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Metro Washington, D.C., Greenprint Performance Report™

VOLUME 2, 2013: PUBLISHED FALL 2014

ULI Greenprint Center for Building Performance

DOWNTOWNDC ecoDistrict

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INTRODUCTION

ABOUT THE DOWNTOWN BUSINESS IMPROVEMENT DISTRICT

The Downtown Business Improvement District (DowntownDC) is a private, nonprofit organization that provides capital improvements, resources, and research to help diversify the economy and enhance the downtown experience for all. This special district, where property owners have agreed to tax themselves to fund services, encompasses a 138-block area in Northwest D.C. of approximately 550 buildings from Massachusetts Avenue on the north to Constitution Avenue on the south, and from Louisiana Avenue on the east to 16th Street on the west. As a catalyst, facilitator, and thought leader, DowntownDC promotes public/private partnerships to create a remarkable urban environment.

ABOUT THE DOWNTOWNDC ECODISTRICT

DowntownDC established the DowntownDC area as an ecoDistrict in 2011 to provide a framework in which to educate and promote sustainable practices such as the better management of energy, water, and waste and multimodal transportation investments. The DowntownDC ecoDistrict's goals include reducing peak and overall energy consumption, enhancing economic performance, and increasing the market share of downtown buildings. The DowntownDC ecoDistrict supports developing and promoting DowntownDC as one of the most sustainable downtowns in the world.

ABOUT THE URBAN LAND INSTITUTE

The mission of the Urban Land Institute is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. Established in 1936, the Institute today has more than 32,000 members worldwide representing the entire spectrum of the land use and development disciplines. ULI relies heavily on the experience of its members. It is through member involvement and information resources that ULI has been able to set standards of excellence in development practice. The Institute has long been recognized as one of the world's most respected and widely quoted sources of objective information on urban planning, growth, and development.

ABOUT THE ULI GREENPRINT CENTER

The Urban Land Institute Greenprint Center is a worldwide alliance of leading real estate owners, investors, and strategic partners committed to improving the environmental performance of the global real estate industry. Through measurement, benchmarking, knowledge sharing, and education, Greenprint and its members strive to reduce greenhouse gas emissions by 50 percent by 2030, in line with the goals of the Intergovernmental Panel on Climate Change.

Greenprint is a catalyst for change, helping members take meaningful and measurable actions to advance environmental performance. In order to meet its objectives, Greenprint is bringing to light sustainability best practices and helping lead the real estate industry toward harmonized global standards for environmental performance metrics and benchmarking. Our members collectively use the Greenprint Environmental Management Platform to track, report, benchmark, and analyze energy, emissions, water, and waste performance for properties, funds, and portfolios. The platform supports comprehensive data management and analysis, which enables members to take actions toward improving environmental performance and reducing emissions. We endeavor to demonstrate the correlation between environmental performance and enhanced property value.

SETTING THE STAGE:

DOWNTOWNDC ECODISTRICT AND ENERGY EFFICIENCY IN THE BUILT ENVIRONMENT

As in most major cities, Downtown D.C. is the fiscal engine of the city. Downtown areas typically have a high density of office buildings, hotels and retail that generate net fiscal benefit to the surrounding neighborhoods and low-density commercial centers. The net fiscal benefit offsets the cost to the city for schools, roads, public safety, health and human services, that are required in the neighborhoods outside of a downtown.

Downtown D.C.'s built environment and infrastructure are the backbone of its competitiveness as a sustainable place to invest, work, live and visit. Its transportation infrastructure provides unparalleled access from all parts of the D.C. region. This access is a key competitive advantage in attracting workers, visitors and residents. Its commercial buildings lead the nation in energy efficiency and green roof performance. By reducing energy, water and infrastructure costs through better building and infrastructure performance, financial savings are realized through lower operating costs. This leads to improved affordability for residents and businesses alike, critical objectives for a sustainable city.

The DowntownDC ecoDistrict, as this report illustrates, is on track to meet its commitment to the U.S. Department of Energy's Better Buildings Challenge by reaching the goal of 20 percent energy reduction by 2020. Two ecoDistrict properties in particular stand out as exemplars. The Hotel Monaco and Macy's, earned the Showcase Project designation in 2013 from the DOE's Better Buildings Challenge because in just two years they have already achieved the 10 year goal of 20 percent energy reduction.

The Macy's at Metro Center, a four-story department store in Downtown, reduced energy use by 30 percent in two years. Prior to their green investments, Macy's building energy motors were designed to perform at 100 percent. To reduce energy consumption, Macy's installed dampers and LED lighting and reprogrammed the Energy Management System. The investment cost $210,000 but Macy's reduced its annual energy cost by $223,000 in just two years.

The Hotel Monaco building, owned by the General Services Administration, was required to meet energy efficiency standards during its recent retrofit. Mechanical systems and fixtures were upgraded to reduce energy consumption which improved guest experience. The retrofit cost $1.8 million and the hotel has reduced its annual energy costs by $350,000. The hotel received over $100,000 in tax rebates from the District of Columbia's energy incentive program.

The new Sustainable DC plan envisions a city where innovative design and technology are applied to buildings and neighborhoods to create a vibrant and resilient urban environment. However, the Sustainable DC building performance goals for Downtown aim for city energy consumption to be reduced by 50 percent by 2032 . To achieve this target continued more detailed research will be required to identify the private sector investments in smarter buildings and the incentives for tenants to more efficiently operate that will have the greatest impacts. This report by the ULI Greenprint Center provides a start to the analysis that will enable the DowntownDC ecoDistrict to meet and exceed the Sustainable DC goals.

INTRODUCTION

The ULI Greenprint Center and DowntownDC are pleased to present the *Metro Washington, D.C., Performance Report, Volume 2.* This report explores data for over 200 properties, with a specific focus on 2012 through 2013, as well as historical data from 2009 through 2013. This report extends the analysis performed in the inaugural report to multifamily properties while also capturing more details for office properties in the metro Washington, D.C., market. This report is one initiative within DowntownDC's ecoDistrict program of work.

Greenprint establishes a standard for measuring, benchmarking, and tracking energy consumption, water use, waste diversion, and carbon emissions. This report presents an energy consumption benchmark as well as analyzes year-over-year environmental performance for a subset of properties. On a year-over-year, like-for-like basis between 2012 and 2013, the metro Washington Greenprint portfolio of 171 like-for-like office and multifamily buildings decreased energy consumption by 1.7 percent (44 million kBtu) and reduced carbon emissions by 3.7 percent (12,400 metric tons CO_2e). The carbon reduction is equivalent to planting over 318,000 trees.

The Greenprint metro Washington office portfolio includes 157 Class A office buildings, comprising 39.3 million square feet. This represents nearly 23 percent of the Class A office properties in metro Washington.[1] This report also contains information about 53 multifamily properties, accounting for over 19 million square feet of building area located within metro Washington.

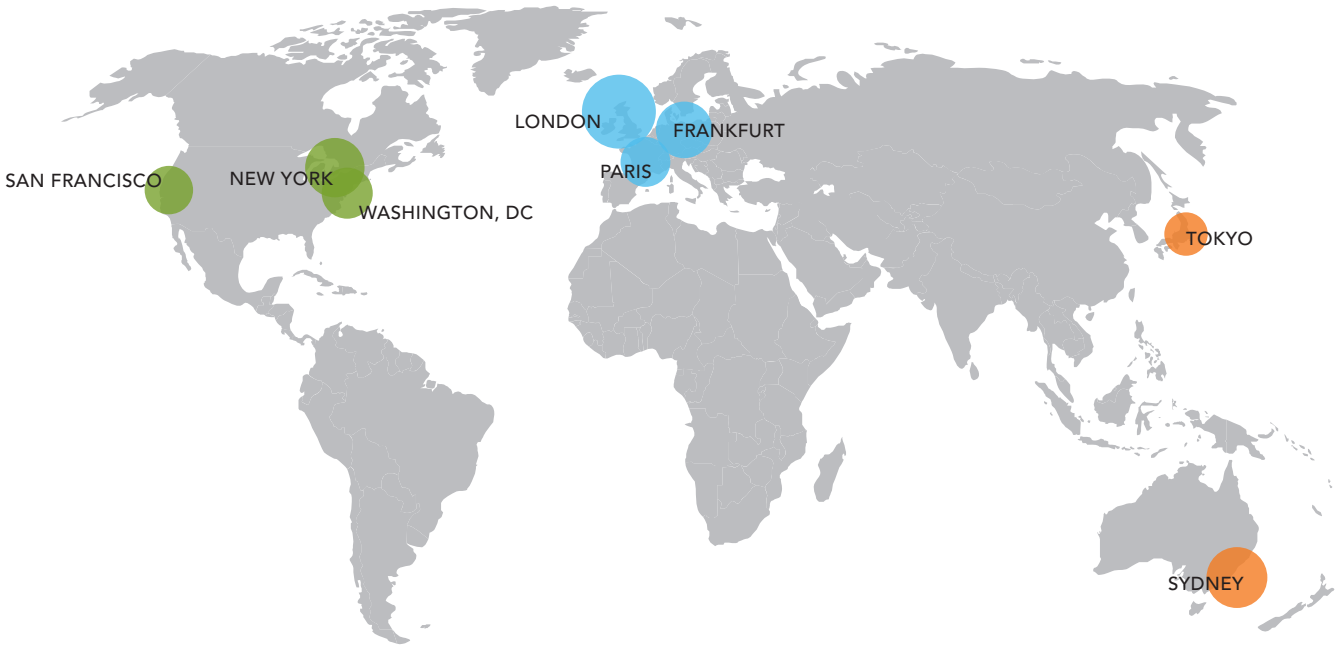
By increasing the number of properties participating in this initiative and the data they provide, Greenprint and DowntownDC can help owners and landlords create robust and transparent benchmarks for the metro Washington marketplace. The District Department of the Environment (DDOE) is also developing an energy benchmarking report using the data collected as part of the Clean and Affordable Energy Act of 2008. The *Greenprint Metro Washington, D.C., Performance Report, Volume 2* differs from the DDOE report because it provides an opportunity for metro Washington office properties to be contextualized across global markets. Furthermore, as a consortium of voluntary participants, the DowntownDC ecoDistrict can run different types of analytics and target metrics that can provide detailed insight into property performance.

