Boston Green Academy Horace Mann Charter School Boston Public Schools – Massachusetts

Boston Green Academy empowers leaders to change the world. We respond to local, regional, and global findings on the state of the environment by refining our Green programming, broadening our sustainability efforts beyond the school into the greater Boston community, and preparing 6th through 12th graders to be leaders in the burgeoning green economy. We do this by establishing and holding high expectations for our students and our staff, addressing our mission in all content areas, reinforcing the pillars through regular presentation opportunities to the community, all while supporting the social and emotional needs of students whose own socio-economic status is in constant flux. Our school serves and empowers a diverse population: 80% of our students are considered high needs, 67% are economically disadvantaged, 32% are students with disabilities, 35% are students for whom English is not their first language, and 92.8% are students of color. We recruit, enroll, retain and graduate a student population that represents the mosaic of the City of Boston and we support our young people's right to equity, and to cultural and individual expression. We are a strong example of how a community of staff and students can use partnerships, relevant and engaging curriculum, and leadership opportunities to transform a turn-of-the-century building into an environmentally sustainable one. We believe that we are a model green school both for Boston's district schools, and for other urban institutions, and receiving a Green Ribbon designation will add heft to our claim as we continue to share our process and results through PD and dissemination practices locally, statewide, and nationally.

Pillar 1: Reduced Environmental Impact and Costs

Pillar 1, Element 1A: Improved energy conservation/energy-efficient building(s).

The Boston Green Academy Green Building Advisory Committee has created a Green Building Action Plan with the singular goal of making BGA the sustainable building model for the Boston Public Schools and beyond. This committee is comprised of the Director of Sustainability at BGA (position defined in Pillar 3, Element A), the Sustainability Manager at Boston Public Schools, the Energy Manager at the City of Boston, the Director of Green Schools at the USGBC, and a host of green building experts from the private sector. A central pillar of the Green Building Action Plan is to reduce C02 emissions through energy monitoring, conservation efforts, building efficiency, and renewable energy updates. BGA is supported in these efforts by the district (http://www.bostonpublicschools.org/domain/895, http://bostongreenschools.org/energy/).

Boston Green Academy is an Energy Star building with a score of 94 (site EUI (kBTU/sf)=53.1). Boston Green Academy receives 48% of its energy from renewable sources. Fourteen percent of these sources come from the 2019 Massachusetts' Renewable Energy Portfolio Standard (RPS), and 34% are received from Green-E certified RECs. MA RPS means it's sourced from local renewable assets in MA/New England, while the Green-E REC's can come from any US renewable project (typically TX or ND).

Boston Public Schools, National Grid, and Steam Trap Systems recently repaired and replaced 203 steam traps at BGA, with an estimated annual savings of 15,631 therms/year, about a 25-30% savings from the 2017-2018 billing cycle and an estimated reduction of 18.2 metric tons of CO2 from the atmosphere.

All classrooms and offices (60 total) have been equipped with occupancy sensors set on 5-minute time delays which, according to a study conducted by US EPA, achieve an average 40-46% energy savings.

The students at Boston Green Academy are also involved in energy conservation efforts. Efforts for school year 2019 to-date have produced a reduction of 2,910 kWh from September to October, which equates to 2.1 metric tons of reduced CO2. We worked with Eversource energy to submeter our electric meter. Students can access our building's daily, weekly, and monthly energy usage via our energy dashboard platform. Students in the middle school Urban Ecology class (defined in Pillar 3, Element A) use Kill-A-Watt meters to figure out which devices in BGA use the most electricity, making sure this device is only plugged in when in use, and that all vampire devices are unplugged on weekends and holidays.

The school also encourages students to use their individual and collective voice to promote their work and are collaborating on several energy campaigns throughout the year. Students in the Career Technical Education (CTE) program (see full description in Pillar 3, Element A) are starting a longer-term cost-benefit analysis that will explore retrofitting current school lighting with LED bulbs (from CFL's). Students in the CTE program are also learning to use thermal imaging cameras to collect internal and external readings of our facility in order to assess the building envelope and window efficiency. They will use their findings to work with Boston Public Schools (BPS) and the City of Boston to make our building more energy efficient over time. Students in our 9th grade are learning about the implications of climate change in Boston and are continuing the work with the city's solar feasibility study of the BGA roof in 2016 to install a solar array on our building. The study showed that the building is capable of supporting an 86 kW system, producing 103,664 kWh annually (about â…“ of our total annual consumption). The City of Boston is working with Boston Public Schools and plans to move on this in 2019.

Pillar 1, Element 1B: Improved water quality, efficiency, and conservation

A second pillar of the Green Building Action Plan is to improve our water quality and reduce water use throughout our building (the Project Coordinator for Stormwater Infrastructure at Boston Water and Sewer Commission is a consultant on this). Last year, the efforts described below combined to reduce our water use by 485,957 gallons, from 1,671,245 gallons in 2017 to 1,185,288 gallons in 2018. BGA is also supported in these efforts by the district (http://bostongreenschools.org/water/).

When Boston Green Academy first moved into our current building in 2014, we did not have access to tap water and got our drinking water from weekly bottled water delivery, significantly impacting our carbon footprint. We worked with the Boston Public Schools Environmental Division to test our tap water supply (which was cleared well below the lead action level) and installed 11 water fountains and refillable bottle stations throughout the building. We now have 2-4 water fountains on every floor, greatly increasing access to drinking water. Boston Public Schools has a very thorough water policy (https://www.bostonpublicschools.org/Page/6092). BPS Environmental Division annually tests all fountains to ensure water levels are below lead and copper action levels.

