PHILADELPHIA BUILDING ENERGY BENCHMARKING

2019 Report

Executive Summary

This report summarizes findings from the Philadelphia Building Energy Benchmarking Program including 2018 building performance data and trends observed over the life of the program. The Energy Benchmarking and Disclosure Law (Philadelphia Code section 9-3402) requires commercial and multifamily buildings 50,000 square feet and larger to report their energy and water usage annually to the City of Philadelphia using the free U.S. EPA's ENERGY STAR® Portfolio Manager® tool. The annual deadline to report the previous year's energy and water usage is June 30th.

Benchmarking is a tool to help building owners measure, track, and disclose their energy and water use on an annual basis. Since the start of Philadelphia's program, facilities have out-performed the national averages. Overall, buildings that have participated in the program have improved energy performance 5 percent and cut greenhouse gas emissions (GHGs) at least 12 percent since 2013.

This report includes results from multifamily properties, which were first required to report in 2015. As the third largest source of carbon emissions in the benchmarking data set, this building sector offers the opportunity to engage residents and property owners in energy efficiency and reduction measures.

Key Findings

- Since 2013, there has been at least a 12% reduction in total greenhouse gas emissions from buildings participating in the program.
- Since 2013, Philadelphia's benchmarked buildings have demonstrated a 5% reduction in overall energy use and over half of all buildings reported every year have achieved energy savings.
- Since the start of the program, there has been a 53% growth in nationally recognized energy efficient buildings.
- The three building sectors with the largest contribution to GHGs are Colleges/Universities, Offices, and Multifamily buildings.
- The average building in Philadelphia is performing slightly better than the national median with an ENERGY STAR score of 55; however, thousands of buildings fall below this score, demonstrating the opportunity to improve energy efficiency in our city's building stock.

2018 Benchmarking Highlights

Since 2012, Philadelphia's largest buildings have been reporting their energy and water use to the City of Philadelphia under Philadelphia's Energy Benchmarking and Disclosure Law (Philadelphia Code section 9-3402). The buildings that shared their benchmarking report in 2018 comprises more than 320 million square feet, representing 20 percent of the city's total square feet of building space. Since the beginning of the program the compliance rate has remained high even as the list of buildings required to report has increased with the expansion of multifamily properties and growth of new construction in Philadelphia.

The average ENERGY STAR score in Philadelphia has continued to remain above the national median of 50; however, a 10 point drop was observed from 2017 to 2018 due to changes made to the EPA ENERGY STAR score calculations. This highlights the opportunity for energy efficiency improvements in commercial and residential buildings citywide to keep pace with the national median. Property owners and managers can utilize energy use data to help identify low energy performing buildings and make informed energy efficiency decisions to improve their scores.

320+ Million Square Feet

2700+ Buildings Reported

55 Median Energy Star Score

Represents **20%** of total citywide square footage

85% Compliance Rate

Tracking Philadelphia's Climate Goals

Philadelphia's Office of Sustainability (OOS) completes a greenhouse gas inventory every two years to determine our local contributions to the carbon pollution entering the Earth's atmosphere, contributing to global climate change.

The single-biggest source of local carbon pollution in Philadelphia is the buildings and industry sector, including electricity from the regional grid that powers our homes and businesses. The 2016 greenhouse gas inventory shows that this sector contributes 72 percent of citywide greenhouse gas emissions, but it also demonstrates progress in cutting emissions, particularly in some of the city's largest buildings. The inventory not only demonstrates the affect of energy efficiency but also shows the impact of cleaner electricity generation on our grid, including new renewable sources like solar and wind.

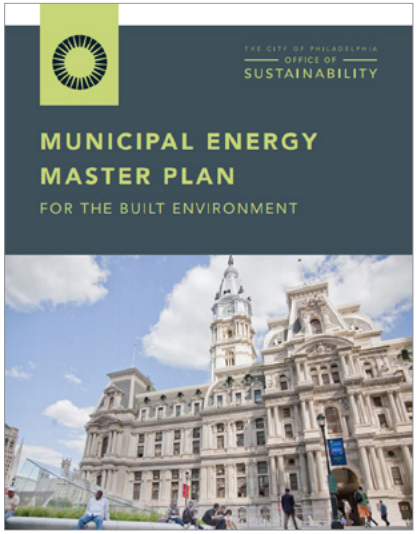
As a result of this transition, transportation accounts for a greater portion of Philadelphia's carbon footprint in the 2016 inventory. However, at roughly a quarter of citywide emissions, transportation is still far less carbon-intensive in Philadelphia than nationally, where it is the leading source of greenhouse gases. The biggest reason for this difference is Philadelphia's density and the low-carbon transit service provided by SEPTA. The most recent SEPTA sustainability plan update estimated that transit ridership in the region prevented more than 1 million metric tons of greenhouse gases from entering the atmosphere.[i]

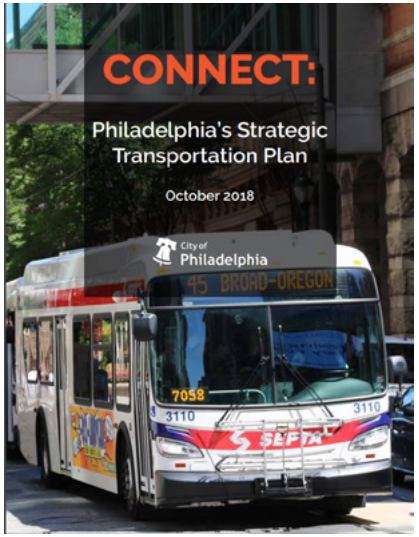
Tracking Philadelphia's Climate Goals

To learn more about how Philadelphia is working to cut its citywide carbon footprint across the major sources of carbon emissions in our city, check out the reports below:

- The **Municipal Energy Master Plan** describes how City government will lead by example, cutting the carbon footprint from municipally managed buildings and streetlights 50 percent and procuring 100 percent clean electricity for city operations by 2030.
- **Powering Our Future** is Philadelphia's clean energy vision, setting out goals and strategies for achieving Mayor Kenney's commitment to cut carbon pollution citywide at least 80 percent by 2050 and move toward 100 percent clean energy.
- **CONNECT** is Philadelphia's strategic plan to create a transportation system that is safe, affordable, accessible, and reliable.
- Philadelphia's **Zero Waste and Litter Plan** sets out strategies to advance our city toward a Zero Waste and litter-free future.