In this report, the analysis is focused on office and multifamily properties. Future reports may include other property types such as industrial, hospitality, and/or retail. The data examined in this report are reported anonymously and displayed in aggregate. Over time, the goal is to drive the analysis toward more specific and targeted metrics that will provide a true assessment of environmental performance.

A GLOBAL PERSPECTIVE

The chart below presents the median energy use intensity for air-conditioned office properties in the Greenprint database across eight leading global markets. One of the goals of the partnership between DowntownDC and Greenprint is to develop a common approach to data management and analysis across global cities. This is intended to provide transparency in real estate energy use as well as learn from best practices where specific markets seem to be outperforming.

With enough information, including weather, space use, and technology, performance data can be normalized and opportunities can be targeted, supporting broad sustainability initiatives.



SAN FRANCISCO
96 properties
65 annual kBtu/ft^2

NEW YORK
67 properties
85 annual kBtu/ft^2

LONDON
251 properties
89 annual kBtu/ft^2 *

TOKYO
15 properties
41 annual kBtu/ft^2

WASHINGTON, D.C.
134 properties
61 annual kBtu/ft^2

PARIS
13 properties
51 annual kBtu/ft^2

FRANKFURT
11 properties
68 annual kBtu/ft^2

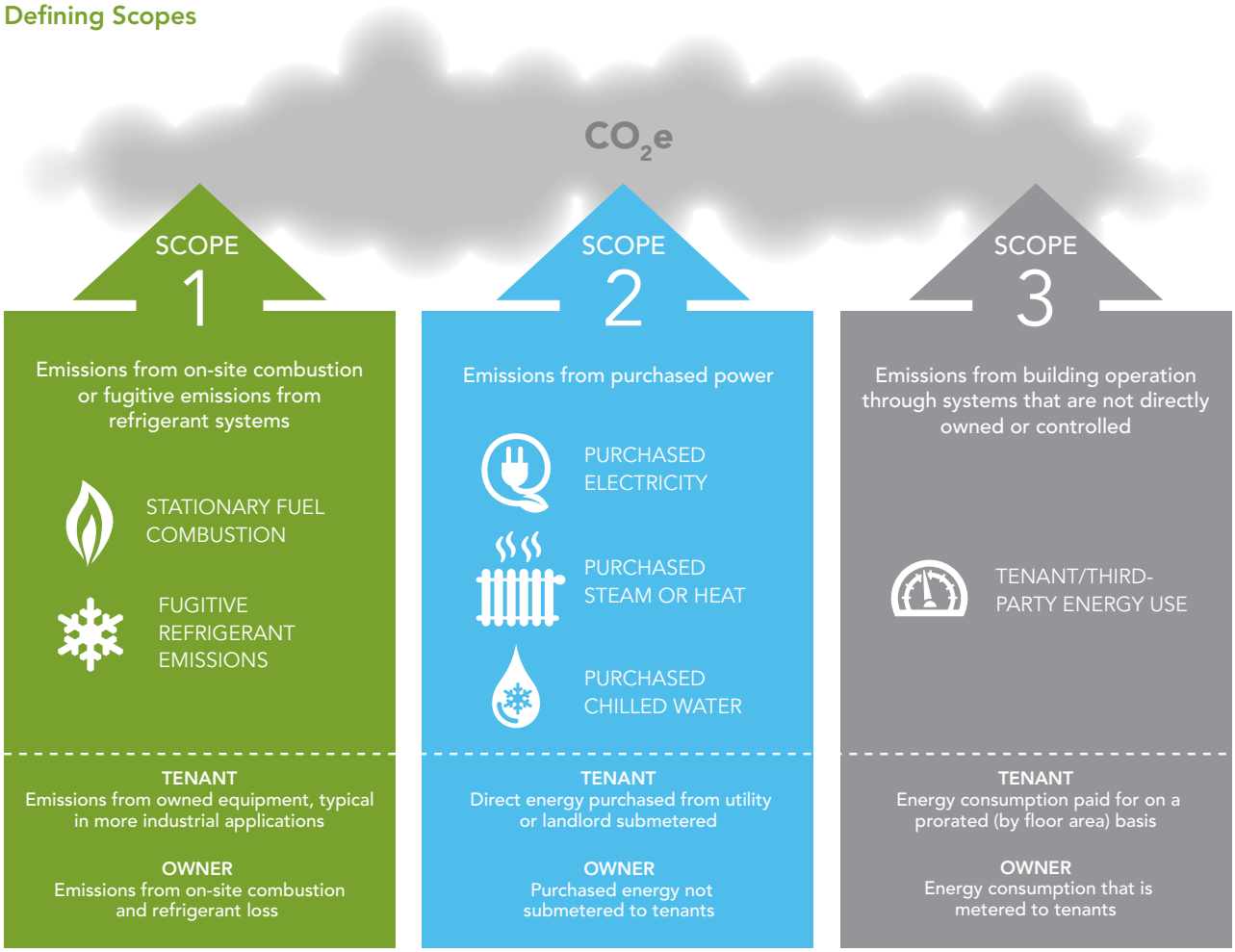
SYDNEY
2 properties
96 annual kBtu/ft^2

* The median energy intensity of 50 naturally ventilated office buildings in London is 44 kBtu/ft^2, not represented above.

EMISSIONS SCOPES EXPLAINED

Greenprint's calculation methodologies align with the World Resources Institute/World Business Council for Sustainable Development's Greenhouse Gas Protocol. Standard greenhouse gas (GHG) accounting separates GHG emissions into three categories: Scopes 1, 2, and 3. Categorizing emissions by scope enables separate accounting of GHG sources by related entities, such as landlords and tenants, and increases transparency.

Defining Scopes



Scopes 1+2+3 = Total Building Emissions

Calculating Greenhouse Gas Emissions

Energy [kWh] x Emissions Factor [kg CO_2e/kWh] = Greenhouse Gas Emissions [kg CO_2e]

Emissions factors are used to calculate the total carbon dioxide equivalent (CO_2e) generated. Developing and applying accurate emissions factors are critical to reliable GHG emissions reporting. Emissions factors are updated over time as updated data and methodologies are released.

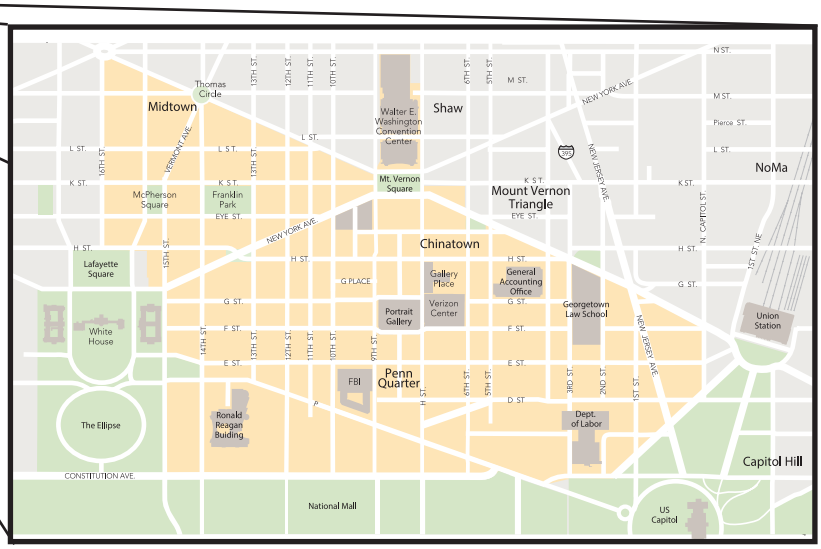
AREAS OF INTEREST

This report details the energy and environmental performance of properties within the Greenprint database that are located within the metro Washington area. The metro area consists of many different geographical boundary designations. For the purposes of this report, the information has been broken down into four categories: DC BID; Washington, D.C. (D.C.); Virginia and Maryland suburbs; and the entire metro Washington area.

The maps below depict the geographic boundaries of these designations. Map A illustrates the geographic boundaries of metro Washington. The DC BID includes properties that are located within the boundaries of the DowntownDC ecoDistrict, which is detailed in map B.

Map A (left): A map of the metro Washington area depicting the three subcategories analyzed in this report: the DC BID, D.C., and suburban Virginia and Maryland.

Map B (below): A map showing the DC BID area highlighted in yellow.



OFFICE PROPERTIES

METRO WASHINGTON OFFICE PORTFOLIO

The portfolio of properties analyzed in this report consists of 157 Class A office buildings located throughout metro Washington. The participating properties have all been submitted on a voluntary basis by the asset owners. The initial participants include institutional investment companies, real estate investment trusts, and private real estate firms, which has led a strong representation of private sector properties in this analysis. Metro Washington includes a large number of federal buildings, a building category that will be better represented in future reports to make the portfolio more representative of the metro Washington market.