All 23 Boston Green Academy bathroom sinks are equipped with faucet aerators that reduce the flow of water. Each aerator reduces water use by about 1gpm. In addition, all bathroom sinks are equipped with self-closing metered faucets that shut water off after 3.5 seconds.

We have worked with BPS and our custodians to reduce hardscapes and increase water retention. Our Urban Ecology and CTE students collect and reuse rainwater in the garden, and our custodians do not irrigate our lawns. We are working to install a rain garden on the northside of our building.

Pillar 1, Element 1C: Reduced waste production and improved recycling and composting programs

The Green Building Action Plan also focuses on significantly reducing and ultimately eliminating waste production in our building. BGA is supported in this goal by the district (https://bostongreenschools.org/zero-waste/).

Boston Green Academy is registered as a MassDEP Green Team school and works with them yearly to update recycling equipment, signage, and curriculum. BGA maintains a single stream recycling system. The Boston Public Works Department picks up our recycling weekly, curbside, at no charge. Our recycling program is managed by our Learning for Independence (LFI) program as a way of integrating math and life skills. Our LFI program is for students with severe disabilities that need supports beyond a traditional classroom. Students help to educate each other at the beginning of every year about the process of making recycling effective. Students pickup classroom bins weekly, log data on contamination, and transport curbside bins. Student efforts have increased our recycling rate from an average of eight to twelve 96-gallon bins weekly and cut down on recycling contamination (particularly around plastic bags, markers, and chip bags). At 40 weeks of school/year, we can estimate 46,080 gal/year or 60,364.8 pounds of recyclables diverted from the waste stream annually. This calculation uses the EPA's commingled recyclable conversion factor of 1 cubic yard of commingled recyclables=262 pounds and 1 cubic yard=200 gallons.

On top of single stream recycling, LFI students collect plastic grocery bags separately from each classroom and recycle them on their weekly trips to the grocery store. In addition, in partnership with our LFI classroom, our 6th grade students made marker recycling baskets for every classroom. LFI students collect the markers and mail them back to Crayola.

All water stations are equipped with a water fountain. In addition, all students at Boston Green Academy receive a free stainless-steel water bottle at the beginning of the school year. These efforts made it practical to remove paper cups from the water stations, greatly reducing paper cup waste. Estimating that our 470 students each used an average of 3 cups/day for 180 days of school, BGA is keeping 253,800 paper cups out of the waste stream each year.

Hand dryers were installed in all student bathrooms in 2014, eliminating the need for paper towels in student bathrooms. Our CTE students started a composting initiative which qualifies them to receive community service hours to monitor composting and recycling stations in the cafeteria during lunch. They partnered with Save That Stuff to pick-up one 64-gallon toter of compostables each week. At an estimated 40 weeks/year at 64 gallons/week, 2,560 gallons/year or 9,728 pounds of food waste is diverted from the waste stream annually (using the EPA's food waste conversion factor of 1 gallon=3.8 pounds). We also have a "share" table in the lunchroom where students place untouched food (like fruit or carrots) for others to eat. In addition, students and staff compost all garden waste in compost bins in the garden and all yard waste produced by landscape and custodial services is composted by grounds staff through the Boston Public Works Department.

Beginning in February 2019, teachers will receive reusable spray bottles for each classroom, which custodial staff will refill with their bulk supply of green cleaner instead of constantly replacing new bottles of disinfectant, reducing our plastic waste in the classrooms.

We partnered with USGBC to pilot their Arc platform for school buildings, which engages students in green building benchmarking and sustainability investigations. Arc calculates a performance score out of 100 based on a global data set and action-oriented strategies across five categories: energy, water, waste, transportation, and human experience. Currently CTE students are working on the waste category. Through composting and recycling initiatives, we have increased our score from 75 to 90, with plans in place to improve even more. District sustainability staff, trained in the Whole School Sustainability model, are supporting BGA's participation in the Arc school programming, with 8 other K-12 districts from across the United States, providing BGA with water, energy, waste, and transportation data to benchmark the school using Arc, and resources needed for experiential projects, like waste audits, while using curriculum from Learning Lab.

Boston Green Academy follows all district policies relating to universal, hazardous, and electronic waste recycling (see custodial training in Pillar 2, Element A).

Pillar 1, Element 1D: Use of alternative transportation to, during, and from school

Students at BGA use some of the greenest transportation methods in the country to get to school, despite the fact that they come from all over the city. Students do not drive and there is not a student parking lot. 20% of students walk or bike to school because they live within a mile of BGA. 63% of students take public transportation (the MBTA) to school (bus, subway, light rail) and are provided all access Charlie Cards by BPS. The MBTA has a new fleet of energy efficient buses, including Hybrid and Hydrogen Fuel-Cell. The remaining students are 6th graders or require door-to-door transportation. These students take a yellow school bus to school.

20% of our staff take alternate forms of transportation to school, including biking, walking, public transportation, and carpooling.

Boston Green Academy partners yearly with Boston Bikes to help train interested students in bike safety (and help them acquire a bike). There is also always a project week group (defined in Pillar 2, Element B) that focuses on biking in the city. Students spend the entire week learning about bike safety and traveling around Boston on bike.