The 3,000 largest buildings in Philadelphia account for around 15 percent of our carbon footprint, which is why the Office of Sustainability is committed to working with those building owners to cut energy waste through the City's energy benchmarking program. The remainder of this report will describe the progress toward reducing this important source of emissions.





Benchmarking in Philadelphia

Building energy benchmarking is a tool to help building owners and managers compare energy performance with similar buildings, set goals, and move towards behavioral, operational, and capital improvements in their facilities. Building personnel required to report under Philadelphia's Energy Benchmarking and Disclosure Law use ENERGY STAR Portfolio Manager, the national standard for tracking, analyzing, and reporting energy usage.

Because buildings are key drivers of greenhouse gas emissions, they represent a solution to reducing the impacts of climate change and building a resilient city. While the city's largest buildings account for a fraction of the total number of buildings in Philadelphia, they account for 15 percent of citywide carbon emissions. Programs that promote energy efficiency and decarbonization, such as benchmarking, are essential in reaching Mayor Kenney's goal to reduce citywide carbon emissions by at least 80 percent by 2050.

Benchmarking also has many benefits that work toward advancing the Greenworks Vision for a Sustainable Philadelphia. Greenworks envisions a city where residents can:

Use clean, efficient, affordable energy

Benchmarking identifies opportunities for building owners and tenants to reduce energy use and save money on their utility bills.

Breathe healthy air inside and outside

People spend nearly 90% of their time indoors. Benchmarking helps owners identify opportunities to improve resident comfort and indoor air quality.

Benefit from sustainability education, employment, and business opportunities

Benchmarking provides free technical assistance to help building owners and managers use energy management software and understand the results of their building metrics. The publicly-disclosed data can also help tenants, brokers, and other stakeholders make more informed decisions in the marketplace.

Carbon Emissions of Philadelphia's Benchmarked Buildings

Total

Citywide Carbon Emissions

72%

Carbon Emissions from Buildings and Industry in 2016

15%

Carbon Emissions from Buildings benchmarked in 2016

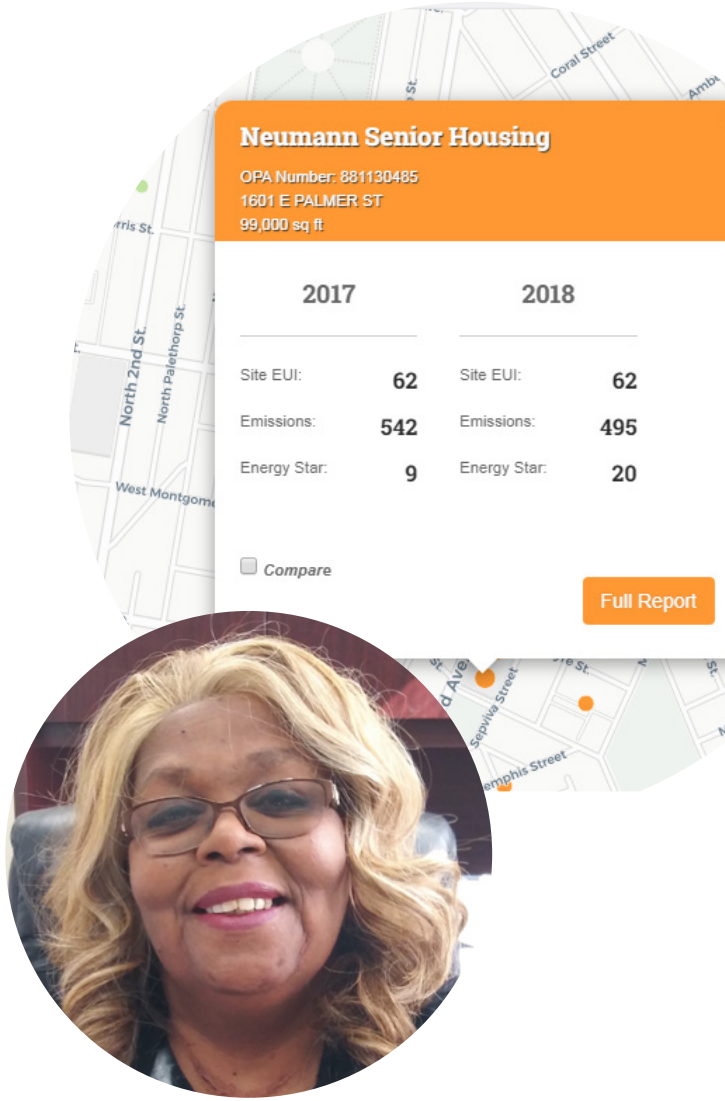
Benchmarking Highlight: Neumann's Senior Housing

When Tracy Richardson was introduced to the Philadelphia energy benchmarking ordinance, she had never heard of the concept. As the building manager for Neumann Senior Housing, and a leader within the building management company, Presby's Inspired Life, she says that benchmarking has changed her outlook.

"I think Philadelphia benchmarking is a great program. My building management practice has changed. Since I've been benchmarking, I've been more cognizant of our energy bills and I meet with tenants frequently asking them to be mindful of their use."

From 2017 to 2018, Neumann's Senior Housing improved its ENERGY STAR score from a 9 to a 20. Benchmarking helped Tracy and the building owner identify opportunities for efficiency. In 2017 and 2018, Presby's Inspired Life completed facade repairs, installed energy efficient lighting and laundry machines, and replaced the burners on aging boilers to make them run more efficiently. Tracy plans to replace the boilers with high efficient ones while taking advantage of PGW's EnergySense rebates at the end of the year.

Tracy now assists other building managers at Presby's Inspired Life's 36 affordable housing residences for seniors and keeps them on track to reporting their energy use every June 30th.