The table below provides an overview of the properties in the analysis. At a high level, the data seem to show large ranges in performance. However, as the information was analyzed, trends emerged, helping Greenprint and DowntownDC target the most relevant metrics. The Greenprint metro Washington office median for energy use intensity is performing slightly better than the Greenprint U.S. office median, whereas the Energy Star score median for Greenprint U.S. office is slightly higher at 82.

	Greenprint Metro Washington Range	Greenprint Metro Washington Median	Greenprint U.S. Office Median
Number of properties		157	861
Size of building (SF)	8,901–1,177,173	214,690	196,682
Year built	1888–2012	1988	1987
FTEs	4–4,036	525	500
2013 occupancy	0%–100%	100%	100%
Site energy intensity (kBtu/SF)	6.5–220	62	63
Energy star score	5–97	79	82
Site Carbon Intensity (kg CO_2e/SF)	0.8 - 24.9	8.2	7.5

METRO WASHINGTON OFFICE PORTFOLIO

Building environmental performance is affected by a variety of factors. This report specifically discusses space use, building age, building size, full-time equivalents (FTEs), and occupancy. Subsequent reports will start to analyze the effects of other influencing factors and how they affect environmental performance.

A strong influencing factor in energy consumption is tenancy and space use. It is clear that data centers and tenants with cafeterias have a higher energy use per square foot than do other office tenants. To further the space use analysis, the tenant mixes of the properties were compared. It was observed that certain locations attract specific types of tenants, affecting performance characteristics. For example, 30 percent of the buildings in the Virginia and Maryland suburbs have technology tenants, which tend to have a high density of energy-intensive electronic equipment. This could be one of the factors driving the 6 percent higher energy intensity of properties in these areas.

In order to benchmark comparable spaces, Greenprint is working to enhance its ability to benchmark specific space use inside buildings. Collecting more specific space data, including number of workers, types of use, and operating hours, will allow for a more comprehensive analysis of building use and associated energy consumption.

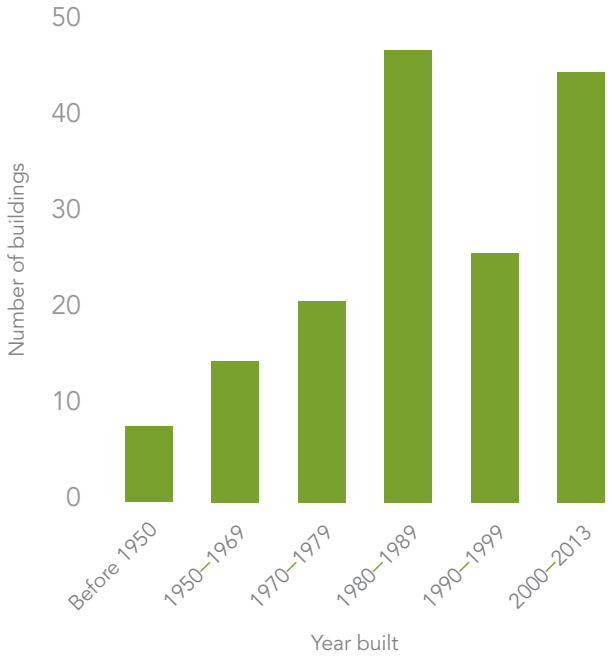
	METRO WASHINGTON	VIRGINIA AND MARYLAND	D.C.	DC BID
Number of properties	157	73	84	36
Site energy intensity	62	65	61	59
Site carbon intensity (kg CO_2e/SF)	8.2	8.7	7.6	7.5
Total floor area (Million SF)	39.5	16.3	23.2	11.0
Occupancy	100%	100%	100%	100%
Average building age	1988	1989	1985	1991
% Government	20%	35%	11%	10%
% General business services	41%	13%	58%	55%
% Financial industry	5%	2%	7%	5%
% Health care	2%	1%	3%	3%
% Technology	12%	30%	2%	4%
% Retail	2%	1%	2%	2%
% Other*	18%	18%	18%	21%

* These spaces include education, museum, storage, and religious facilities, and smaller diverse nonstandard tenants within the mixed-use spaces of these buildings

PORTFOLIO BY BUILDING AGE

The year a building was built can affect energy consumption because of design strategies and engineering systems common during that era, as well as the end-of-life renovation cycles.

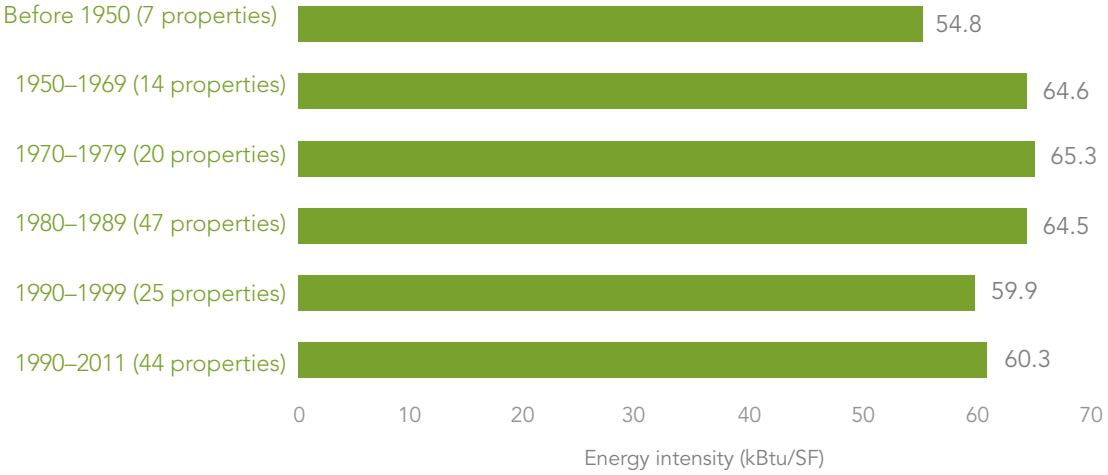
157 buildings



Compared with most U.S. cities, metro Washington has a newer building stock. More than 87 percent of the portfolio was built after 1970, and 44 percent was built after 1990.

MEDIAN ENERGY INTENSITY BY BUILDING AGE

Buildings are retrofitted in 25-to-35 year cycles. The information presented in this report shows that properties built in the 1980s are currently some of the worst performers. This might be indicative of the fact that the equipment is nearing the end of its useful life.



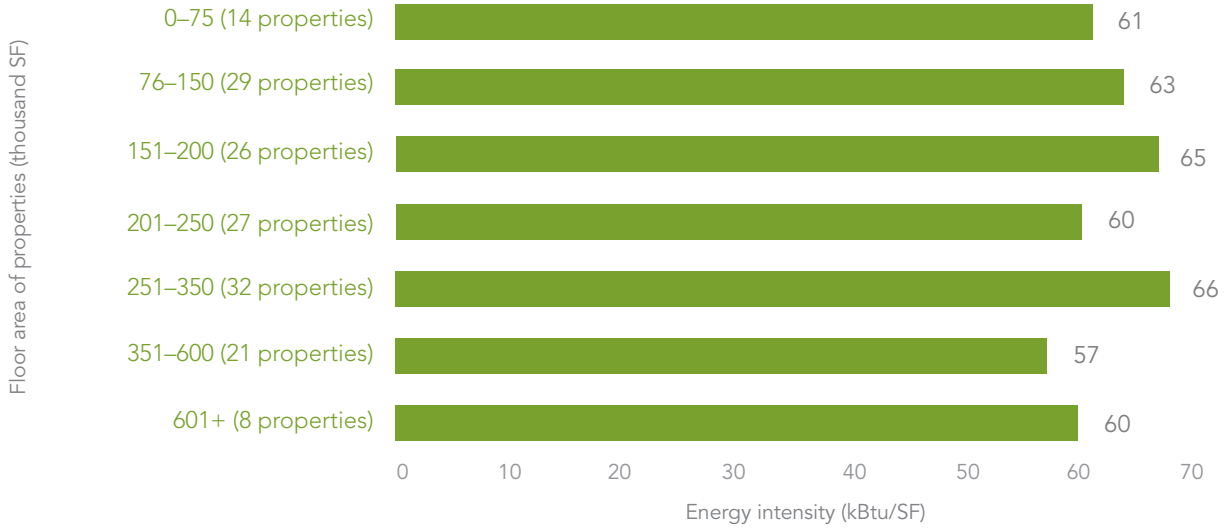
PORTFOLIO BY BUILDING SIZE

The size of a building affects energy use. Generally, increasing the height of a building correlates with higher energy intensities, and increasing the area of a building correlates with lower energy intensities.

Over 50 percent of the office properties submitted in metro Washington fall between 150,000 and 350,000 square feet.

MEDIAN ENERGY INTENSITY BY BUILDING SIZE

In the metro Washington market, due to the height limits, energy intensity tracks more closely to building size, with the largest properties being the most efficient and smaller properties being the least efficient. This generally holds true, except for the smallest properties in the analysis.