BGA is a no idling zone and supported in their energy efficient transportation efforts by the district (http://bostongreenschools.org/transportation/).

Pillar 2: Improved Health and Wellness

Pillar 2, Element 2A: An integrated school environmental health program

The Boston Public Schools recognizes that healthy physical environments are critical to the prevention of asthma and other chronic and infectious diseases that impact learning. To that end, our district is committed to providing high-performing school buildings and grounds that are clean, in good repair, have healthy indoor air quality and water quality, have sanitary and accessible bathrooms, and use

resources efficiently. BPS strives to provide adequate facilities for physical activity that are accessible and culturally-inclusive learning environments that positively impact the productivity, health, and wellness of all students and staff. To address environmental risk factors for chronic and infectious disease, every school, including Boston Green Academy, annually receives an Environmental Audit, conducted by BPS Environmental Division and Boston Public Health Commission, to evaluate health and safety conditions such as leaks, mold, pests, chemical storage, and cleanliness. The District also supports a Healthy School Environments Committee to promote and raise awareness of the health of the built environment and ensure continuous improvement of BPS healthy school environment policies and programs. District departments and all schools, through an Environmental Committee or school-based Wellness Council (see below), comply with existing federal and state regulations, city ordinances and District policies related to promoting and managing healthy school environments. Per the BPS District Wellness Policy (https://drive.google.com/drive/folders/0B3uV5Tndvx1zNnpLNnN5aWVtUGc), Boston Green Academy adheres to the following BPS district-wide policies related to healthy and green school environments:

1) Healthy School Environments: https://drive.google.com/file/d/1guOZrK-B8Ri_vUyVAi2NQBuAUPRS0rFI/view

2) Green Cleaners: https://drive.google.com/drive/folders/0B3uV5Tndvx1zOWxhVTcwNnNaOUE

3) Integrated Pest Management: https://drive.google.com/drive/folders/0B3uV5Tndvx1zOWxhVTcwNnNaOUE

4) Recycling and Zero Waste: https://drive.google.com/drive/folders/0B3uV5Tndvx1zOWxhVTcwNnNaOUE

5) Infection Prevention & Control: https://drive.google.com/drive/folders/0B3uV5Tndvx1zY1pVZlVtYlN0T3M

6) Tobacco Free Environment Policy: https://drive.google.com/drive/folders/0B3uV5Tndvx1zNnpLNnN5aWVtUGc

7) Environmental Audits: https://drive.google.com/drive/folders/0B3uV5Tndvx1zOWxhVTcwNnNaOUE

8) Drinking Water Access: https://www.bostonpublicschools.org/Page/6092

9) Laboratories and Chemical Inventory "Right to Know" Law

10) Science Safety in Laboratories and Classrooms: https://drive.google.com/file/d/1CRV6D-cxv9fgugaRn3sl4LCGK2yI5jKB/view

11) No Idling of buses or other motor vehicles on school property, and participation in Safe Routes to School per MGL Chapter 90, Section 16A, and

12) BGA AHERA plan for asbestos: https://www.epa.gov/asbestos/asbestos-and-school-buildings.

BGA's custodial staff are trained annually by Facilities Management in the areas of recycling, energy conservation, drinking water access, green cleaning, reporting environmental or building hazards, universal and hazardous waste, and integrated pest management. (2018 Presentation:

https://docs.google.com/presentation/d/1PJQBhLMbLaaVXY6y4O6lnUrfjuoy5tS3hifb0ktyZS0/edit?usp=sharing)

BGA's Director of Sustainability facilitates decluttering days for staff and students at the end of each term and especially over the summer. This diverts recyclables from the waste stream and reduces clutter that attracts pests.

BGA's chemistry teacher is trained and supported by Beyond Benign, a nonprofit that provides educators with the skills and tools to teach green chemistry in their classrooms and laboratories, including specialized open-access curriculum â€“ including over 200 lesson plans and units â€“ focused on sustainable science, green chemistry and related subjects.

Pillar 2, Element 2B: High standards of nutrition, fitness, and outdoor time

At Boston Green Academy, we believe strongly in serving the social, emotional and physical well being of all students, in addition to their academic needs. We invest in a talented and robust Student Support Team (SST) so that our students can be served well both inside and outside our school with compassion, empathy, responsibility, and integrity. The Team consists of two divisions, the Office of Counseling and Wellness and the Office of Support and Intervention. The Office of Counseling and Wellness consists of 3 school social workers, 2 guidance counselors, 5 counseling interns, and 1 school nurse. The Office of Support and Intervention consists of the Assistant Headmaster and 4 Community Field Coordinators who monitor school culture and discipline. To support school culture, SST incorporates Restorative Justice approaches (see below) and other Social Emotional Learning models. The Student Support Team also partners with Arbour Counseling services (arbourhealth.com/), Doc Wayne Sports Therapy program (docwayne.org/), West End Boys and Girls Club, Big Brothers/Big Sisters of Massachusetts, along with others who educate our teaching staff about trauma-informed practices.

Boston Green Academy weaves restorative justice into all elements of the school. The Director of Student Support and the Director of Teaching and Learning lead monthly staff professional development on diversity and restorative justice. All advisors lead a weekly restorative justice circle and all teachers and administrators use restorative justice approaches in their everyday interaction with students, including discipline.

