the innovative sustainability features have raised the bar for green buildings.
Total Energy Consumption
In spite of major weather-driven year-to-year fluctuations, Housing & Dining has decreased energy consumption through conservation and efficiency measures. In FY08, H&D consumed 126,649 MMBTU, compared with 97,018 MMBTU in FY16. This is a 32% reduction from FY08 and a 10% reduction from FY15.

Energy Demand
In FY16, approximately 53% of H&D’s energy was derived from electricity, with the remaining 29% from natural gas and 17% from chilled water and steam. Electricity use increased slightly, by 1,936 MMBTU, but, likely from a mild winter, natural gas decreased significantly, by 31% or 13,210 MMBTU, and chilled water and steam held constant with a change of only 200 MMBTU.

Energy Density
Even while H&D’s building area has remained the same since FY08, energy density has still decreased. In FY16 it consumed 92 kBTU/sq ft, down from 111 kBTU/sq ft in FY15, a 17% reduction. For comparison purposes, ENERGYSTAR provides benchmarking data for energy density. The U.S. national median for colleges and universities is 130.7 kBtu/sq ft, residence halls/dormitories is 73.9 kBtu/sq ft, and offices is 67.3 kBtu/sq ft.

Waste Diversion
Diversion at Greater Homewood is 44%. Waste diversion is not granular for Housing and Dining, but by estimates from their facilities, we have seen a decrease in 91 tons of waste generated, or 14%.

Greenhouse Gas Emissions
Excluding the AMRs, as those GHG emissions are included in Homewood’s main campus footprint, H&D’s emissions were 19,016 MT-CO2e in FY08 and 11,151 MT-CO2e in FY16, a 36% reduction, a 1.8% reduction from FY15, as well. This is equivalent to the carbon captured by 6,498 acres of forest, an area almost 50 times the size of the Homewood campus.

In 2013, President Ron Daniels put his pen to paper, officially signing Johns Hopkins University’s Homewood Campus up for the Real Food Challenge – a goal to source 20% “real food” for campus cafes and dining halls by 2020. In an unexpected moment he upped the ante, increasing JHU’s commitment to 35%, the highest of any participating institution at that time. Since then, JHU Dining has worked closely with students from Real Food Hopkins, employing “calculator interns” to help determine baseline metrics and track ongoing progress. At the close of FY16, the university is currently sourcing 25% real food – defined as local/community-based, fair, ecologically sound, and/or humane in sourcing and production. When looking at each of those criteria, JHU food purchases are lead by being sourced locally, with 34% of food coming from nearby. Progress to date can be attributed to the myriad efforts by Dining, our campus food service provider, Bon Appetit, and a diverse group of passionate students.
Keswick & Mt. Washington Campuses

**by the numbers:**

- **$788K**
  - Economic cost of Keswick and Mt. Washington's FY16 carbon footprint
  - Using Stanford’s economic costs for emissions this would be $4.3M

- **2,952**
  - Herbs given away during Earth Week since FY12

- **6,000**
  - Customer trips to the Keswick Farmers’ Market in FY16

- **345**
  - MWh of Electricity generated from solar panels in FY16

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**Total Energy Consumption**

*Keswick* was acquired in 2011, and still increasing in occupancy, and energy usage has also steadily risen each year. Keswick consumed 28,387 MMBTU in FY11 compared with 44,047 MMBTU in FY16. Mt. Washington, rose from 96,219 MMBTU in FY08 to 113,369 MMBTU in FY16.

**Energy Density**

As with total energy, energy use per square foot has continued to increase for Keswick, but is slightly down from FY15. At Mt. Washington, its energy usage has varied year to year, especially given growth in its energy-intensive data center. In FY16, *Keswick* consumed 90 kBTU/sq ft, up from 58 kBTU/sq ft in FY11, likely due to occupancy changes. *Mt. Washington’s* energy density was 74 kBTU/sq ft in FY08 and is now 87 kBTU/sq ft. Both are higher than the average of 67.3 for office space.

**Greenhouse Gas Emissions**

Despite the addition of the Keswick facility in FY11, GHG emissions decreased between Keswick and Mount Washington by 9.6% since FY08. Mt. Washington alone emitted 21,778 MTCO2e in FY08, while both contributed 19,692 MTCO2e in FY16. This reduction is equivalent to the carbon captured by 1,975 acres of forest, roughly 2,000 football fields of trees.

**Waste Diversion**

Both campuses continue to improve their recycling and composting efforts. In FY11, the diversion rate was 30% combined, and in FY16 *Keswick*, alone, achieved a 40% diversion rate. Mt. Washington diverted 38.7%, down from 51% in FY15. This includes the collection of 139,560 lbs of compostable material during the year, a 25% increase since collection started. By comparison, the average diversion rate for the entire university was 43% in FY16.

**Domestic Water Consumption**

Domestic water consumption was approximately 31,281,500 gallons between the two campuses, an increase from FY15. The university consumed an estimated 316,500,000 gallons in all of its own buildings in FY16.