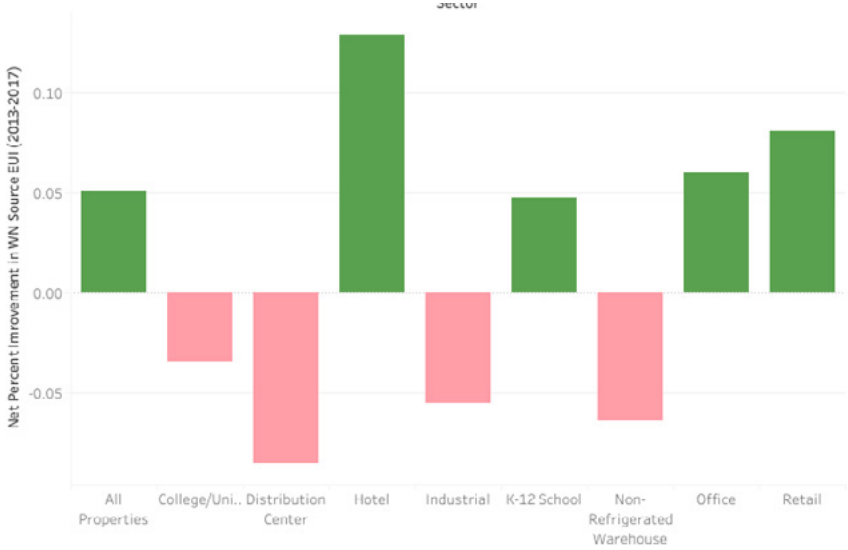
Benchmarkings Impacts Over Time

Since the start of the benchmarking program, energy performance in Philadelphia's building stock has improved considerably. Through a rigorous analysis of the performance of building energy data submitted between 2013 and 2017, an overall performance improvement of 5.09 percent was measured.[ii] The metric used to accurately capture progress in this case was weather-normalized source Energy Use Intensity (EUI) so that the buildings' fuel mix and changes in weather conditions were considered.

In these results it is clear that the largest buildings in Philadelphia are working to becoming energy efficient. While the exact reasons for these changes have not been identified, we can infer that the practice of monitoring performance over time creates an incentive to reduce use and costs. In fact, the EPA found that "organizations benchmarking consistently in Portfolio Manager have achieved average energy savings of 2.4 percent per year, and an average increase in ENERGY STAR score of 2 points per year in their buildings."[iii]

Some sectors are leading the way in building energy performance such as hotels and retail establishments. Hotels saw the most improvement with a 12.9 percent reduction in weather normalized source EUI with retail trailing with an 8.1 percent reduction. Often hotels and retail stores within Philadelphia are managed by larger organizations that implement energy performance policies while working to improve their corporate sustainability practices. This may be one reason why they've seen such a dramatic improvement in performance since 2013. Hotels and retail make up around 7.5 percent of total property area in the benchmarking dataset, indicating that there is still much improvement to be made in other building sectors such as multifamily and office space.

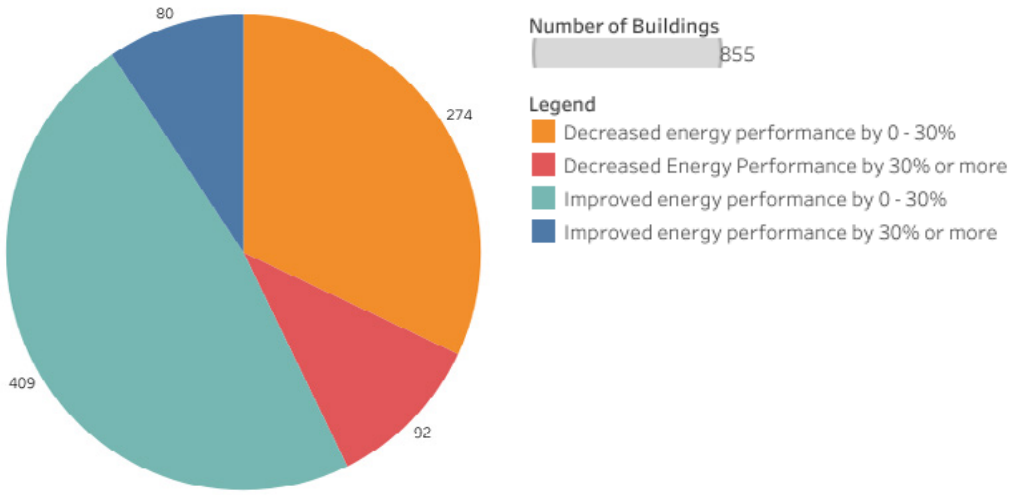
Improvement in Weather Normalized Source EUI



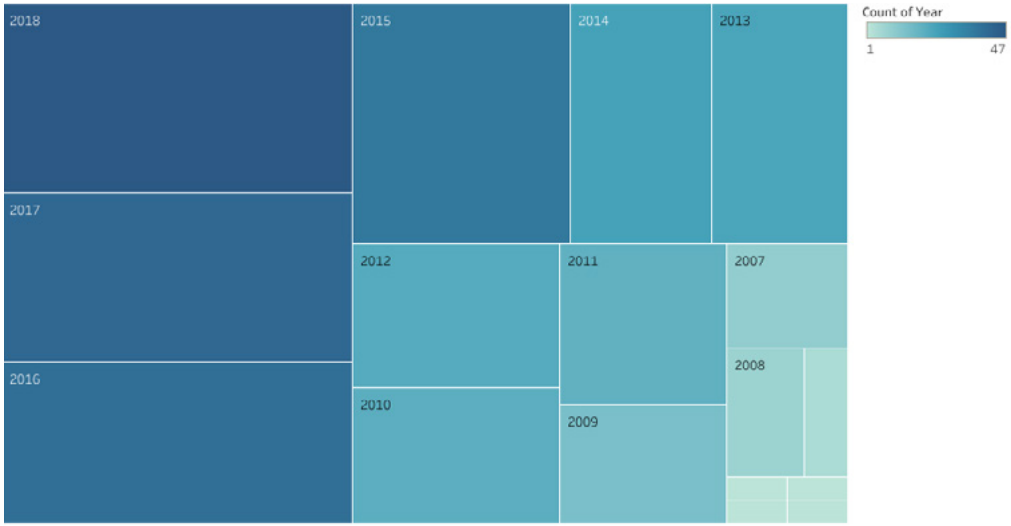
Benchmarkings Impacts Over Time

Out of the of 855 properties analyzed in Philadelphia, over half achieved energy savings, and nearly 10 percent of all properties improved their performance by over 30 percent. This highlights the benefit of benchmarking for the majority of buildings in Philadelphia. However, nearly 10 percent of properties also increased their energy consumption by 30 percent or more, demonstrating an important opportunity for energy conservation measures to be identified moving forward.