The Student Support Team runs a girls and boys mentoring group, called GLAM and MORE respectively. The GLAM Squad provides members with the prevention, empowerment and leadership skills they need to thrive, succeed, and achieve. GLAM members are exposed to and equipped with the tools necessary to build leadership skills, confidence, and strength. Through weekly sessions, and experiential events in our community and beyond, GLAM members develop their own sense of self, increase their own strength and are prepared to enter the world after high school. GLAM is open to anyone that identifies as female. The M.O.R.E. program (Men, Organized, Responsible, Educated) at Boston Green Academy aspires to develop young men of color as leaders in our school and in our communities. The members meet weekly after school to plan events, discuss important topics relevant to being a man/young man in our society, get support with their academics and provide moral support to each other.

The Wellness Council is headed by our Director of Student Support and composed of 8 BGA staff members and students. The priorities of the wellness council are to promote character and community building, increase health and fitness instruction, create a safe and welcoming learning environment, and

prepare students to lead in the sustainability of our community and world. Products of our wellness council include a GSA (Gay/Straight Alliance) for our middle and high school (high school students help run the middle school GSA), a nutrition team that works with the cafeteria to support healthy eating, and health classes for our middle school and 10th grade students.

The Physical Education program at BGA is designed to help students develop the skills and knowledge necessary to be healthy and physically active now and throughout their lives. Throughout the program, students learn about sexual health, relationships, and decision making; team sports; individual sports, group problem solving, and fitness skills. All middle school students (6th-8th) take Physical Education and Health each year. It is also offered as an elective in the high school.

During our annual Project Week, students spend an entire week off campus—hiking , biking, cooking, meditating, teaching, dancing, sailing, painting, protecting, exploring, discovering and engaging—with the Greater Boston community and beyond. Project Week builds community: it removes boundaries between students and teachers and across grades and classes; it provides opportunities for physical and mental fitness and for making a difference in the world; it connects students to businesses, government, nonprofits and cultural institutions; and it challenges comfort zones and provides a sense of place in and shared responsibility for the global community.

We are proud to be a Thompson Island multi-year partner school. Each of our middle school grades stay on Thompson Island for an immersive 3-day outdoor environmental science learning adventure each fall and a 1-day team-building and leadership experience each spring. Thompson Island Outward Bound ignites curiosity and allows students to push past their preconceived ideas of what they can achieve (thompsonisland.org/programs/connections/school-year/).

Our entire 8th grade class visits the White Mountains in New Hampshire every spring for a 3-day, 2-night outdoor leadership experience with A Mountain Classroom (part of the Appalachian Mountain Club). Here students split into smaller groups, hone their leadership skills, and climb the nearby peaks. A Mountain Classroom uses inspiring outdoor settings and experiential methods to engage students and their teachers in learning (www.outdoors.org/youth-programs/mountain-classroom).

In the fall, all of our brand new 6th graders visit Hale Reservation in Westwood, MA for a day of outdoor teambuilding and leadership training. Students split up into smaller groups and work through team-building games, low ropes, and high rope elements. Hale Reservation's mission is to provide educational experiences that foster responsibility, leadership and appreciation for the natural environment (halereservation.org/climb-the-mountain/education-adventure/).

We are host to one of the most robust outdoor clubs in the Boston Public School district. Boston Green Academy is partnered with the Youth Opportunities Program, which is part of the Appalachian Mountain Club. The Outdoor Club gives students the opportunity to experience the natural world and promote environmental awareness through participation in outdoor adventures including camping, hiking, canoeing, cross country skiing and snowshoeing. Students meet weekly, engage in bi-weekly outdoor trips, and participate in at least 6 overnight trips each year, including an extended week-long trip during April's Project Week (www.outdoors.org/youth-programs/youth-opportunities-program).

BGA's entire south-facing lawn has been converted into an outdoor classroom and garden for our students. This area was designed, built, and is still maintained by students (see Pillar 3, Element B).

There are eleven 4x8 raised beds for growing produce, 8 outdoor tables for working and eating al fresco, and 6 work-benches for planting, growing seedlings, and collecting the harvest. There is also beautiful signage in the garden designed and created by students. Urban Ecology middle school classes and CTE classes in the high school manage and tend to the garden and outdoor classroom. During the fall and spring, students plant, grow, and cook with produce from the garden, all while developing healthy recipes and nutritional practices. In addition, many classes use the outdoor classroom during the warmer months as a means to get the students outdoors while still learning.

Our LFI program created and manages the BGA Café. In the LFI classroom, students develop menus and cook healthy meals for staff members every Thursday in the BGA Café (which includes a fully functional kitchen). They often use produce from the garden in their recipes. The program builds life skills, basic culinary skills, and exploration of nutrition. Each of the two groups of students within the LFI science class has a particular focus: One group works on building vocabulary, sorting foods into groups, and practicing cooking skills, functional reading, and community skills while traveling to and from the store to purchase anything they need that we do not currently grow or produce. The second group works on planning the meal and exploring the nutritional content of the meal (calories, protein, carbs, fat). This group also takes time to explore budgeting and calculating costs per meal. All meals are served in reusable containers, collected, and washed in the LFI kitchen.

BGA is proud to be a Scholar Athletes partner school. Scholar Athletes partners with public high schools to help close the opportunity gap for thousands of young people in grades 9-12 across the Commonwealth. Scholar Athletes' programs leverage the power of athletics and wellness to cultivate the discipline, confidence and social-emotional skills needed to support success in school, as well as success in life (wearesa.org).