**Domestic Water Consumption**

- Domestic water consumption was approximately 31,281,500 gallons between the two campuses, an increase from FY15. The university consumed an estimated 316,500,000 gallons in all of its owned buildings in FY16.
Montgomery County Campus

**Total Energy Consumption**
Through energy conservation measures, MCC has reduced its overall consumption in recent years. In FY08, it consumed 17,085 MMBTU, and in FY16 it consumed 15,935 MMBTU—a 7% decrease.

**Energy Density**
MCC’s building area has remained the same, but its energy consumption has fallen, which has led to further improvement in energy use per square foot. In FY16, MCC consumed 149 kBtu/sq ft in its owned facilities, down from 160 kBtu/sq ft in FY08 and 154 in FY15. For comparison purposes, ENERGYSTAR provides benchmarking data for energy density. The U.S. national median for colleges and universities is 130.7 kBtu/sq ft and for offices is 67.3 kBtu/sq ft.

**Greenhouse Gas Emissions**
MCC’s emissions have dropped by 31% since FY08, from 3,213 MTCO2e to 2,225 MTCO2e, down 8% from FY15. This is equivalent to the carbon captured by 936 acres of forest, an area six times the size of the National Mall in Washington D.C.

**Waste Diversion**
MCC’s had an estimated diversion rate of 17% in FY16, the same as in FY15. This is achieved through recycling alone as there is no composting on-site.

**Domestic Water Consumption**
Domestic water consumption is estimated to be almost 969,844 gallons, which was slightly lower than in previous years. The university consumed an estimated 316,500,000 gallons in all of its owned buildings in FY16.

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**Shining a Light**
Through a comprehensive LED lighting project, the campus is anticipating a reduction of 500,000 kilowatts of electricity use annually, equating to a reduction of 288 metric tons of carbon dioxide equivalent, about one-third of MCC’s total reduction. The change-out of roughly 2,000 fluorescent fixtures for light-emitting diode lamps—more efficient and longer lasting units that emit less heat when in use—will also help achieve energy and labor cost savings through improved conditions for mechanical systems, like HVAC, and reduced maintenance.

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**by the numbers:**

- 96% of Copy Paper contains at least 30% recycled content
- $89K economic cost of MCC’s FY16 carbon footprint
- Using Stanford’s economic costs for emissions, this would be $490K
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**Montgomery County Campus**

**fiscal year 2016**
**Total Energy Consumption**

Through energy conservation measures, Peabody has been able to decrease energy consumption by 5.6% below the FY08 baseline in spite of a small increase between FY08 and FY15. Peabody consumed 45,921 MMBTU in FY08 and 46,061 MMBTU in FY15, compared with 43,462 MMBTU in FY16.

**Energy Density**

Peabody’s building area has remained the same since FY08, but its energy consumption has fallen, which has led to an improvement in energy density. In FY16, Peabody consumed 95 kBTU/sq ft, down from 100 kBTU/sq ft in FY15 and 101 kBTU/sq ft in FY08. For comparison purposes, ENERGYSTAR provides benchmarking data for energy density. The U.S. national median for colleges and universities is 130.7 kBtu/sq ft.

**Greenhouse Gas Emissions**

Peabody’s emissions have dropped by 35% since FY08, from 6,836 MTCO2e to 4,437 MTCO2e, and by 13% from FY15. This is equivalent to the carbon captured by 1,651 acres of forest, or more than 10 Homewood campuses.

**Waste Diversion**

For smaller campuses such as Peabody, only estimates are available for waste and recycling collection. Since FY08, Peabody has had an estimated diversion rate between 15% and 18%. By comparison, the average rate was 43% for the entire university.

**Domestic Water Consumption**

Domestic water consumption was approximately 6,173,500 gallons in FY16, which is about the same as previous years. Peabody was the first to receive the new Baltimore water meters, and should have more accurate readings moving forward. The university consumed an estimated 316,500,000 gallons in all of its owned buildings.

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**by the numbers:**

- ** Saving Resources**
  - The only thing better than recycled paper is not using paper at all. By making course catalogs available online, and printed copies by available by request only for students, Peabody has reduced its paper usage by 17.5%, not to mention the ink. Sustainability works best when it saves money, makes things easier to use, and preserves resources.
by the numbers:

Total Energy Consumption
The School of Medicine had a quick start at reducing its energy use. Total energy dropped from the FY08 baseline of 1,000,929 MMBTU by 17% in FY09. However, faced with years of growth, it peaked energy use at 1,064,225 MMBTU in FY11. It has since dropped 5% the past two years, and is now back down 3% below the FY08 baseline, at 972,544 MMBTU in FY16. This is 8.6% below the FY11 high.

Energy Density
In FY16, SoM consumed 363 kBTU/sq ft, improved from 380 kBTU/sq ft in FY08 and 384 in FY15. For comparison purposes, ENERGYSTAR and the International Institute for Sustainable Laboratories provide benchmarking data for annual energy density. The U.S. national median for colleges and universities is 130.7 kBTU/sq ft and biological and chemical laboratory facilities are typically about 375 kBTU/sq ft.