Property Count of Observed Savings and Increased Consumption



Number of Energy Star Certified Buildings by Year



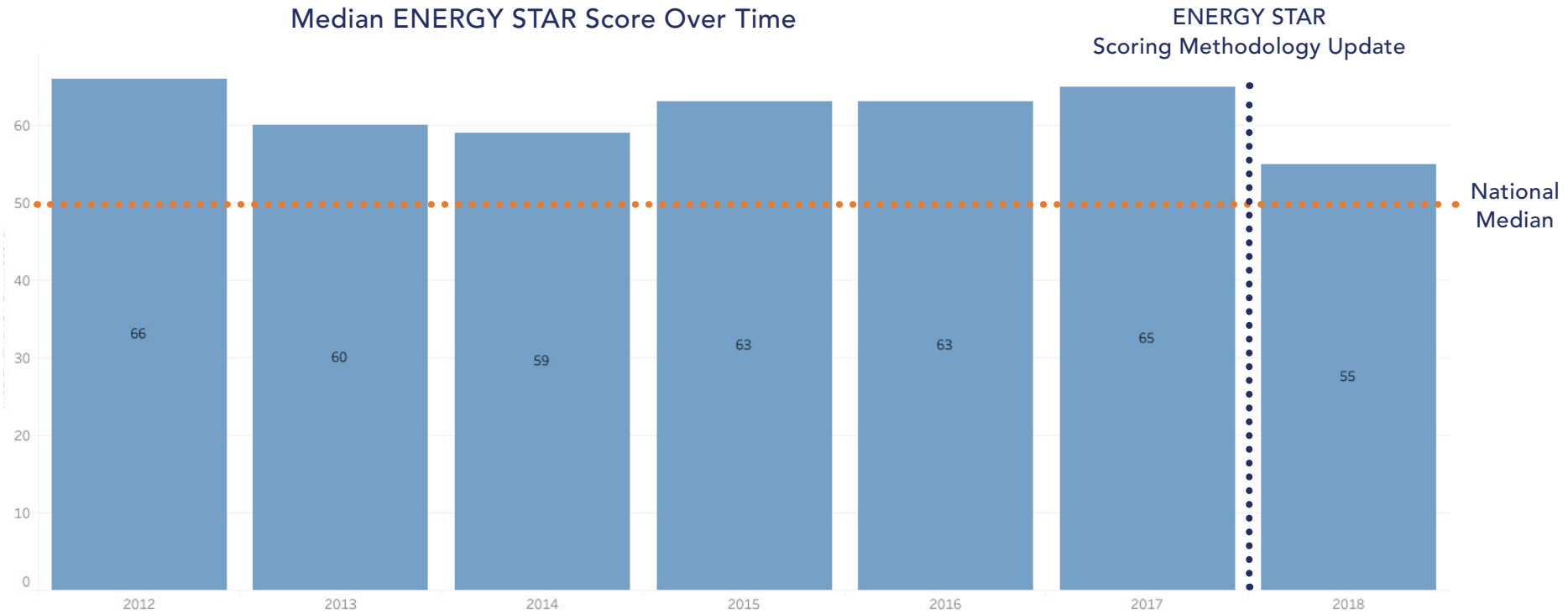
ENERGY STAR Certification

The number of ENERGY STAR certified buildings in Philadelphia has grown every year since the start of the benchmarking program in 2012. As of today, there are 73 buildings that received an ENERGY STAR certification after 2013, as compared to 34 that received a certification before 2013. This represents a 53 percent growth in nationally recognized energy efficient buildings.

Benchmarkings Impacts Over Time

Similarly to what has been observed in Philadelphia's benchmarked buildings, properties across the country are improving overtime. As the national performance average continues to increase, it is important to measure individual buildings reflective of their peers. In 2018, the EPA updated the ENERGY STAR Portfolio Manager tool to include current market survey data for calculating metrics such as the ENERGY STAR score. Due to these changes, quite a few of Philadelphia's buildings reported a dip in their scores. The Philadelphia's observed median ENERGY STAR score reported in 2017 was 65 while in 2018 it dropped to a 55.[iv]

While Philadelphia's benchmarked buildings are still outperforming the national average of 50, this new metric demonstrates that there is significant opportunity to continue to improve the efficiency of our buildings.