All middle schoolers have recess built into their schedules. Recess promotes outdoor time, growth and development, and physical fitness. Recess also provides mental breaks and encourages social time that can have benefits for a teen’s emotional health and behavior during school.

Boston Green Academy has several sports teams that promote health and fitness. Sports teams include women’s/men’s: soccer, basketball, volleyball, baseball/softball, track and field, football, and dance.

Pillar 3 – Environmental and Sustainability Education

Pillar 3, Element 3A: Interdisciplinary learning about the key relationships between dynamic environmental, energy, and human systems

Boston Green Academy employs a full time Director of Sustainability to ensure the success of our mission, which is to empower students to lead in the sustainability of our community and world. The Director of Sustainability works with staff, students, community members, and green organizations/companies across New England to make sure our students are fully prepared for and not left out of the burgeoning green economy (an historically white, middle to upper class career track). It is the responsibility of the Director of Sustainability to oversee all sustainability-focused courses, programs, opportunities, trainings, committees, and green building updates highlighted in this application, and see them through to fruition.

The Director of Sustainability created Green Milestones, a continuum of green-focused academic and career opportunities, and works with each grade level team to ensure that all students: 1) establish a meaningful relationship with our community and earth; 2) grapple and engage with real world, sustainability issues; and 3) engage with leadership opportunities that promote sustainability. Many of these milestones are highlighted in this application, including outdoor overnight trips, Urban Ecology, and Green Exhibitions (all defined below in this section).

All staff participate in a 2.5 hour weekly professional development organized by our Director of Teaching and Learning. The Director of Sustainability works with the Director of Teaching and Learning to create at least 10 hours of sustainability professional training per year, which is augmented by the direct work with grade level teams. The professional development is centered around teaching through the lens of sustainability and creating healthy environmental, social, and economic systems that work now and in the future. Teachers are coached and assessed on utilizing this practice.

Each year, all grade levels and all content teams in the high school complete a term long interdisciplinary project focused on sustainability, called Green Exhibitions. We challenge our students to grapple with important environmental, social, and economic issues while empowering them to create change in their own lives and beyond. During exhibition season, the classroom walls open up and contents merge. Each grade level digs deeply into a sustainability issue in all of their classes through real world learning experiences (field trips, data collection, interviews, research) and presents their findings and solutions at their end of year exhibition. While the bulk of this project happens during one term, learning takes place all year through field trips, readings and videos, scientific and mathematical investigations, and more. Watch our video here (https://vimeo.com/261540669) to learn more. Specific action projects are defined in Pillar 3, Section C below.

Urban Ecology is a required class for all 6th-8th grade students. In partnership with the Boston Nature Center, this class provides hands-on, project-based curriculum focusing on environmental issues in our communities. Students study energy and water systems, investigate climate change both locally and globally, engage with the food system and food justice, and solve engineering challenges through the lens of sustainability. (https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/boston-nature-center) Boston Green Academy just received Chapter 74 status for and is the only high school in the Boston Public Schools to offer an Environmental Science & Technology career and technical education (CTE) pathway program. The Ch74 CTE pathway solidifies BGA's own status as an innovator within BPS. Students in this exciting program take in-depth courses, experience special field trips and projects, and take dual enrollment courses at BGA through our partnership with Quincy College. Students get to partner with industry leaders for internships and explore the career possibilities in this growing and important field. Graduates of the CTE pathway will be prepared to continue their education in college or enter the workforce with the kind of environmentally-specific knowledge and experience that will qualify them for work as water quality specialists, environmental scientists and engineers, and community and state officials investigating real-world environmental issues. Graduates of the Environmental Science pathway program will be certified in First Aid and CPR, 10-hour OSHA general industry safety, and OSHA 40-hour Hazardous Waste Operations. Students will also be trained in wastewater and drinking water technologies, which will prepare them to take the Massachusetts Class II Municipal Wastewater Treatment Plant Operators and Massachusetts Grade I Drinking Water Treatment Exams administered by the State of Massachusetts. We enroll twenty new 9th graders in the program each year, which will impact over a quarter of our high school students by the time they graduate!

Currently, (SY19) we have 40 9th and 10th grade students enrolled, next year we will have 60 9th-11th graders, and the following year will complete the pathway with 80 students enrolled.

In partnership with Cambridge College, 11th and 12th grade students in good academic standing can sign up for the Sustainability Management Pathway. Students in the pathway will take 3 sustainability college level courses in Physics, Humanities, and Business, while receiving simultaneous college and high school credit for each course. Successful completion of all 3 courses will earn BGA students a Sustainability Management Certificate from Cambridge College while they are still in high school.

All of our 9th grade students take Environmental Science as their freshman science course. Environmental Science is interdisciplinary, embracing topics from geology, biology, environmental studies, environmental science, chemistry, and geography. This course is unique in that we have adopted a project-based learning (PBL) approach. Students work collaboratively and individually on tasks and products that are designed to help them succeed at meeting complex, authentic environmental challenges. Because challenges in the real world of environmental science rarely draw upon only one topic, the challenges in this course require students to draw from a broader knowledge base. This gives students the opportunity to learn about the same objectives multiple times throughout the course through different contexts and perspectives.