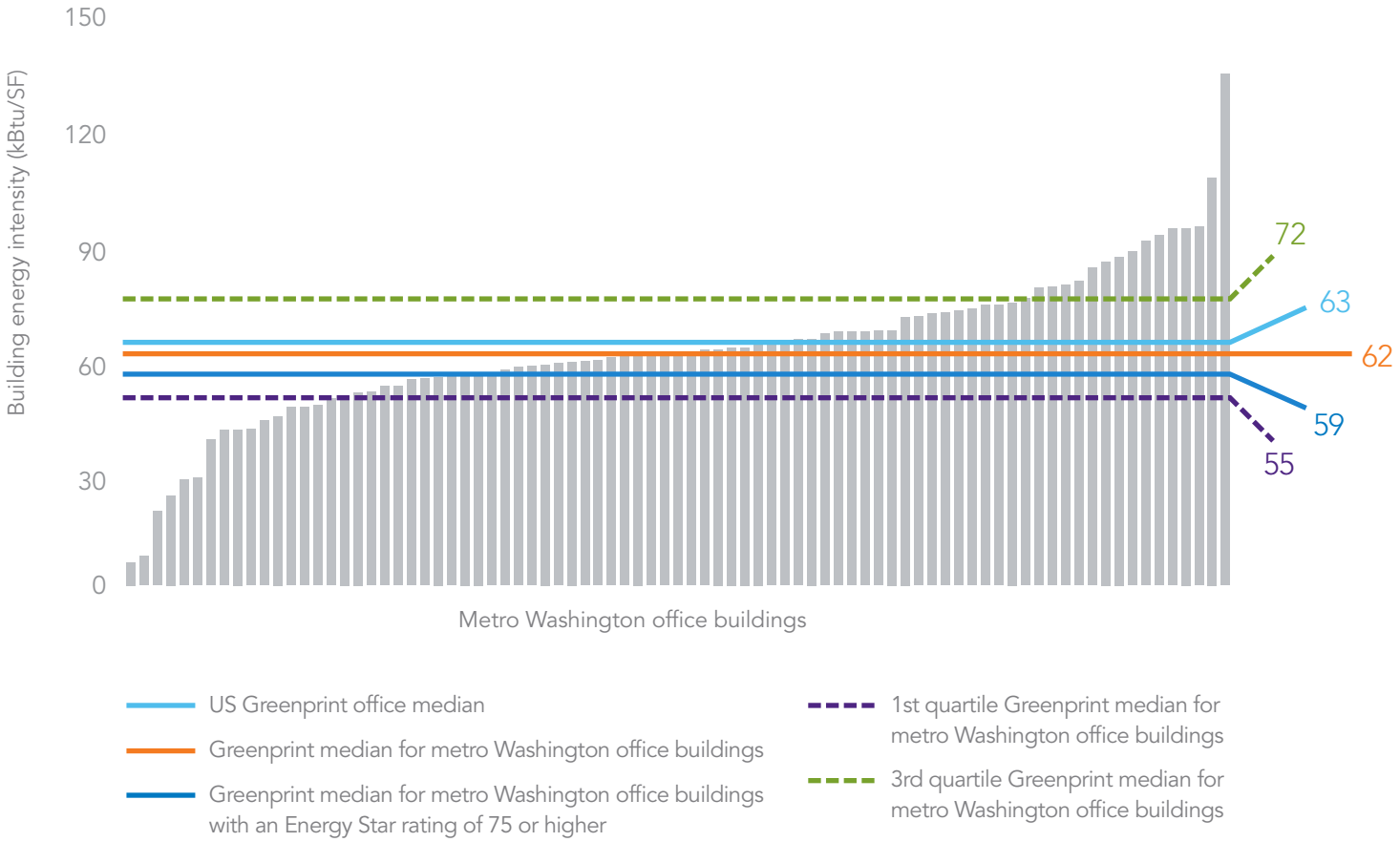
METRO WASHINGTON, D.C., OFFICE BENCHMARKING

The energy intensity of the metro Washington office portfolio is depicted below. Each vertical line on the chart represents a building. The Greenprint metro Washington office benchmark, based on the median energy intensity of office buildings in the metro Washington area, is 62 kBtu/SF. Ninety buildings in the Greenprint benchmark for metro Washington have an Energy Star score of 75 or higher. Because of the general high performance of this portfolio, the range in quartile performance is fairly tight, with 17 kBtu/SF separating the top and bottom quartile. The U.S. Greenprint office median is 63 kBtu/SF, shown in the chart below as a light blue line.

The Greenprint benchmark for this report is based on performance data for full-year 2013. Energy Star uses the Commercial Building Energy Consumption Survey (CBECS) as the basis for benchmarking. The property owners and managers, as well as the building design, operations, occupancy, and space use, are factors that may help explain the performance of Greenprint office buildings relative to alternative market benchmarks.

GREENPRINT METRO WASHINGTON OFFICE PORTFOLIO BENCHMARKING

157 buildings



METRO WASHINGTON OFFICE PORTFOLIO TRENDS

The like-for-like portfolio is composed of 122 office properties with consistent data from 2009 to 2013. Like-for-like performance excludes the effects of acquisitions and dispositions across the portfolio. Details for each region of this analysis are provided in the tables on the next page.

ENERGY

From 2012 through 2013, metro Washington reduced energy consumption by 2.2 percent (55 million kBtu). The DC BID outpaced the other regions and reduced energy consumption by 3.0 percent (20 million kBtu).

For metro Washington, energy intensity decreased 11.3 percent from 2009 to 2013 while properties in the D.C. BID reduced energy use by 7.4 percent. DC and Virginia/Maryland properties saw decreases in energy consumption of 10.8 percent and 11.9 percent, respectively. This reduction provided a reduction in energy use per FTE by 9.1 percent from 2009 to 2013.

The 7.4 percent reduction in energy use experienced by DC BID properties supports the ecoDistrict's commitment to the Better Buildings Challenge of achieving a 20 percent reduction in energy consumption by 2020.

The cost of energy was reduced by around 4 percent from 2009 to 2013, representing savings of about $9.5 million in annual operating expenses.[2]

EMISSIONS

From 2012 to 2013, carbon emissions decreased 4.2 percent across metro Washington and by 3.9 percent and 2.4 percent in the DC BID and Virginia/Maryland, respectively.

Carbon emissions decreased 12.9 percent from 2009 to 2013. Emissions have decreased through a combination of use of energy-efficient technologies and operational best practices at the properties, and the implementation of less carbon-intense energy generation (i.e., natural gas or renewable energy sources replacing coal) throughout the local grid.

Emissions are decreasing at a faster rate in D.C. than in Virginia and Maryland. This could be due to fuel switching at properties or across the region's electricity grid.

Greenprint's Metro Washington office portfolio reduced emissions from 2009 to 2013 at a level equivalent to:


planting 1,075,179 trees


taking 8,828 cars off the road

LIKE-FOR-LIKE PERFORMANCE: 2012-2013

The tables below detail the like-for-like performance of the metro Washington properties, broken into four segments: Metro Washington, Virginia and Maryland suburbs, D.C., and the DC BID. The table below compares like-for-like properties from 2012 through 2013.

	Metro Washington: 145 properties (37.8 million SF)			Virginia/Maryland suburbs: 68 properties (15.8 million SF)		
	2012	2013	% change	2012	2013	% change
Energy use (million kBtu)	2,464	2,410	-2.2%	1,066	1,043	-2.2%
FTEs (thousands)	93.2	92.8	-0.4%	43.1	43.5	1.0%
Site energy intensity (kBtu/SF)	65.2	63.8	-2.2%	67.4	66.0	-2.2%
Emissions (thousand metric tons CO_2e)	323	310	-4.2%	145.2	141.7	-2.4%
Site emissions intensity (kg/SF)	8.6	8.2	-4.2%	9.2	9.0	-2.4%

	D.C.: 77 properties (22.0 million SF)			DC BID: 33 properties (10.3 million SF)		
	2012	2013	% change	2012	2013	% change
Energy use (million kBtu)	1,397	1,367	-2.2%	655	635	-3.0%
FTEs (thousands)	50.1	49.3	-1.6%	23.9	23.5	-1.7%
Site energy intensity (kBtu/SF)	63.6	62.2	-2.2%	63.4	61.5	-3.0%
Emissions (thousand metric tons CO_2e)	178	168	-5.6%	83.2	80.0	-3.9%
Site emissions intensity (kg/SF)	8.1	7.7	-5.6%	8.0	7.7	-3.9%

LIKE-FOR-LIKE PERFORMANCE: 2009-2013

The tables below detail the like-for-like performance from 2009 through 2013 of the metro Washington properties, broken into four segments: Metro Washington, Virginia and Maryland suburbs, D.C., and the DC BID.

	Metro Washington: 122 properties (33.2 million SF)			Virginia/Maryland suburbs: 56 properties (13.7 million SF)		
	2009	2013	% change	2009	2013	% change
Energy use (million kBtu)	2,470	2,191	-11.3%	1,056	930	-11.9%
FTEs (thousands)	88.2	85.9	-2.6%	40.1	40.6	1.3%
Site energy intensity (kBtu/SF)	74.4	66.0	-11.3%	77.2	68.1	-11.9%
Emissions (thousand metric tons CO_2e)	324.1	282.2	-12.9%	143.9	127.0	-11.7%
Site emissions intensity (kg/SF)	9.8	8.5	-12.9%	10.5	9.3	-11.7%