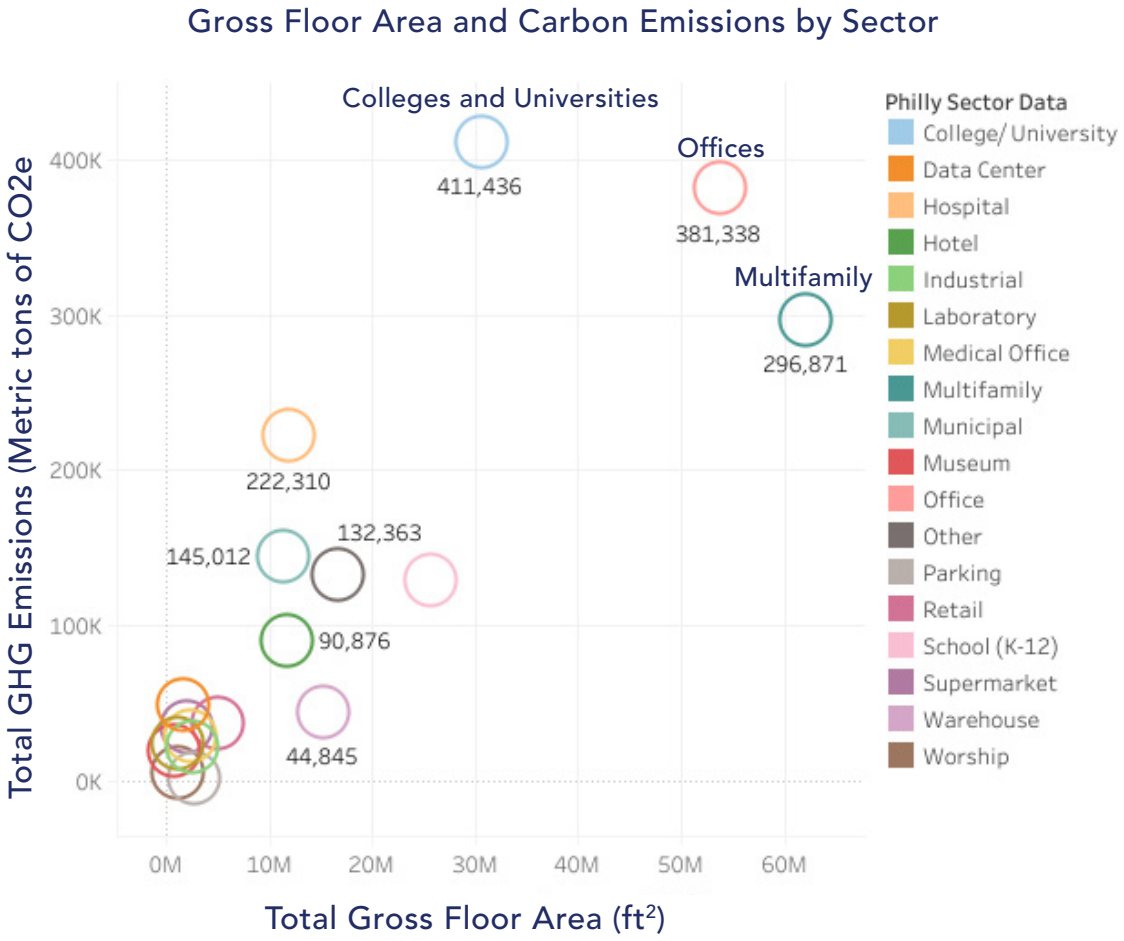


2018 Building Energy Performance by Building Sector

	Number of Buildings Reported	Percent of Total Property GFA	Median ENERGY STAR Score	Average WN Site EUI (kBtu/ft^2)	National Median Site EUI Score	Median Water Use Intensity (kgal/ft^2)
College/University	366	11.89%	44	163.6	99.6	21.6
Data Center	2	0.60%	N/A	338.8	40.1	43.4
Hospital	72	4.63%	77	241.9	251.0	45.8
Industrial	26	0.98%	N/A	144.1	47.9	8.2
Laboratory	4	0.41%	N/A	274.9	159.1	56.5
Medical Office	17	0.93%	59	132.9	114.6	23.6
Multifamily	767	24.09%	58	66.5	66.9	35.2
Municipal	31	4.41%	25	140.3	176.1	20.1
Museum	6	0.03%	N/A	219.5	59.7	19.3
Office	182	20.86%	63	84.6	76.7	13.3
Other	75	7.00%	50	108.6	49.9	9.8
Parking	14	1.01%	N/A	23.2	N/A	0.9
Retail	47	1.90%	58	83.5	81.7	8.1
School (K-12)	295	9.96%	49	71.4	68.6	10.8
Supermarket	24	0.75%	39	243.5	223.4	18.6
Warehouse	109	5.81%	59	35.9	37.6	1.7
Worship	32	0.44%	90	63.7	48.6	6.0

2018 Building Energy Performance by Building Sector

Since the last benchmarking report analyzing 2014 data, nearly 1,000 multifamily buildings were added to the compliance list. This increase in properties and data has allowed for a better picture of the performance of our building stock. Before residential buildings were required to report in 2015, the majority of property floor area was represented in office buildings. Today, multifamily residential buildings cover more than 25 percent of property floor area, making it our largest sector by square footage.



This graph compares gross floor area and carbon emissions by sector. It is clear that residential buildings also represent one of our biggest opportunities for improvement, making up 15 percent of total GHG emissions among reported properties.

Improving the efficiency of Philadelphia's multifamily properties will reduce carbon emissions. It also has cost savings benefits which can address the energy burden faced by low-income households. With a poverty rate at 25.8 percent in 2018 it is essential that Philadelphia residents don't have to choose between utilities and groceries.[v]

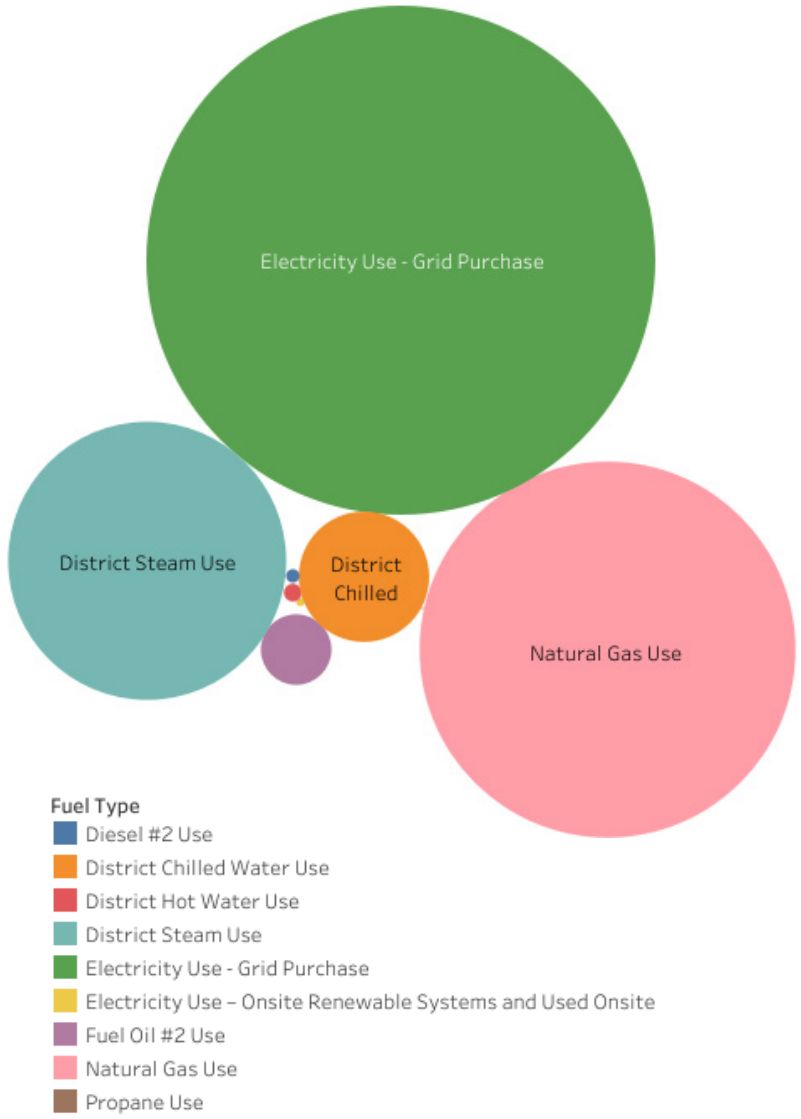
In addition to residential multifamily buildings, colleges and universities, office buildings, and hospitals contribute the majority of GHG emissions from benchmarked buildings at 20 percent, 18 percent, and 11 percent respectively.