The Advanced Placement course for Environmental Science is a rigorous interdisciplinary college level course offered to interested 11th and 12th grade students. The AP Environmental Science course is designed to be the equivalent of a one-semester, introductory college course in environmental science, through which students engage with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. The course requires that students identify and analyze natural and human-made environmental problems, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving or preventing them. Environmental Science is interdisciplinary, embracing topics from geology, biology, environmental studies, environmental science, chemistry, and geography.

All of our 12th grade students take Green Physics. This innovative physics course explores the laws and principles of physics through the lens of Clean Energy technologies. The project-based format is optimal for students to develop hands-on skills as they work with real Clean Energy hardware to design and engineer solutions to reduce our reliance on fossil fuels. Students dive into the conceptual and mathematical physics of photovoltaic arrays, solar thermal technology, wind power, and heat pumps. The authentic experiences presented in this class will help develop citizen-scientists who recognize their impact on the local and global environment, are prepared to make informed decisions, and communicate and advocate for a sustainable future. Problem solving, discussion, and argumentation are stressed as students gain experience as independent, self-motivated learners and become prepared for Clean Energy and STEM occupations and post-secondary majors.

Green engineering is an elective class offered to 11th and 12th grade students. This course takes an interdisciplinary approach to assessing and developing sustainable solutions to meet the needs of society, the economy, and the environment on regional and global scales. Students use primary sources to gain a better understanding of product design, programming and robotics, energy challenges that society faces, and how to communicate these issues. After diving into the physics underlying these systems, students use the Engineering Design Process to define, develop and optimize sustainable solutions to authentic problem-based scenarios. This course helps to nourish citizen-scientists who

recognize their impact on the local and global environment and economy, are empowered to make informed decisions, and communicate and advocate for a sustainable future.

Pillar 3, Element 3B: Use of the environment and sustainability to develop STEM content, knowledge, and thinking skills

The Director of Sustainability works with partners, staff, and students to turn our 103,056 square foot building built in 1895 into a Green STEM Laboratory. Teachers at BGA utilize the following tools, programs, and improvements in their curriculum to strengthen students critical thinking skills and deepen their STEM knowledge:

The Davis Vantage Pro2 Plus Wireless Weather Station is a customizable weather station with a wide range of options and sensors to help students measure, monitor, and manage weather data. Students are able to access live weather data, including: Indoor and Outside Temperature and Humidity, Barometric Pressure, Dew Point, Rainfall, Wind Speed and Direction sensors, and UV and Solar radiation.

Students can access our building's up-to-date energy usage via our energy dashboard platform, which organizes data into easy-to-read graphs, tables, and charts.

We installed a Classroom Observation Beehive (http://www.classroomhives.org/) in our library, so that students can observe and learn about the insects that are critical to maintaining our food system.

Once it arrives, we will install a 300-gallon aquaponics system with media beds capable of growing 2,000 heads of lettuce/year for our CTE program. Aquaponics is the perfect teaching tool for core STEM subjects like Math, Biology, Chemistry and Engineering. Students can study fish, plants, and bacteria interacting in a living ecosystem. Students can perform water quality tests and measure growth rates in fish and plants. Our CTE class will create and execute a business plan using the produce, all while learning economic and marketing skills.

In their Engineering class, students designed and proposed green roof models for our flat, accessible rooftop. They learned about and designed models that were environmentally and economically sustainable, and also accessible for all students. They present their models to a panel of Boston based architects and engineers.

In 2014, our sub-separate high school science classes designed, fundraised for, and then built a parklet outside a restaurant in Boston. After two years, we had to move the parklet to BGA because of over-wintering issues. Students re-designed the parklet to fit into our burgeoning outdoor garden. Over time, classes from all content areas have added raised beds, tables, and other learning tools to the outdoor garden. Today, all classes use the area and it is managed by our Middle School Urban Ecology students and our CTE students.

Students in the green physics class worked with a professor and engineer from Boston University to design and build a bike that converts human energy into electrical energy. The bike is still on display and used in a many different classrooms to demonstrate energy conversions and can even power small appliances, like a blender.

As part of their Green Exhibition in spring 2019, our 9th grade math students will work with the City of Boston energy department to conduct a solar feasibility study of the BGA roof.

In school year 2017, BGA partnered with Gensler Architects, Turner Construction, and City Year to redesign our outdated library to better meet our mission and the needs of our students. They loved working with our staff and students so much (and loved our mission), that they've reached out to us again to design and build a MakerSpace for us in June 2019. This space will be high tech (featuring 3D printers, laser cutters, CNC equipment, AutoCAD software, design software, audio/recording devices, cubelets, circuit materials, solar panels, wind kits, generators, etc.), and help to fill the technology gap many public school students face. The space will be overseen by the Director of Sustainability and the Director of Technology at BGA, making it a MakerSpace dedicated to solving environmental challenges.

Currently, students have access to the above-mentioned equipment through our partnership with the GE Brilliant Career Lab. Each year, GE brings their Fab Lab to our Green Engineering, Green Physics, and CTE classes. The physical digital fabrication lab offers interactive experiences that combine experiential learning with career-readiness planning in high-demand STEM fields. The Brilliant Career Lab brings state of the art technology, including 3D printers, laser cutters, circuits, milling machines, and programming tools so students can learn STEM disciplines and skills using an interdisciplinary, applied hands-on approach. The Brilliant Career Lab helps prepare students for the innovative jobs of the future with career exploration experiences, information on regional labor market demands, and career pathway information by offering both technical and essential skills training.