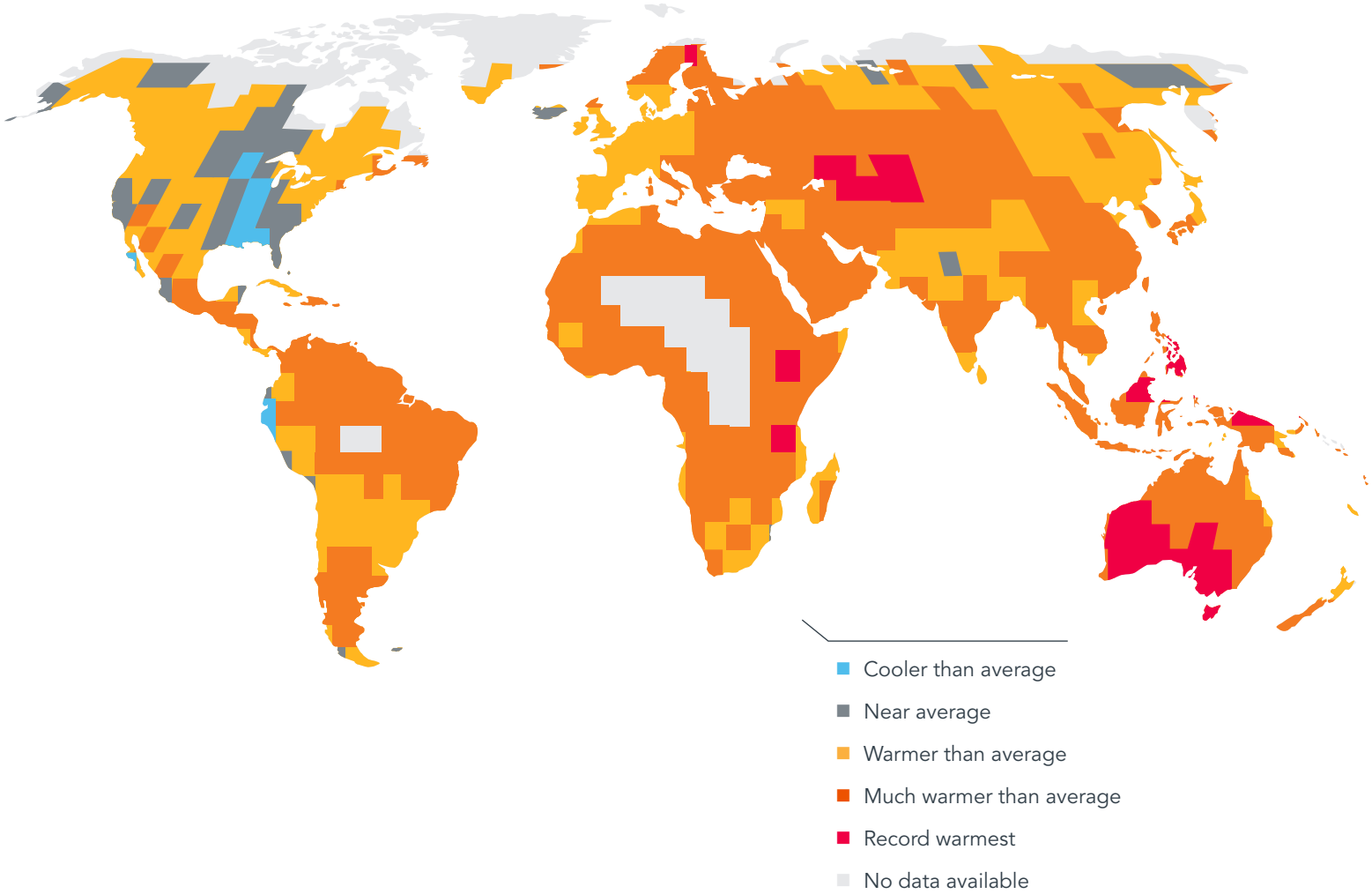
	DC: 66 properties (19.5 million SF)			DC BID: 31 properties (9.9 million SF)		
	2009	2013	% change	2009	2013	% change
Energy use (million kBtu)	1,414	1,261	-10.8%	661	613	-7.4%
FTEs (thousands)	48.1	45.3	-5.9%	23.6	22.1	-6.3%
Site energy intensity (kBtu/SF)	72.3	64.5	-10.8%	67.1	62.2	-7.4%
Emissions (thousand metric tons CO_2e)	180.2	155.1	-13.9%	83.2	77.1	-7.3%
Site emissions intensity (kg/SF)	9.2	8.0	-13.9%	8.4	7.8	-7.3%

RELATIONSHIP BETWEEN ENERGY AND WEATHER

Weather can significantly affect energy used for heating, ventilation, and air conditioning (HVAC). In commercial and residential buildings, heating and cooling account for 40 percent of a building's energy consumption. Variations in weather can increase or decrease energy consumption by 7 percent from normal operating conditions.[3] Understanding how local weather deviation affects a building's energy needs and consumption is important in order to develop consistent comparisons from one period to the next.

The graphic below represents how weather across the globe in 2013 diverged from the 30-year average. Based on the chart below, metro Washington seemed to experience a warmer than average 2013. This illustrates the importance of normalization when considering annual variations in performance.

Temperature Deviations from the Norm, January to December 2013[4]



MULTIVARIABLE NORMALIZATION

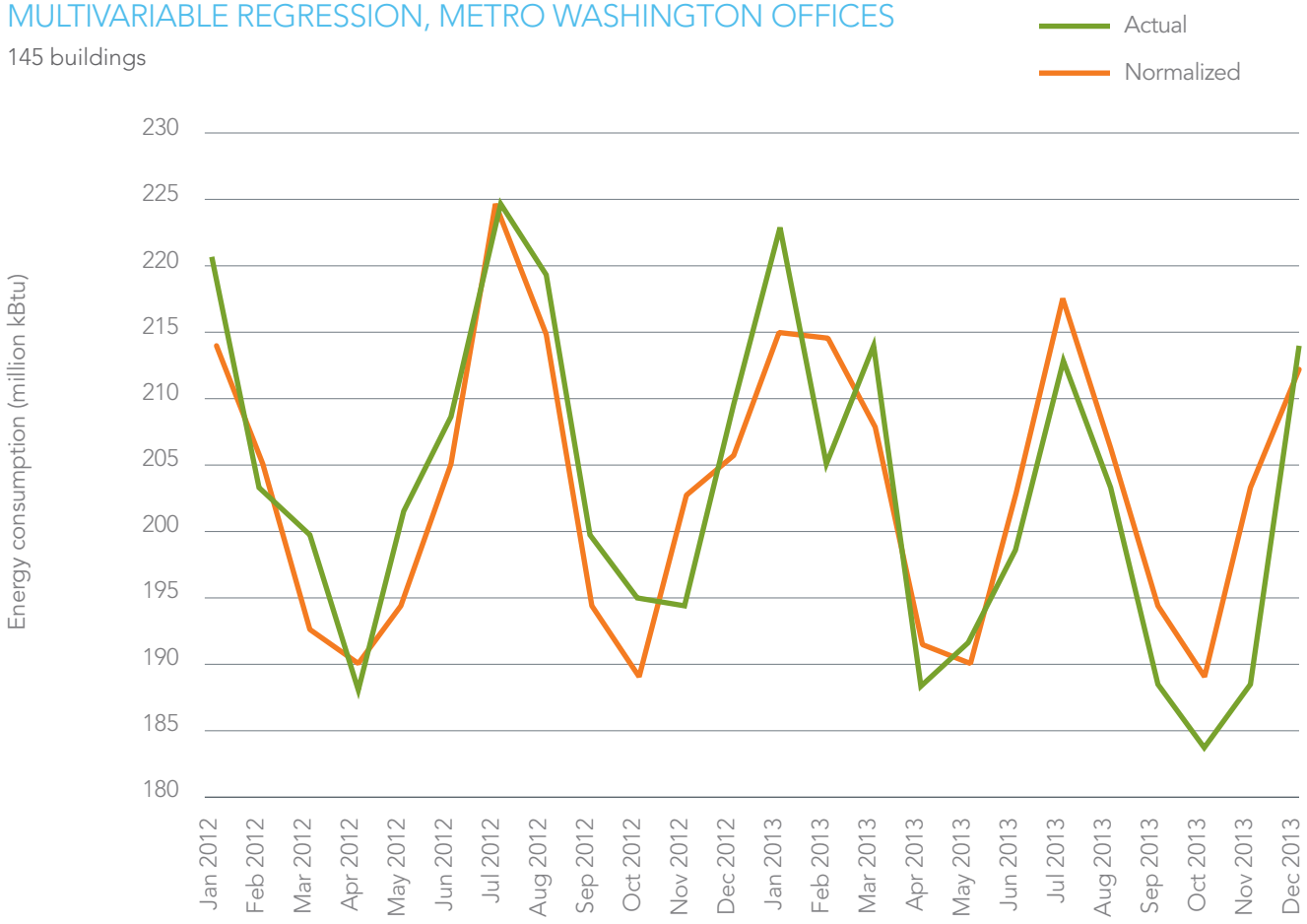
Energy use in properties is dependent on a variety of factors, including the number of occupants (full-time equivalents), building space use, weather, and many others. Each of these factors will contribute to regular variations in energy use. Often, weather and full-time equivalents (FTEs) are noted as major contributors to annual changes in performance. By analyzing monthly weather and FTE data with monthly energy use, it is possible to develop a regression that can help determine how weather and FTEs affect overall building performance. This enables building owners and operators to compare facilities over time as conditions change.

The chart below depicts a multivariable regression for office properties in the metro Washington market. The orange line represents normalized performance and the green line represents the actual performance. The normalized performance tracks the expected energy use if variations in weather and FTEs were removed from the analysis.

The results of the regression show that in 2013 the portfolio performed better than the normalized performance. In fall 2013, the "actual" line is below the "normalized" line, which means energy use is below the expected performance. Conversely, in fall 2012, the "normalized" line is below the "actual" line, meaning that energy use is higher than anticipated based on the regression.