2018 Building Energy Performance

The fuel mix of the analyzed properties shows that over half of all energy is being purchased from the electricity grid followed by natural gas and district steam comprising 28 percent and 15 percent of energy use respectively. In recent years, there has been a shift away from combustion fuels such as natural gas and fuel oil. In 2018, only 1 percent of energy was sourced from fuel oil, the most carbon intensive form of energy used in buildings.

In 2018, nearly 200 buildings reported that they use electricity as their only energy source. As the market shifts toward electrification, it will be critical to clean our regional electricity grid away from fossil fuels and toward carbon free energy.

2018 Fuel Mix (kBtu)



Benchmarking Highlight: Engaging Tenants

Because of the breadth of data that now exists from public disclosure, non-profits, businesses, and students can utilize these figures to inform their work moving forward. Since multifamily properties began reporting in 2015, we now see that this sector is one of our biggest opportunity for improvement, making up 15% of total GHG emissions.

In 2018, a researcher at the University of Pennsylvania explored how to reduce energy use in low-income, multifamily buildings, while addressing the inequities and needs of residents. Through a pilot program, criteria was set for selecting which properties to engage, and a community outreach strategy was developed and implemented.

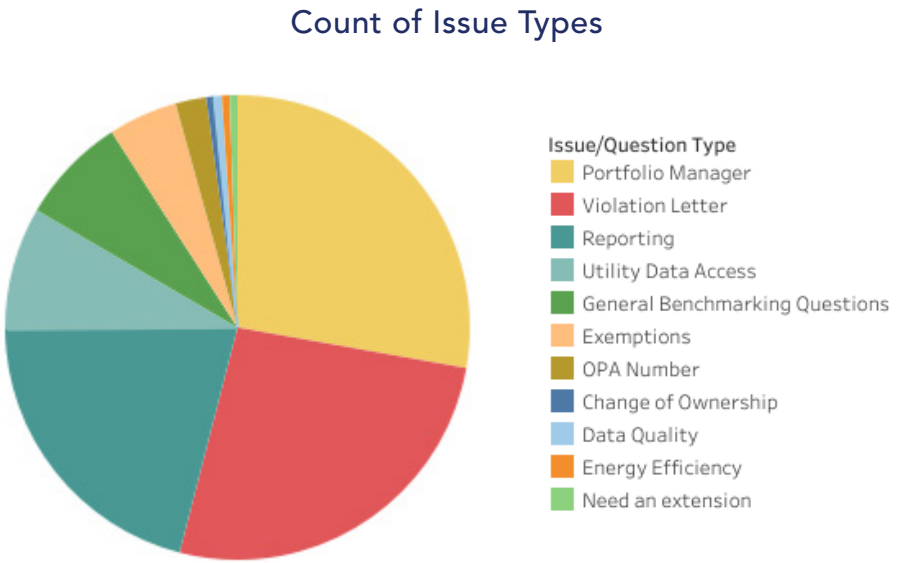
After reviewing the highest priority buildings with layered socioeconomic and demographic data, a shortlist of five buildings were identified to host"Energy Resource Fairs" where tenants had the opportunity to learn from local utilities and organizations about energy incentives and assistance programs. The pilot found that there is a gap in what information tenants know about reducing their energy use as well as understanding what resources are available. While tenants at the fairs showed interested in reducing energy use, they were not aware of the free resources available to make actionable change. This demonstrates a need for increased education around energy efficiency and reduction for building managers and residents.[vi]

Compliance and Outreach

In 2019, the City of Philadelphia opened the reporting window in March, one month earlier than previous years. In order to improve communications, Green Building United, a non-profit contractor, engaged an outreach strategy to share regular email reminders of the benchmarking deadline and hosted six in-person benchmarking trainings for property owners and managers. Despite these efforts, the amount of reports received before the June 30th deadline remained at around 70 percent, consistent with prior years.

Over 1,200 emails were answered and nearly 200 phone calls received seeking support for the benchmarking process. Over a quarter of inquiries were about technical support with ENERGY STAR Portfolio Manager. While many property managers may keep their Portfolio Manager accounts up to date, there is quite a bit of confusion around the final step of reporting data. Over 21 percent of inquiries related to this topic, demonstrating an opportunity to improve communications around the reporting process.