Greenhouse Gas Emissions
SoM’s emissions have dropped by 34% since FY08, from 128,887 MT-CO2e to 84,994 MT-CO2e, and by 6% from FY15. This is equivalent to the carbon captured by 41,549 acres of forest, an area just smaller than Washington, DC.

Waste Diversion
In FY16, SoM achieved a 48% diversion rate, a slight reduction from 52% in FY15. By comparison, the average diversion rate for the entire university was 43%.

Domestic Water Consumption
The school’s domestic water consumption was approximately 117,655,800 gallons in FY16, which was more than one-third of the university’s total consumption. Consumption is largely driven by the volume of lab space. This was a 6% reduction from FY15 consumption.

Collaborative Change
The Facilities Management Department at the School of Medicine, alongside Reduction in Motion and ASI Waste, received the Sustainability Partnership Game Changer Award from the National Waste and Recycling Association. This award recognizes partnerships that include municipal and county governments, regulatory agencies, community organizations and private industry that have successfully partnered to implement game-changing initiatives, policies or programs that advance sustainability in their community.
by the numbers:

**Total Energy Consumption**
Without proper maintenance and improvements, buildings will become less efficient over time. SoN has been able to maintain a relatively consistent level of energy consumption over the last several years, with a slightly larger increase this year. In FY08, SoN consumed 24,518 MMBTU, compared with **27,289 in FY16, an 11% increase**. This is a result of increased heating and cooling energy use. Electricity use is down 13% since FY08, and natural gas use hasn’t changed.

**Energy Density**
In FY16, SoN consumed **238 kBtu/sq ft**, down from **263 kBtu/sq ft** in FY08 and up from **231 kBtu/sq ft** in FY15. This matches the increase in Chilled Water and Steam for heating and cooling.

**Greenhouse Gas Emissions**
SoN’s emissions have dropped by **25%** since FY08, from **3,008 MTCO2e** to **2,252 MTCO2e**. This has been a further **1% decrease** from FY15. The emissions savings is equivalent to the carbon captured by 716 acres of forest, about the size of Druid Hill Park.

**Waste Diversion**
In FY16, the SoN achieved a **45% diversion rate**—roughly consistent with last year. By comparison, the average diversion rate for the entire university was 43%.

**Domestic Water Consumption**
The school’s domestic water consumption was approximately **379,548 gallons** in FY16, which was about the same amount as in recent years. The university consumed an estimated 316,500,000 gallons in all of its owned buildings in FY16.

**33% of copy paper contains at least 30% recycled content, down from 50% in FY15**

**40 bike parking spots on campus**

**$90K economic cost of SoN’s FY16 carbon footprint**
Using Stanford’s economic costs for emissions, this would be $495K
Total Energy Consumption
Due to energy conservation measures and favorable weather, JHU in Washington DC has reduced its overall energy consumption significantly in recent years. It’s reduced energy use 5% each of the past two years. In FY08, it consumed 26,220 MMBTU, and in FY16 it consumed 18,400 MMBTU—a 30% decrease.

Energy Density
In FY16, JHU in Washington DC consumed 67 kBTU/sq ft, down from 96 kBTU/sq ft in FY08, and from 70 in FY15. For comparison purposes, ENERGYSTAR provides energy density benchmarking data for U.S. facilities. The annual median for colleges and universities is 130.7 kBTU/sq ft, and for offices is 67.3 kBTU/sq ft.

Greenhouse Gas Emissions
The JHU in Washington DC’s emissions have dropped by 50% since FY08, from 4,411 MTCO2e to 2,209 MTCO2e. The JHU in Washington DC leads the university in percentage emissions reduction. This is equivalent to the carbon captured by 7,402 acres of forest, an area slightly larger than Manhattan.

Waste Diversion
JHU in Washington DC had an estimated diversion rate of 20.3% in FY16, excluding any compost collection. This was a slight increase from prior years and included for the first time paper shredding that went to recycling. By comparison, the average rate was 43% for the entire university.

Domestic Water Consumption
Domestic water consumption was approximately 4,056,000 gallons in FY16, 22% more than in FY15. This is the highest use on record. The university consumed an estimated 316,500,000 gallons in all of its owned buildings in FY16.

domestic water consumption in FY16 was 22% higher than in FY15, reaching 4,056,000 gallons. This is the highest use on record, surpassing FY15’s consumption of 3,341,000 gallons. The university consumed an estimated 316,500,000 gallons in all of its owned buildings during FY16.

by the numbers:

- 91.0% of Copy Paper contains at least 30% recycled content
- $88K economic cost of DC’s FY16 carbon footprint
- 19 reusable to-go containers sold in the JHU in DC cafeteria - students, faculty, and staff may purchase these in the cafeteria in place of disposable containers

Using Stanford’s economic costs for emissions this would be $486K