7 Greenprint Performance Report™

VOLUME 7

ULI Greenprint Center
for Building Performance

Members and Strategic Partners

AETOS CAPITAL REAL ESTATE

architecture 2030

AvalonBay COMMUNITIES, INC.

Bentall Kennedy

Berkshire COMMUNITIES

BlackRock®

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LaSalle INVESTMENT MANAGEMENT®

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SONAE SIERRA

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About 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, ULI today has more than 39,000 members globally, representing the entire spectrum of the land use and development disciplines. ULI 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 ULI Greenprint Center

The ULI Greenprint Center for Building Performance 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 the implementation of best practices Greenprint and its members strive to reduce greenhouse gas emissions by 50 percent by 2030.

Greenprint is a catalyst for change, helping members take meaningful and measurable actions to advance environmental performance and overcome market barriers. 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. 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 performance and reducing cost. On an ongoing basis, Greenprint endeavors to demonstrate the correlation between environmental performance and enhanced property value.

Greenprint Member Reach

5,414 Properties
In the Greenprint Portfolio

Over €900B
($1,012B)
Real estate assets under management
by Greenprint members

123 Million m^2
(1.32 Billion ft^2)
Covered by
Greenprint buildings

1,126,963
Employees working in
Greenprint buildings

Over €37 Million
($42 million)
Annual energy and water cost savings

39
Countries represented
in the portfolio
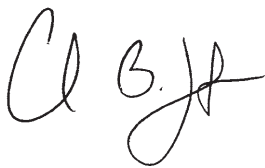
Introductory Letter

This year, responsible investment is characterized by inspirational global collaboration and community building. In December 2015, 195 countries signed the Paris Climate Accord, an unprecedented agreement to combat climate change.[1] Because buildings account for over one-third of global emissions attributed to climate change, the real estate industry has a large role to play in both mitigation and adaptation.[2] As industry leaders, Greenprint members have been collectively working toward reducing emissions and supporting responsible real estate management for more than seven years. Their commitment and actions show how improving building performance can reduce operating costs, enhance property value, reduce pollution, and save natural resources. Greenprint members' actions demonstrate to the industry that the goals set forth in the Paris Climate Accord are truly achievable.

The Greenprint community provides a depth of experience and knowledge unmatched in the real estate industry, enabling the sharing of ideas, information, and best practices, which elevates the performance of all members and the industry. The Greenprint community starts with its direct members and reaches across ULI's 39,000 individual members. It also includes its strategic partner network, where Greenprint continues to develop relationships with like-minded organizations, including the 2030 District Network, Natural Resources Defense Council, Better Buildings Partnership, Global Alliance for Buildings and Construction, C40, Institute for Market Transformation, New Buildings Institute, and Cornell Hotel Sustainability Benchmark. This year, the Cornell Hotel Sustainability Benchmark provided a record 4,692 hotel properties to strengthen Greenprint's reach in to the hospitality industry. Alone, Greenprint can only reach a portion of the market, but together with its partner network, it can achieve greater impact.

Our membership takes an integrated approach to property investment, ownership, and management, always looking across the investment life cycle to optimize environmental and financial returns. In an effort to help our members and the industry generate lasting asset value, we are working across ULI to integrate and align our work with various programs, such as the Tenant Energy Optimization Program, Capital Markets, the Building Healthy Places Initiative, and the Urban Resilience Program. By providing broad programming and connectivity, Greenprint will continue to be a valued resource for building owners and investors.

We would like to acknowledge the outstanding leadership of our members, partners, and collaborators. Thank you for your contributions and inspiration. We look forward to working with you in the years ahead.