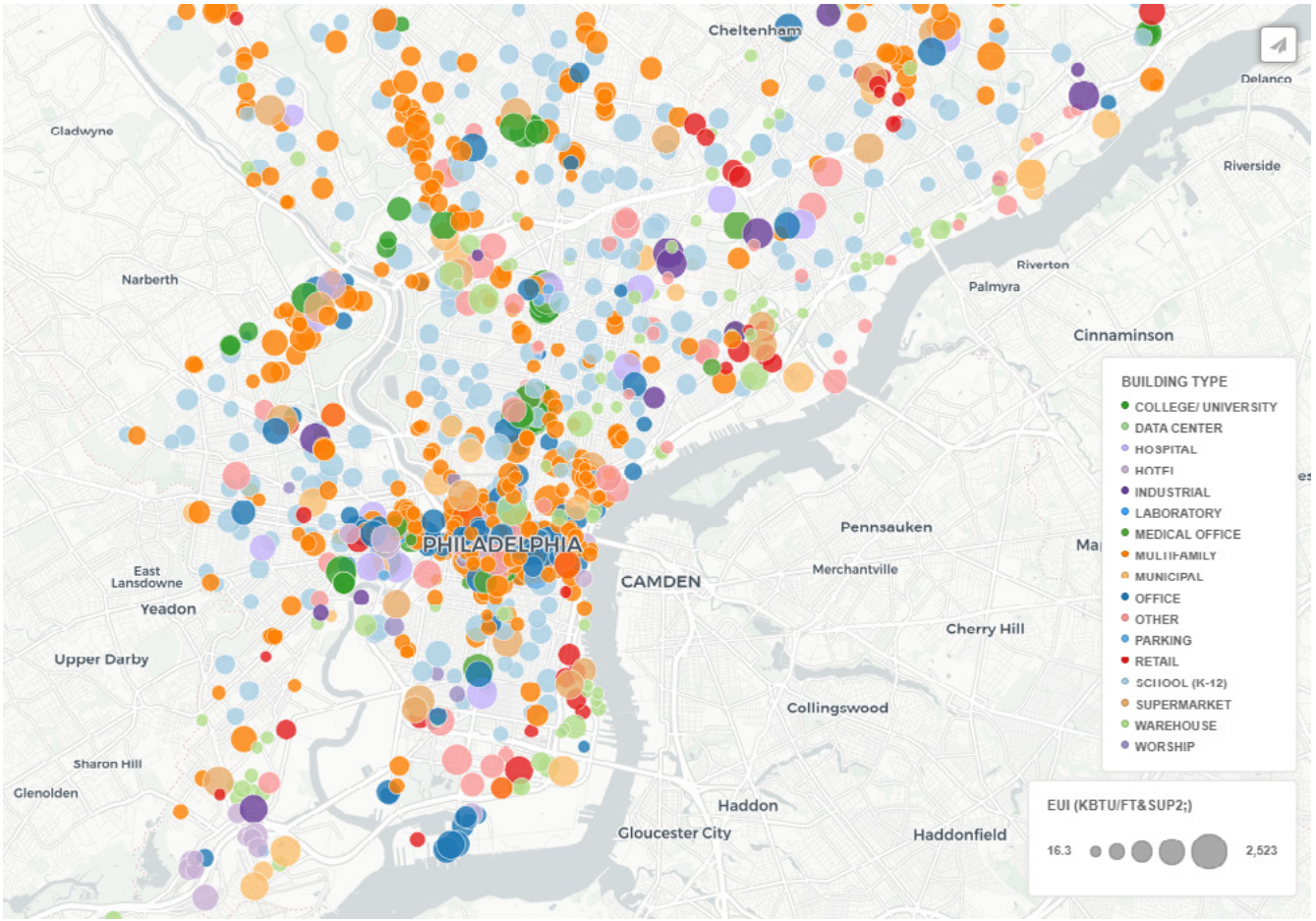
Since the beginning of the program the compliance rate has remained high even as the list of buildings required to report has grown with the expansion of multifamily properties and growth of new construction in Philadelphia. For 2018 benchmarking data, there was an 85 percent compliance rate for the number of buildings required to report. The compliance rate has slightly fallen since the last benchmarking report was released with 2014 data. This is due to the fact that over 900 multifamily buildings have been added to the compliance list and changes in building ownership.



Compliance and Outreach

Moving ahead, the Office of Sustainability (OOS), Green Building United, and ICF are working to improve the compliance process and resulting data quality received from benchmarking reports. In 2019, these organizations have been refining the tools used in the program to include automated alerts and messaging for reports containing missing data or energy and water use outside of a realistic range. This process will increase the capacity of OOS and partners to ensure high quality data in the year to come.

OOS will continue to publically disclose all shared benchmarking reports via the Philadelphia Building Benchmarking Data Visualization Tool. This online, interactive map facilitates peer-to-peer comparison of building performance and remains a useful tool for building managers and tenants for understanding their buildings' energy efficiency.

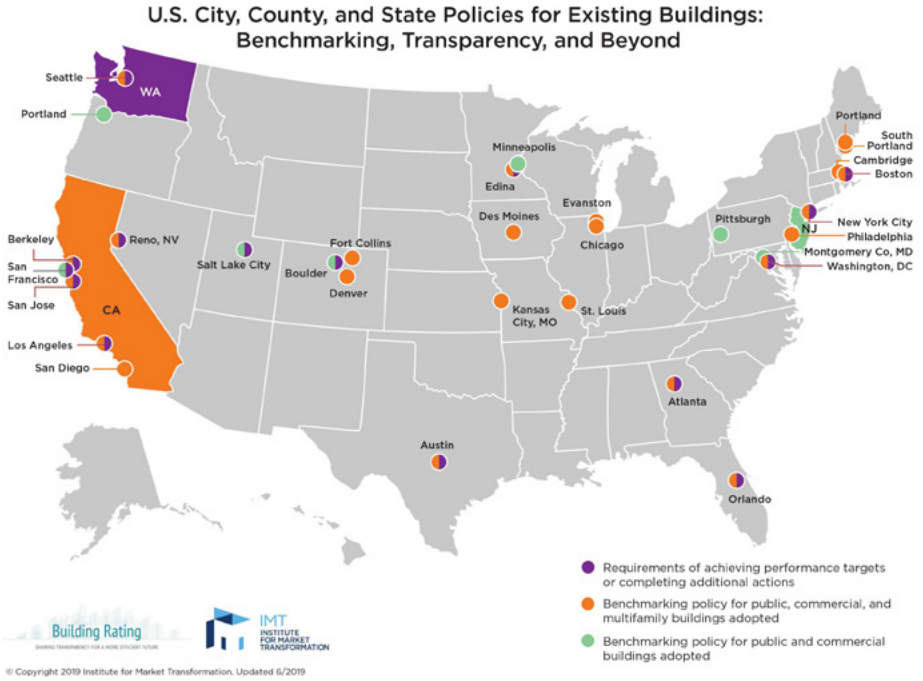


Building on Success

Since Philadelphia began the benchmarking in 2012, several other cities and states have adopted benchmarking policies. Several more have gone on to require buildings to reach performance targets or complete further action.

Building Tune-Ups

In Philadelphia, City Council recently passed legislation that will require building owners to go one step further. The Building Energy Performance Policy (Bill 190600) will require owners of certain large buildings to conduct regular tune-ups of their energy and water systems. These tune-ups will identify low cost opportunities for savings such as temperature set-backs and lighting sensors. This legislation will provide the opportunity for an additional 5 percent reduction in carbon emissions, $50 million aggregate energy cost savings annually, and an estimated 250 to 600 new jobs created across the region in the first six years of program implementation.



Future Opportunities

The Powering Our Future report assesses potential policies and programs for further improving energy efficiency and cutting carbon pollution from Philadelphia's biggest buildings. The Office of Sustainability and partners will continue to evaluate energy incentives and policy opportunities to support building owners in cutting energy waste, saving money, and moving Philadelphia toward a clean energy future.

Ways to Save

Once building performance has been measured, it is up to the building owner and manager to use benchmarking data to identify energy saving opportunities. These may include energy efficient LED lighting, improved insulation, programmable thermostats, energy efficient appliances, and more. A fun activity to help identify these opportunities and engage building tenants is the ENERGY STAR Treasure Hunt. During an Energy Treasure Hunt, teams walk around a facility looking for quick ways to save energy.[vii]

Opportunities for rebates, incentives, and assistance for implementing energy conservation measures are available through Philadelphia's utilities and more.