MULTIVARIABLE REGRESSION, METRO WASHINGTON OFFICES

145 buildings



MULTIVARIABLE NORMALIZATION

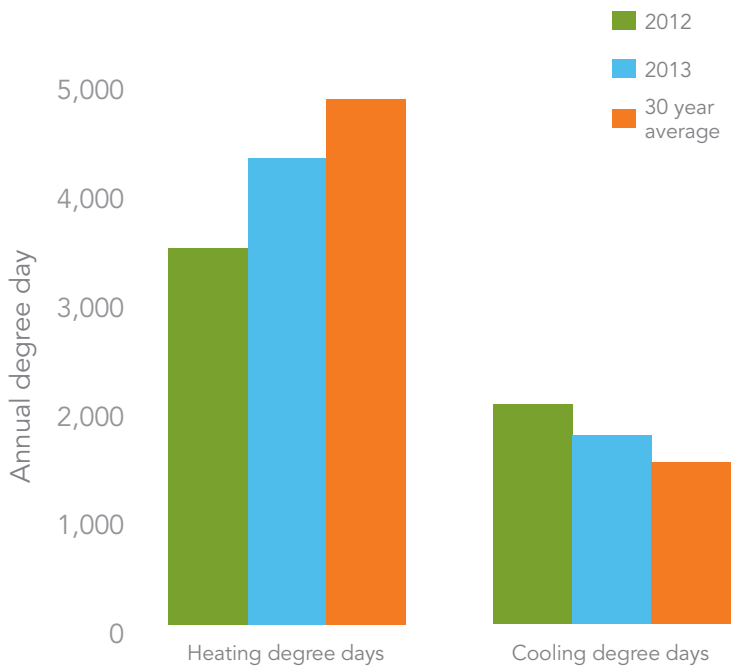
The regression also enables building owners and operators to understand the variables that most affect performance. Based on the regression, changes in FTEs have minimal impact on performance; however, weather affects energy use significantly. If "average" conditions were experienced, the portfolio would consume around 2,412 million kBtu. Average performance is defined using the 30-year average weather conditions for the metro Washington market, as shown in the table below.

As the chart below illustrates, 2012 had a mild winter but a warmer than usual summer while 2013 had a cold winter and a mild summer. This information, coupled with the fact that 2012 actual performance appears to be below the regression, indicates that based on this regression, metro Washington buildings' energy consumption is more sensitive to hot weather than cold weather. This is interesting as it aligns with Energy Star Portfolio Manager's regressions where cooling degree days (CDD) are a stronger driver for energy consumption than heating degree days (HDD). HDD and CDD are metrics often used in the building industry as a proxy for air temperature in relation to a base temperature, in most cases 65 degrees Fahrenheit (16 degrees Celsius).

COMPARING HEATING DEGREE DAYS TO COOLING DEGREE DAYS

	HDD	CDD
30-year average	4,717	1,178
2012	3,380	1,974
2013	4,046	1,684

Both 2012 and 2013 have more cooling degree days and fewer heating degree days than the 30-year average, showing that temperatures in metro Washington in 2012 and 2013 were overall warmer than the 30-year average.

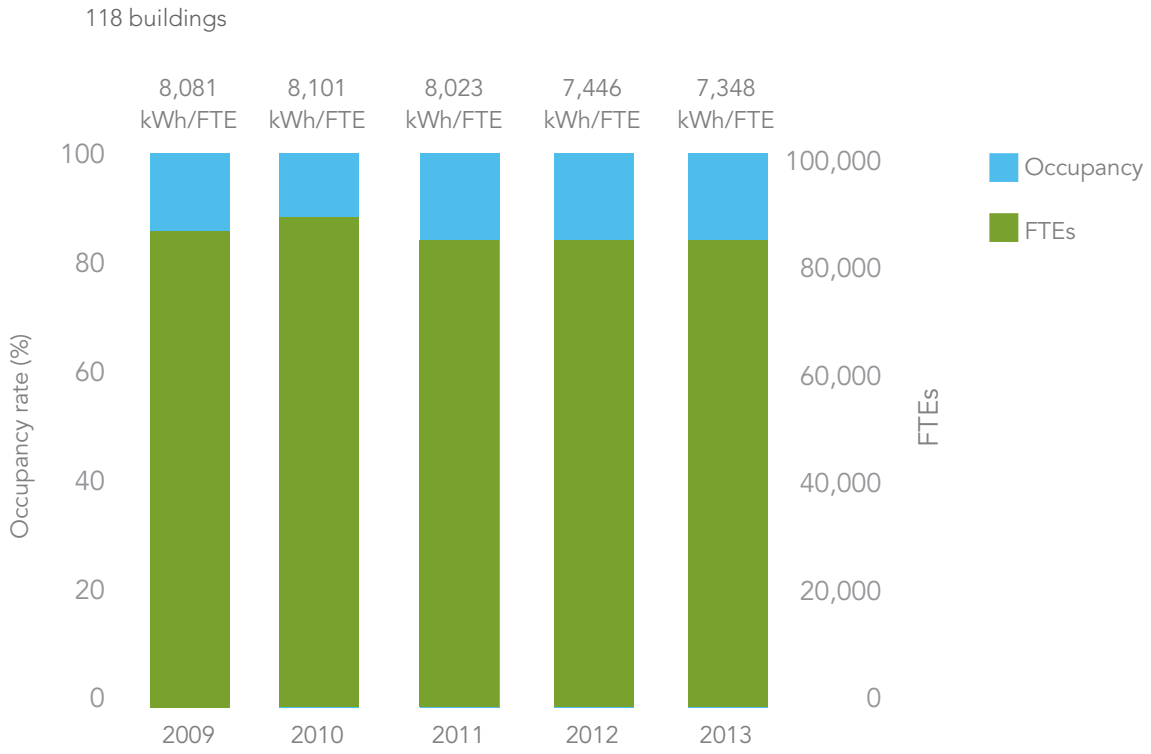


ENERGY, FULL-TIME EQUIVALENTS, AND OCCUPANCY

Metro Washington energy use decreased 11.3 percent from 2009 to 2013. Energy use per FTE decreased 9.1 percent from 2009 to 2013, showing that the properties in metro Washington have been focused on improving performance while the building's FTEs change over time.

Another interesting point is that occupancy for all properties remains at 100 percent across all years. This is likely not the reality but registers this way because the occupancy metric in Energy Star is oftentimes not maintained on a regular basis. Data for occupancy, like a majority of data for this report, are pulled from Energy Star. In order to use occupancy information effectively, it would be beneficial to promote the importance of updating occupancy data on a regular basis. If data from CoStar is used to calculate average occupancy rates for the properties in this analysis, the results for 2013 average occupancy is closer to 95 percent.

ENERGY, FTES, AND OCCUPANCY

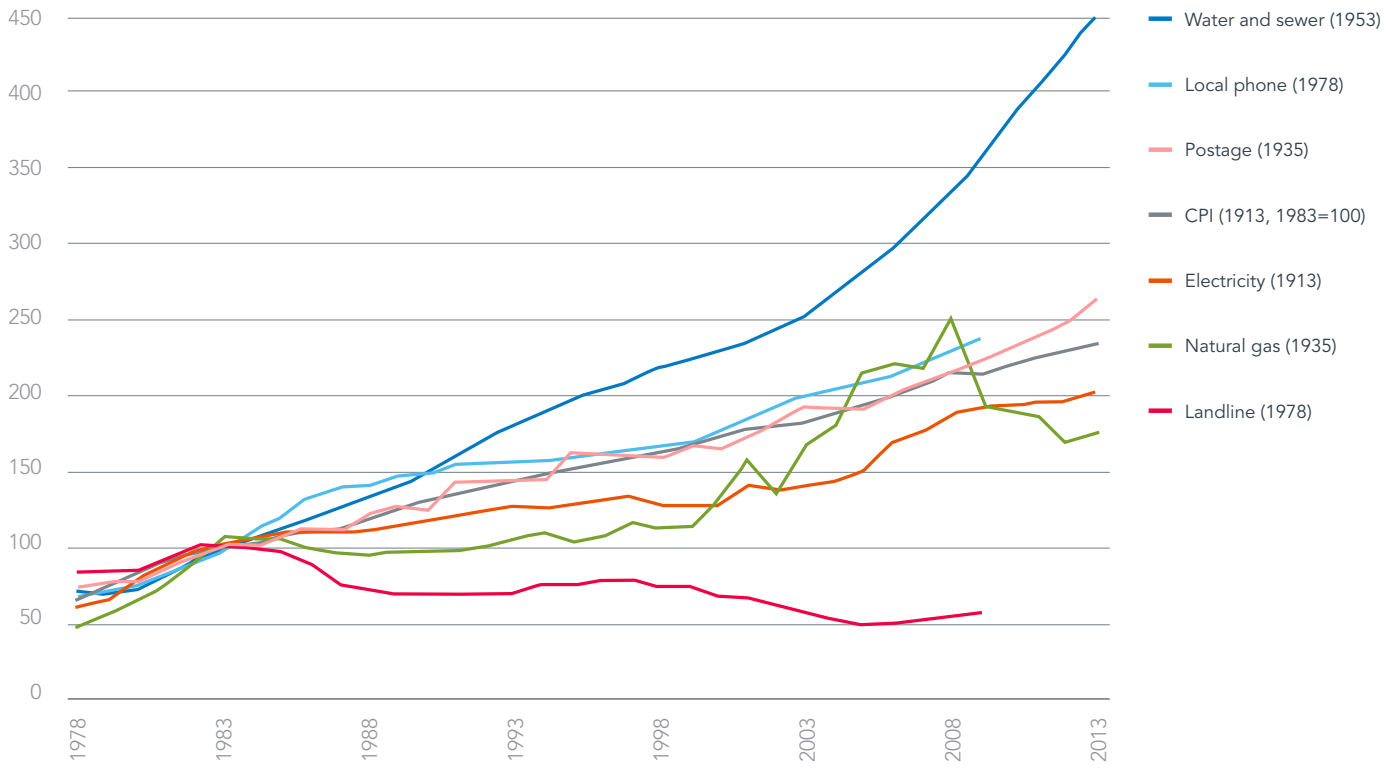


From 2009 to 2013, energy use per FTE has decreased by 9.1 percent.