BGA is part of the STEM Happens Network (SHN). SHN partners with schools to develop a common definition for STEM as it relates to practice, learning model, and capacity for integrated STEM instruction across content areas. SHN works with a team of 4 educators at BGA to integrate STEM into a cohesive cross-curricular teaching and learning model, providing students with opportunities to gain experience with real-world applications that lead to a trans-disciplinary culture of teaching and learning. This creates a lever to implement a culture of change within the school and provides authentic college and career readiness education for students. We are currently working with SHN to deepen the STEM content in our 9th grade Green Exhibition. (www.stemhappensnetwork.com)

We are a 2019 BPS STEM Factor School. Sponsored by the GE Foundation, the BPS STEM Factor is a program dedicated to engaging BPS students in STEM experiences that are critical to compete in an increasingly technology-driven workplace. BPS STEM Factor is a two-part program featuring work-based learning (WBL) and project-based learning (PBL) initiatives. In Project Based Learning initiatives, students are able to identify problems, design possible explanations, and test and evaluate solutions until the best explanation is found. When classrooms mimic real world scenarios, students are able to problem solve in meaningful ways. In the summer, all students participate in a paid internship in a STEM field. Work-based learning complements and enhances STEM education by exposing students to the day to day work that is required in STEM careers in their own community. When students see themselves in STEM careers through an immersive experience, it makes STEM careers more tangible to them. (externalaffairsbps.org/stemfactor/)

Sophomores and Juniors in good academic standing can take our Harvard MedScience program, a high school STEM education initiative inspiring students to engage with science through hands-on experiences. The program, run on-site at the Harvard Medical School campus alternates between simulation cases, clinical skill stations, and tours at hospitals & labs. The curriculum is based on the idea that the science in medicine is more than biology - it is the chemistry of membranes and molecules, it is the physics of cardiac vectors, surface tension and tensile strength and the sociology and anthropology

underlying the social determinants of disease. The Medscience Curriculum brings all these sciences together showing the student the integrated complexity of human life and inspiring them to find their place in the mystery!

All 10th grade students participate in the BioBits program through their required Biology course. Hands-on learning is known to be more engaging and effective for teaching science to students, but even the most basic molecular and synthetic biology experiments require equipment far beyond an average classroom's budget. Now, a collaboration between the Wyss Institute at Harvard University, MIT, and Northwestern University has developed BioBits, new educational biology kits that use freeze-dried cell-free (FD-CF) reactions to enable students to perform a range of simple, hands-on biological experiments. The BioBits kits introduce molecular and synthetic biology concepts without the need for specialized lab equipment, at a fraction of the cost of current standard experimental designs.

Pillar 3, Element 3C: Development and application of civic engagement knowledge and skills

For the past three years, Boston Green Academy has been a member of the Teaching Our Cities partnership, a group of six urban environmental public high schools across the Northeast United States who work together to mobilize the urban environment as a learning laboratory, create urban public schools that are responsive to our cities, and grow a new, more diverse generation of environmental and community leaders. These six schools are building a community of practice â€“ supporting each other as we build our schools' capacity, and as we document and share our school's practices. We meet in person at least 3 times a year and support each other through sharing best practices and exploring problems of practice. (http://www.teachcity.org/)

At Boston Green Academy, we offer year-long, monthly trainings in 6 different learning techniques (all teachers must choose one to focus on each year). One of these techniques is Project Based Learning. This training is based on the Buck Institute of Education model. In this model, students work on a project over an extended period of time that engages them in solving a real-world problem or answering a complex question. They demonstrate their knowledge and skills by developing a public product or presentation for a non-school audience. Throughout the process, students develop deep content knowledge as well as critical thinking, creativity, and communication skills in the context of doing an authentic, meaningful project. Our Green Exhibition projects use a Project-Based Learning model.

The Director of Sustainability works with the Director of Teaching and Learning to create at least three, 2-hour professional development sessions that guide all teachers to create strong, interdisciplinary Green Exhibitions that meet the following criteria: engage with a real audience, deal with relevant/real world issues, and get the students off campus into their community. In the 9th grade students dig deeply into the topic of climate change. Products include a TedTalk style presentation for stakeholders, BGA photovoltaic roof feasibility study, and urban tree planting throughout Boston. In the 10th grade, students take a deep dive into the sustainability of our food system. Students write a research paper and work in teams to design, refine, and teach a lesson on our food system taught at local elementary schools throughout Boston. In the 11th grade, students pick an urban sustainability issue of their choice and complete a participatory action research project (PAR) that addresses this issue. During their research, students find and work with a local organization involved with the topic they are researching. They present their work to an audience of community stakeholders at a showcase held in downtown Boston. In the 12th grade, students focus on real world problems facing displaced migrants. Students are given a choice of countries and asked to research geographic, political, and economic realities. They

create narratives, data sets, and construct an upcycled product designed to benefit a refugee in a specific geographical location. Students present to a panel of stakeholders at the end of project exhibition.

All of our students complete 45 hours of mission-consistent community service as a graduation requirement. In the 9th and 10th grade, groups plan for and complete small group community service projects through their Advisory (Advisories include 1 teacher, 15 students). Groups have completed their projects at local food banks, homeless shelters, animal shelters, social justice organizations, and supply donation organizations. This is a great way to introduce students to meaningful community service that is mission focused and makes a difference in their community. This year, all 9th grade students will also participate in a service learning project as part of their Green Exhibition on climate change, in partnership with the nonprofit Speak for the Trees. Students will identify parks and other areas in Boston that are in need of more urban trees, create a plan on when and where to plant, and then plant these trees over the course of one week in the spring.