- PECO Smart Ideas - PECO Smart Ideas programs help commercial and multifamily customers reduce energy costs through a variety of customized rebates and programs such as PECO Smart Equipment Incentives for retrofits. To find out how you can save, contact PECO smart ideas at pecosmartideas@dnvgl.com for commercial buildings, smartideasbiz@peco-energy.com for multifamily buildings or call 1-844-4BIZ-SAVE.
- PGW EnergySense - PGW energysense is a series of programs, grants, rebates and conversion incentives designed to help your business save money now and far into the future while reducing its carbon footprint. You can receive money back on new, energy-efficient equipment while helping Philadelphia become and remain the greenest city in America. For more information call 855-PGW-SOLVES.
- Fannie Mae has a suite of Green Mortgage Loan products that benefit borrows who invest in energy and water efficiencies, including preferential pricing and additional load proceeds for energy and water efficiency retrofits. Visit www.fanniemae.com/multifamily/green-initiative-financing# for more information.
- Green Building United - Green Building United convenes the Philadelphia 2030 District, a program that connects building owners who are committed to deep carbon reduction in their facilities. This program supports property owners through education and training opportunities, resources, and bi-monthly partner meetings to share insights and challenges. Visit www.greenbuildingunited.org/initiatives/philadelphia-2030-district for more information.

Glossary

British Thermal Unit (Btu) - A unit of energy, that can represent both thermal energy and electricity. One BTU is the amount of energy required to raise one pound of water one degree Fahrenheit.

Energy Use Intensity (EUI) - The metric used for comparing buildings in Energy Star, EUI expresses a building's energy use relative to its size. In this report it is expressed as kBtu/ft², and is calculated by taking the total energy consumed in a year (in kBtu) and dividing it by the floor area of the building (in ft²). All EUIs in this report are weather-normalized.

ENERGY STAR Rating - The 1-100 ENERGY STAR score was developed by the Environmental Protection Agency and provides a metric for comparison with other similar buildings across the country. The score accounts for differences in climate, occupancy and operating hours. A score of 50 represents median energy performance, while a score of 75 or better indicates a building is a top performer.

Site EUI - Site energy represents the amount of heat and electricity consumed by a building as reflected in utility bills. This is a relevant metric for facility managers, to understand how a building's energy use has changed over time. Site EUI does not, however, account for the environmental impacts of transmission and delivery of energy. Site energy sources for public buildings in this report include: electricity, natural gas, chilled water and steam.

Source EUI - Source energy represents the amount of heat and electricity consumed in the generation, transmission, and delivery of energy to the building.

Total GHG Emissions (MtCO2e) - The metric used in this report for greenhouse gas emissions, which represent a million metric tons of carbon dioxide equivalents. Equivalent CO2 (CO2e) is a universal standard measurement for greenhouse gasses and their ability to trap heat in the atmosphere. These greenhouse gasses include carbon dioxide, methane, nitrous oxide and chloroflouro-carbons.

Weather Normalized - When energy use is adjusted to account year-to-year weather differences, allowing for comparison of a building to itself over time. Through this procedure, the energy in a given year is adjusted to express the energy that would have been consumed under 30-year average weather conditions.

Appendix

The analysis of benchmarking data was completed by the Office of Sustainability with help from consultants at Green Building United and ICF. Listed below are some of the data filtering criteria used in the 2018 benchmarking data and in the trend analysis from 2013-2017.

2013-2017 Analysis

The analysis conducted by ICF included several filtering criteria such as abnormally high/low EUI, incomplete data indicated in Portfolio Manager, and more. Because properties may not report data each year, some interpolation of data was conducted to identify trends over time. In this case, if the missing value fell between two other values, the average of the two surrounding years' EUIs was used, and if the missing value fell at either end of the analysis period, the EUI value for the nearest data year was used. The resulting data set included 855 reports.

2018 Analysis

In 2018, EPA updated the ENERGY STAR Portfolio Manager® tool to include current market survey data in their formulas for calculating metrics such as the ENERGY STAR Score. This is done so that performance metrics are reflective of what is observed in the marketplace. Following this update, EPA conducted a score review for U.S. K-12 schools, worship facilities, warehouse properties, hotels, offices, retail stores, and supermarkets. After gathering stakeholder feedback, EPA finalized its analysis for each score model in July 2019. In October 2019, the City of Philadelphia received a dataset of properties whose metrics were updated to reflect the final analysis.

The 2018 benchmarking data was downloaded from EPA's ENERGY STAR Portfolio Manager on October 31st, 2019 and combined with the updated dataset provided by EPA that included updated metrics. In order to ensure the 2018 dataset provided realistic and accurate data, several filtering criteria were applied:

- Gross Floor Area <1,000 ft2
- Source EUI <5 or >2,000 kBtu/ft2/yr
- Estimated Energy Data = "Yes", "Unable to check"
- Whole/Partial Building Data ≠ Whole Building
- Electricity Use = 0
- Energy Star Score <1 or >99 (unless certified)
- District Steam Use > 1,000,000,000 kBtu
- Water Use > 200,000 kgal

End Notes

i. http://www.septa.org/sustain/pdf/2019-03-septainable-report.pdf
ii. ICF, ***Multi-Year Analysis of Philadelphia Benchmarking Data***, 2019, 4.
iii. https://www.energystar.gov/sites/default/files/buildings/tools/DataTrends_Savings_20121002.pdf
iv. This analysis represents data from 2,004 buildings in Philadelphia. For details on the data filtering methodology, please see the Appendix.
v. https://www.census.gov/quickfacts/philadelphiacitypennsylvania
vi. Francesca Ramocciotti, ***Relieving the Energy Burden: Developing an Equitable Community Outreach Plan for Energy Use Reduction in Philadelphia's Multifamily Residences***, University of Pennsylvania, 2018, 22.
vii. https://www.energystar.gov/sites/default/files/tools/14336_ENERGY_STAR_Treasure_Hunt_Lite_Guide_v06_508.pdf

Photos:
Pg. 7 - Photo provided by Tracy Richardson
Pg. 14 - Photo provided by Guild House

Acknowledgments

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GREEN BUILDING UNITED

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PHILADELPHIA WATER DEPARTMENT

The report was produced by LeAnne Harvey at Green Building United and Rich Freeh at the City of Philadelphia Office of Sustainability with design help from WFGD studio.

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