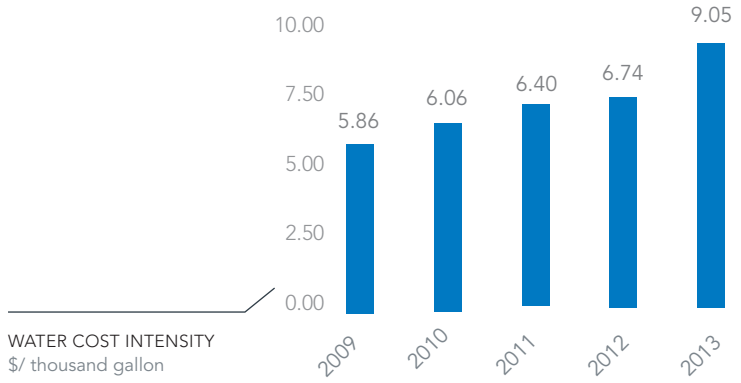
WATER COST

The graph depicts the long-term cost trends associated with multiple utilities and the Consumer Price Index (CPI). The CPI is used to measure the average change over time of prices paid for a basket of goods and services. Over the last 30 years, the cost of water has outpaced the CPI by over 200 basis points and is growing at the fastest rate of any utility. Water is now 4.5 times more expensive compared to 1983 while electricity is only twice as expensive. Because water is currently not a large expense for most properties, it is often overlooked. However, as the cost of water continues to outpace nominal inflation rates, its use will be more important to manage effectively.

Long-Term Trends in Consumer Prices (CPI) for Utilities[5]



Metro Washington Median Cost per kgallon



Over the past five years, the cost of water for metro Washington properties has increased by 55 percent, in line with the chart.

WATER USE IN METRO WASHINGTON OFFICES: 2012-2013

Out of the portfolio of 157 buildings in the metro Washington market, 101 provided consistent, like-for-like water data from 2012 through 2013.

WATER

Water use intensity in metro Washington properties decreased 8.9 percent from 2012 to 2013. Virginia/Maryland properties saw a large decrease of over 18 percent in water consumption while D.C. properties experienced a decrease of 2.9 percent. Anecdotally, property owners remarked that there are more opportunities to reduce water use at suburban properties due to the presence of irrigated landscape.

WATER COSTS

Water cost data were provided for 62 properties from 2012 to 2013. The average cost per gallon of water has increased by 32 percent from about $6.80 to $9.00 per 1,000 gallons. These increases are in line with what property owners across the country have experienced.

The increase tracks with the historic trends in water costs that the metro Washington market has experienced over recent years.

	Metro Washington: 101 properties (28.6 million SF)			Virginia/Maryland suburbs: 49 properties (12.1 million SF)		
	2012	2013	% change	2012	2013	% change
Water use (million gallons)	621	566	-8.9%	244	200	-18.2%
Site water intensity (gallons/SF)	21.7	19.8	-8.9%	20.1	16.4	-18.2%
Site water intensity (gallons/FTE)	8,186	7,404	-9.6%	6,596	5,337	-19.1%

	DC: 52 properties (16.5 million SF)			DC BID: 23 properties (7.7 million SF)		
	2012	2013	% change	2012	2013	% change
Water use (million gallons)	377	366	-2.9%	199	188	-5.6%
Site water intensity (gallons/SF)	22.9	22.3	-2.9%	25.9	24.4	-5.6%
Site water intensity (gallons/FTE)	9,653	9,333	-3.3%	10,963	10,194	-7.0%

MULTIFAMILY PROPERTIES

METRO WASHINGTON MULTIFAMILY PORTFOLIO

Environmental performance for multifamily buildings is affected by a variety of factors including property subtype (i.e. garden, mid-rise, high-rise), location, amenities and weather. The multifamily portfolio of properties analyzed in this report consists of 38 buildings located throughout metro Washington that range from garden-style properties to larger high-rise buildings. Metro Washington has a population of over 5.8 million people, which according to the U.S. Census Bureau makes it the seventh most-populous urban area in the country. Housing this population are many large multifamily properties, which are owned by individuals, institutional investors, and real estate investment trusts.

Unlike the office properties detailed earlier in this report, multifamily properties capture and track different subsets of energy data: common-area energy and whole-building energy. This is because in some buildings the tenants are directly submetered by the utility while in others the utility only services a single master meter. These subsets require distinct analysis.

OVERVIEW OF MULTIFAMILY PROPERTIES ANALYZED

	Greenprint metro Washington range	Greenprint metro Washington median	U.S. Greenprint multifamily median
Number of buildings	38	38	524
Size of building (SF)	9,769–1,081,784	308,380	260,586
Year built	1900–2013	1997	2000
Number of multifamily units	96-842	275	234
2013 Occupancy	100%	100%	96%
Common-area site energy intensity (kBtu/SF)	1.3–19.6	6.7	9.1
Whole building area site energy intensity (kBtu/SF)	12.3–93.2	48	40
Site carbon intensity (kg CO_2e/SF)	2.7-13.5	8.3	3.9

At this time, not enough data exist on multifamily properties in the metro Washington market to create relevant benchmarks like those created for the office sector. However, the report does capture changes in performance from 2012 through 2013. Benchmarking of multifamily properties is in its infancy. In fact, the U.S. Environmental Protection Agency's Portfolio Manager tool, which has been benchmarking a variety of other properties for many years, has just released its multifamily module and benchmarking capabilities (September 2014). Therefore, as more research is performed in this space and trends uncovered, Greenprint will work with DowntownDC to determine the metrics that should be captured and tracked in order to ensure that properties can be compared against each other in effective and appropriate manners.

METRO WASHINGTON MULTIFAMILY PORTFOLIO TRENDS

The like-for-like portfolio is composed of 26 multifamily properties with consistent data from 2012 and 2013. Like-for-like performance excludes the effects of acquisitions and dispositions across the portfolio. Details for metro Washington and Virginia/Maryland are provided in the table below. Both whole-building and common-area energy data are captured in the like-for-like analysis.

ENERGY

For metro Washington, energy intensity across the 26 like-for-like properties increased by 12.7 percent from 2012 to 2013. D.C. and Virginia/Maryland properties experienced increases in energy consumption of 5.6 percent and 15.1 percent, respectively. Occupied area for the 16 properties that provided occupancy rates in 2012 and 2013 increased by 2 percent, which might explain a portion of the increase in consumption.

The increase was driven primarily by an increase in natural gas consumption. Of the 26 like-for-like properties, 23 experienced an increase in natural gas use. This could have been driven by a variety of factors, such as colder weather in 2013 than in 2012.

Electricity use across the like-for-like portfolio decreased by 0.8 percent from 20.9 million to 20.7 million kWhs. Natural gas use increased by 98% across the portfolio, and even though it accounted for only 24% of the energy use in multifamily properties in metro Washington, it drove both energy use and emissions generated higher.

EMISSIONS

Due to the increase in energy use, carbon emissions also increased. Within the like-for-like portfolio of 26 properties, emissions increased by 5.6 percent. Emissions increased at a slower rate than energy use because natural gas use increased and natural gas is less carbon intensive than the local electricity grid.

	Metro Washington: 26 properties (9.2 million SF)			Virginia/Maryland suburbs: 21 properties (8.3 million SF)		
	2012	2013	% change	2012	2013	% change
Energy use (million kBtu)	82.8	93.3	12.7%	61.5	70.8	15.1%
Number of units	7,808	7,808	—	6,765	6,765	—
Site energy intensity (kBtu/SF)	9.0	10.1	12.7%	7.4	8.5	15.1%
Emissions (thousand metric tons CO_2e)	10.1	10.7	5.6%	7.7	8.2	6.5%
Site emissions intensity (kg/SF)	1.1	1.2	5.6%	0.9	1.0	6.3%

Due to colder weather in 2013 natural gas use went up by 98%, driving an increase in energy and emissions for multifamily properties.