Also during the spring, all students at Boston Green Academy participate in our annual Project Week (Defined in Pillar 2, Element B). All of the projects in the middle school and many of the projects in the high school are service related, getting students off-campus and working on service projects throughout Boston and beyond. Service themes include: Environmental Protection, Food and Gardening, Social Justice, Homelessness and Hunger, and Elder Care. In addition, 10 high school students are selected each year to go on an international environmental service learning trip. Destinations have included the Dominican Republic, Puerto Rico, and Cuba.

Students in grades 6-10 participate in guest speakers, career and activity fairs, and career panels in their advisory class to expose them to a variety of career fields. The Guidance Counselors work with the Director of Sustainability to include a variety of jobs in the sustainability field.

All seniors (and next year all juniors and seniors) will complete a 4-hour job shadow in a sustainability field of their choice. All seniors complete a 6 week, 150-hour sustainability internship in a field of their choice. Students work with the Director of Sustainability to find an internship for Term 4 (instead of coming to school, they go to their internship). They can choose one of two pathways: 1) Choose an internship in a sustainability field or 2) Choose an internship in a different field but create a sustainability project while there (for example, create a composting pilot). This is a graduation requirement.

The Director of Sustainability, BGA CTE teacher, BGA science facilitator, and BGA headmaster meet quarterly with a group of sustainability professionals in Boston, called the Program Advisory Committee (PAC). These meetings keep the CTE curriculum at the forefront of the environmental science and technology field and connect our students with real world projects and partnerships in the Boston community. Two project examples include: 1) Along with the thermal imaging of our own building (see Pillar 1, Element A), CTE students are currently partnering with the Old State House to take thermal images of the historical 1713 building for use in their ongoing historical, green updates to the building envelope. This partnership has the potential to expand to other City of Boston buildings, as the city does not have thermal images on file of any of their buildings. 2) All CTE students participate in the Land Science-Virtual Internship program, coordinated by Massachusetts Audubon Society. In Land Science, students are tasked with proposing a rezoning plan for the city of Lowell, MA that takes into account the demands of the various stakeholder groups, including housing, jobs, pollution control, wildlife

protection, waste disposal, and others. Using an online platform, students are placed into project teams with a Planning Consultant who mentors them through the experience. Over the course of the internship, students use research studies, stakeholder input, and professional land planning tools to propose land-use changes. Using these resources, students perform tasks similar to those Urban Planners complete in their training. They research citizen's concerns about issues like revenue, water pollution, waste, housing, and more; use a GIS model of Lowell, MA, called iPlan, to create preference surveys and redevelopment proposals; as well as record and reflect on their tasks in an electronic planning notebook. The internship culminates with students making final zoning recommendations. All of the stakeholders' concerns cannot be addressed simultaneously, so project teams must decide which demands to meet, and tradeoffs to make. Students write a formal proposal justifying their team's decisions and convincing the stakeholders that their proposed plan is an ideal compromise.

Students in the 9th-12th grade sign-up and are selected (via an application and teacher recommendations) to participate in Green Ambassadors. This is a group that works internally to promote our mission at Boston Green Academy and represents Boston Green Academy externally at different events (for example, many of our Green Ambassadors have spoken at our annual gala or served on external student councils).

Boston Green Academy has a middle and a high-school student council. Students serving on the council work with faculty advisors to provide opportunities for student voice and student leadership at BGA. Many of these opportunities are mission driven, including food and clothing drives, assemblies focused on environmental and social justice, and guest speakers.

At Boston Green Academy, all high school students create an online Green Portfolio that shows their challenges, growth, and development from freshman to the end of their junior year. During Term 4 of 11th grade, all juniors must present and defend their Green Portfolio to a panel of judges at a community attended event called Junior Review. The presentation includes their green exhibitions, green milestones, community service, and future plans.

Highlights – Boston Green Academy Horace Mann Charter School; Boston Public Schools; Boston, MA

Boston Green Academy empowers leaders to change the world. We respond to local, regional, and global findings on the state of the environment by refining our Green programming, broadening our sustainability efforts beyond the school into the greater Boston community, and preparing 6th through 12th graders to be leaders in the burgeoning green economy. We do this by establishing and holding high expectations for our students and our staff, addressing our mission in all content areas, reinforcing the pillars through regular presentation opportunities to the community, all while supporting the social and emotional needs of students whose own socio-economic status is in constant flux. Our school serves and empowers a diverse population: 80% of our students are considered high needs, 67% are economically disadvantaged, 32% are students with disabilities, 35% are students for whom English is not their first language, and 92.8% are students of color. We recruit, enroll, retain and graduate a student population that represents the mosaic of the City of Boston and we support our young people's right to equity, and to cultural and individual expression. We are a strong example of how a community of staff and students can use partnerships, relevant and engaging curriculum, and leadership opportunities to transform a turn-of-the-century building into an environmentally sustainable one. We believe that we are a model green school both for Boston's district schools, and for other urban institutions, and receiving a Green Ribbon designation will add heft to our claim as we continue to share our process and results through PD and dissemination practices locally, statewide, and nationally.