MULTIVARIABLE NORMALIZATION

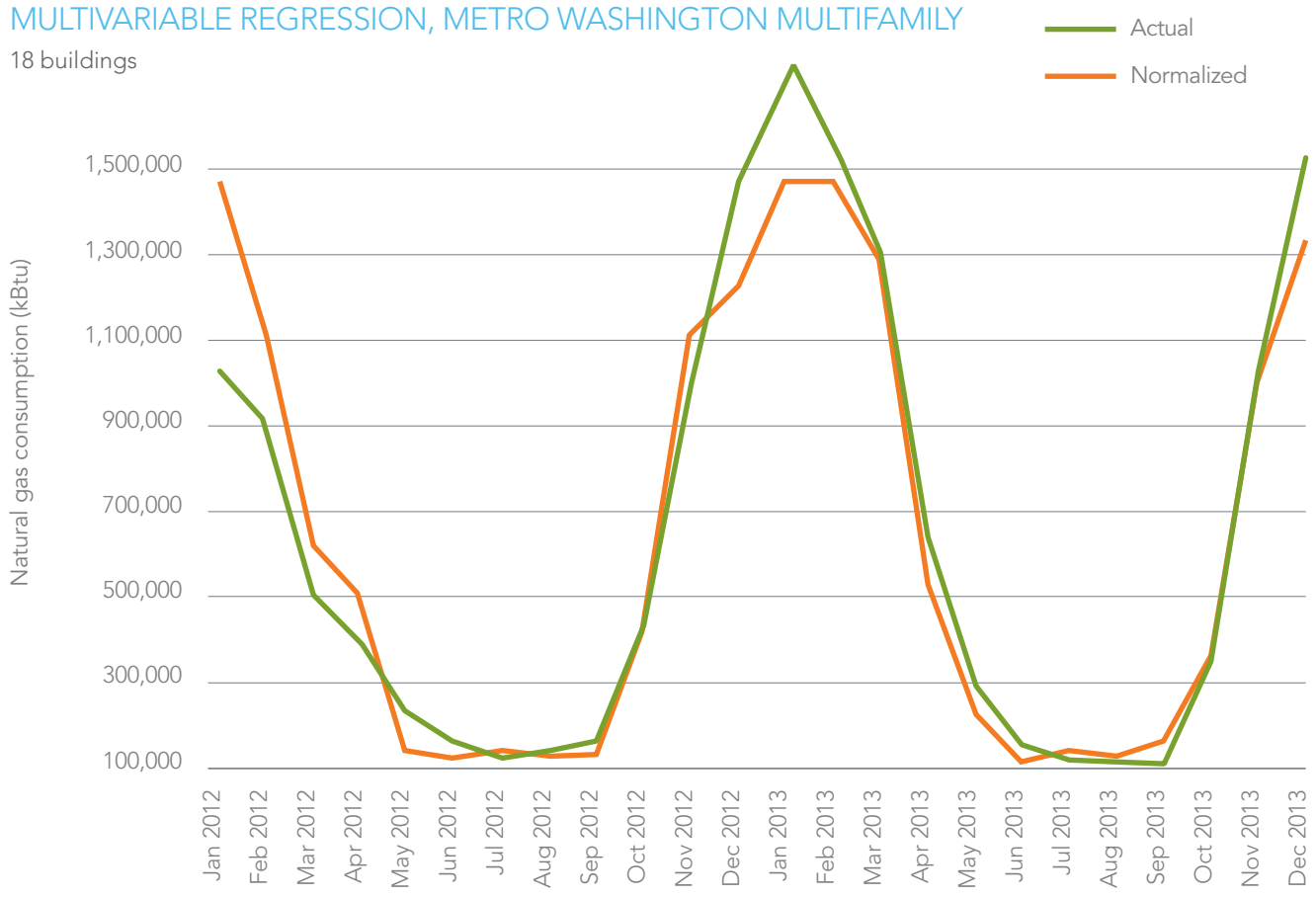
Energy use in multifamily properties is dependent on a variety of factors, such as amenities, building space use, weather, and many others. As is the case with offices, weather is a major contributor to annual changes in performance for multifamily properties. By analyzing monthly weather in conjunction with monthly energy use, it is possible to develop a regression that can help determine how weather affects performance. This enables building owners and operators to compare facilities over time as conditions change.

The chart below correlates natural gas consumption with weather for multifamily properties in the metro Washington market. Natural gas was used instead of total energy because electricity, the other major energy source, only supplied energy to the common area baseload (e.g. common area lighting, elevators) while natural gas consumption supplied energy to the entire building.

Natural gas is predominantly used for heating. This is illustrated in the chart below where in the winter months there is an increase in natural gas consumption. Natural gas consumption across the summer months is the baseload and is associated with cooking and, where relevant, heating for common area amenities such as pools. The supply of heat is often controlled by tenants even if natural gas is centrally purchased and managed by the property owner. Engaging with tenants to use energy more efficiently may be a solution to limit the large fluctuations in fuel consumption over the year.

MULTIVARIABLE REGRESSION, METRO WASHINGTON MULTIFAMILY

18 buildings



WATER USE IN METRO WASHINGTON: 2012-2013

Out of the portfolio of 38 multifamily buildings in the metro Washington market, 24 properties provided consistent, like-for-like water data from 2012 and 2013. Unlike energy data, water data are provided for the entire building and all services tenants, landscaping, and any additional features throughout the properties.

	Metro Washington: 24 properties (8.3 million SF)		
	2012	2013	% change
Water use (million gallons)	318	289	-9.1%
Site water intensity (gallons/SF)	38.1	34.6	-9.1%

	DC: 5 properties (0.9 million SF)			Virginia/Maryland suburbs: 19 properties (7.4 million SF)		
	2012	2013	% change	2012	2013	% change
Water use (million gallons)	24	26	10.2%	294	263	-10.7%
Site water intensity (gallons/SF)	25.4	28.0	10.2%	39.6	35.4	-10.7%

WATER

Water use intensity decreased 9.1 percent from 2012 to 2013. Virginia/Maryland properties experienced a decrease consistent with the overall reduction while D.C. properties experienced an increase in consumption of 10.2 percent.

For multifamily properties, water use is highly correlated with physical occupancy. Tracking the number of residents in multifamily units might be an important consideration for future analysis in order to develop a strategy to normalize water use.

WATER COSTS

Water cost data were not provided for enough multifamily properties to uncover any trends in performances. However, we suspect that water costs have increased for multifamily properties just as they have for office properties. This is significant because water consumption is often master metered and included in the overhead for the property.

CONCLUSION

Greenprint and DowntownDC are pleased to present the results of the second *Metro Washington, D.C., Building Performance Report, Volume 2*. This report represents an evolution from the inaugural report and includes information about multifamily properties along with performance normalization. The overall trends uncovered reinforce that metro Washington is a high-performing market that has shown consistent improvements in performance over the reporting period, 2009 through 2013.

During this time, the metro Washington Greenprint portfolio of 171 like-for-like office and multifamily buildings reduced energy consumption by 1.7 percent (44 million kBtu) and carbon emissions by 3.7 percent (12,400 metric tons of CO_2e). The carbon reduction is equivalent to planting over 318,000 trees. The improved performance was achieved even though space uses and weather conditions varied over time.

With over 4,000 properties globally in the its platform, Greenprint has come to the conclusion that localized benchmarking and space-type comparisons can help provide deeper insight into property and market environmental performance. This is due to the unique particulars of each market; in metro Washington's case, this would include the specific tenant mix, weather, and distinctions in construction, such as the building height cap. Future reports will attempt to capture more properties, including federal buildings, and bring to light the metrics that matter in the metro Washington market.

GLOSSARY

Carbon dioxide equivalent (CO_2e)—the metric used to compare emissions of various greenhouse gases (GHGs) based on their global warming potential; it includes carbon dioxide, methane, and nitrogen dioxide.

Energy use intensity (EUI)—the annual energy consumption divided by floor area.

Full-time equivalent (FTE)—the number of employees working an eight-hour interval, e.g., one employee working eight hours equals one FTE, and two employees working four hours also equals one FTE. This does not include visitors such as clients or customers, but does include subcontractors and volunteers.

ISO 14064—a globally recognized standard for quantification, monitoring, and reporting of sources of greenhouse gas emissions, as well as the validation of emissions data and assertions.

Like for like—a specific year-over-year analysis of the current year's properties that also have data from the previous year.

Median—the value lying at the midpoint of a distribution of observed values.

Normalized—a reference to adjusting values on a different scale to a common scale, such as energy intensity that is independent of the size of the building by dividing energy use by corresponding floor area.

Occupancy—the percentage of rentable floor area that is leased.

Heating Degree Days (HDD)—a measure of how much (in degrees), and for how long (in days), outside air temperature was lower than a specific "base temperature" (or "balance point"). They are used for calculations relating to the energy consumption required to heat buildings.

Cooling Degree Days (CDD)—a measure of how much (in degrees), and for how long (in days), outside air temperature was higher than a specific base temperature. They are used for calculations relating to the energy consumption required to cool buildings.

PROPERTY SUBTYPE DEFINITIONS

Office

Air conditioned or naturally ventilated are the only subtypes.

Multifamily

Garden—one- to four-story buildings that usually do not contain an elevator and have a courtyard or single-family-type setting and a wide range of units.

Mid-rise—four to nine stories serviced by elevators and usually located in the inner city or dense suburbs with a limited range of unit types.

High-rise—buildings with ten or more stories that sometimes have underground parking and security, with full-service and standard plan and limited unit types.

NOTES

1. CBRE, Washington, D.C., *Commercial Real Estate Market Report*. www.cbre.us/o/washingtondc/pages/washington-dc-commercial-real-estate.aspx.

2. Energy cost savings are calculated by using the median cost per kBtu across the portfolio and applying that to the annual savings across the like-for-like properties. Across the portfolio, the median cost per kBtu is $0.034 (~$0.12/kWh). The savings are 279 million kBtu x $0.034 = $9.5 million.

Market	Energy savings (MM kBtu)	Cost/kBtu	Annual savings
Metro Washington	279	$0.034	$9.5 million
Virginia/Maryland suburbs	125	$0.026	$3.2 million
D.C.	154	$0.038	$5.8 million
DC BID	49	$0.038	$1.9 million

3. Tianzhen Hong, Wen-kuei Chang, Hung-wen Lin. A Fresh Look at Weather Impact on Peak Electricity Demand and Energy use of buildings Using 30-year Actual Weather Data. May 2013 (eetd.lbl.gov/sites/all/files/lbnl-6280e.pdf)

4. National Oceanic Atmospheric Administration Data Service. www.ncdc.noaa.gov/sotc/service/global/map-percentile-mntp/201301-201312.gif

5. Bureau of Labor Statistics, 2013 Consumer Price Index. www.bls.gov/cpi.

6. U.S. Environmental Protection Agency, www.epa.gov/watersense/commercial/types.html.

Disclaimer

All calculations presented in this report are based on data submitted to the ULI Greenprint Center. While every effort has been made to ensure the accuracy of the data, the possibility of errors exists. This report is not intended to be a flawless accounting of carbon emissions by Greenprint's membership. Greenprint does not accept responsibility for the completeness or accuracy of this report, and it shall not be held liable for any damage or loss that may result, either directly or indirectly, as a result of its use.

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