Sincerely,

Charles B. Leitner III
Chairman, ULI Greenprint Center

Helen A. Gurfel
Executive Director, ULI Greenprint Center

Executive Summary

Greenprint Performance Report™, Volume 7, is the largest global collection of transparent, verifiable, and comprehensive property data that provides aggregate benchmarks and performance trends for the real estate industry. This report is based on analysis of data Greenprint and its members collected on 5,414 properties across 123 million square meters (1.32 billion square feet) of building area in 39 countries. The collected data do not include strategic partner data, which if added would triple both the property count and the site area.
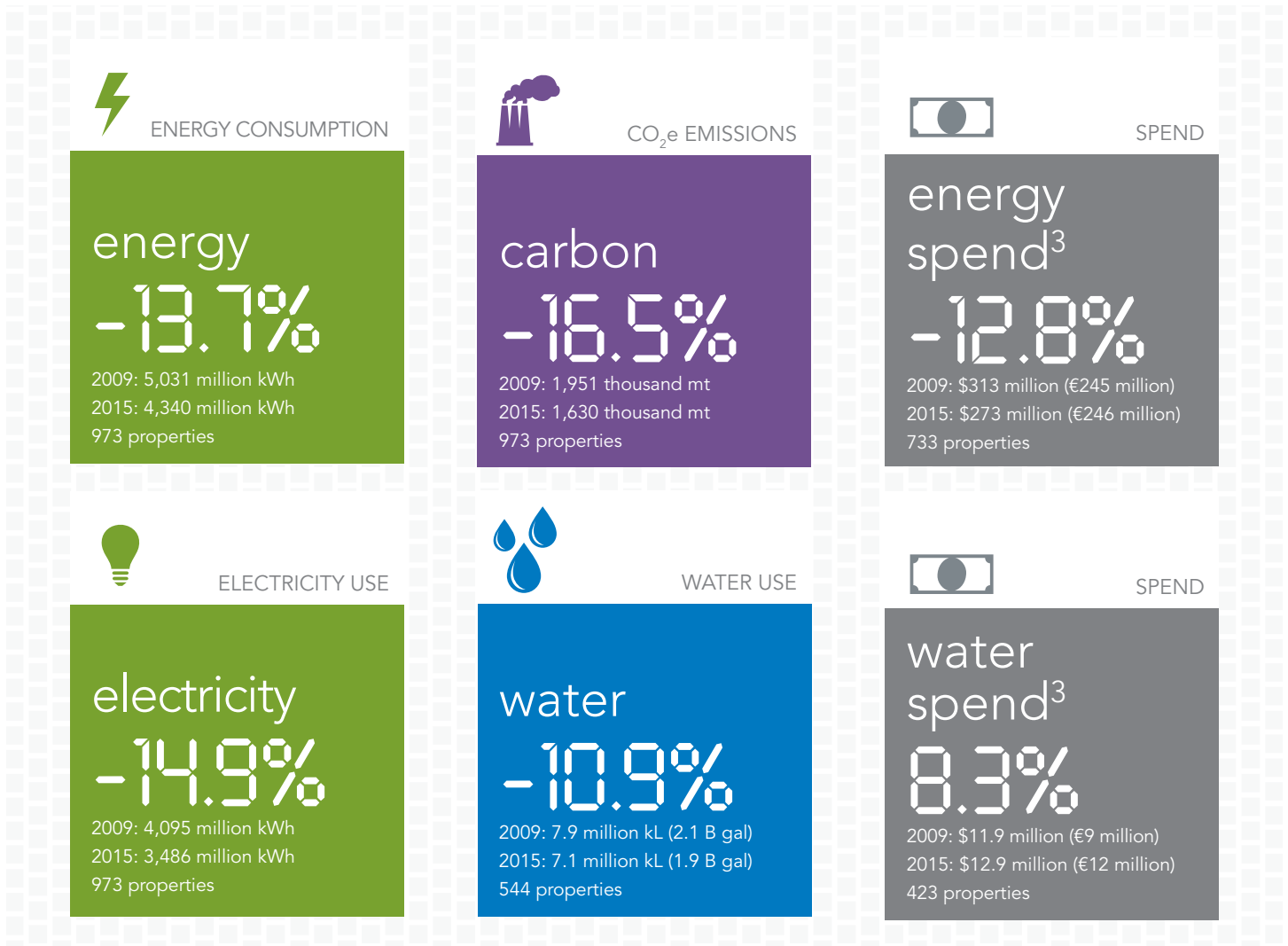
Highlights from this year's report:

- For the sixth year in a row, properties participating in Greenprint achieved reductions in energy consumption, carbon emissions, water use, and waste generation. For those buildings participating in Greenprint since its inception in 2009, energy consumption decreased by 13.7 percent, greenhouse gas emissions by 16.5 percent, and water use by 10.9 percent. These reductions were achieved even with increases in occupancy, demonstrating that improved environmental performance does not jeopardize economic performance. (See page 7.)

- From 2014 to 2015, same-building energy consumption decreased by 3.4 percent, greenhouse gas emissions by 3.9 percent, and water use by 4.8 percent. These results put Greenprint members on pace to exceed their shared long-term goal of reducing carbon emissions 50 percent by 2030. (See page 12.)

- From 2014 to 2015, Greenprint members realized an annual cost savings of $42 million (€37 million). This was achieved through building upgrades and improved operating practices. (See page 12.)

- In six U.S. cities, buildings participating in Greenprint significantly outperformed the portfolio average, achieving reductions of 5 percent, 6 percent, or even 10 percent between 2014 and 2015. These cities encompass a range of policy and climate circumstances, demonstrating the role that a program like Greenprint can play in moving the market forward. (See page 17.)

- The substantial progress made by Greenprint members to reduce the environmental footprint of their buildings is attributable to numerous best practices, some of which are highlighted in this report as well as in past years' member case studies. (See page 24.)

- As industry leaders often on the cutting edge, Greenprint members are increasingly pioneering emerging trends in their approach to building performance. These include focusing on energy reduction within tenant spaces, expanding building performance to include health and wellness, and embedding sustainability in the investment life cycle. (See page 10.)

This report provides aggregate performance data and high-level benchmarks, more detailed information and benchmarks can be found on the ULI website at uli.org/greenprintperformance.

Results and Analysis since Inception

Greenprint Members Achieve Reductions Six Years in a Row

Greenprint members have consistently improved the environmental performance of their properties and portfolios since the inception of Greenprint in 2009. Members achieved these improvements through a variety of methods, including implementing operational best practices and investing in technologies and services that reduce energy consumption, water use, and waste. These improvements support Greenprint's mission to reduce emissions by 50 percent by 2030, in line with IPCC targets, and uphold ULI's commitment to Paris Climate Accord. Greenprint members' impressive results demonstrate what is possible for the broader real estate industry.

ENERGY CONSUMPTION

energy
-13.7%

2009: 5,031 million kWh
2015: 4,340 million kWh
973 properties

CO_2e EMISSIONS

carbon
-16.5%

2009: 1,951 thousand mt
2015: 1,630 thousand mt
973 properties

SPEND

energy spend[3]
-12.8%

2009: $313 million (€245 million)
2015: $273 million (€246 million)
733 properties

ELECTRICITY USE

electricity
-14.9%

2009: 4,095 million kWh
2015: 3,486 million kWh
973 properties

WATER USE

water
-10.9%

2009: 7.9 million kL (2.1 B gal)
2015: 7.1 million kL (1.9 B gal)
544 properties

SPEND

water spend[3]
8.3%

2009: $11.9 million (€9 million)
2015: $12.9 million (€12 million)
423 properties

2009–2015 Emission Reduction Equivalents[4]

743,183
BARRELS OF OIL
NOT CONSUMED

33,897
HOMES NOT
CONSUMING ENERGY

67,806
CARS TAKEN
OFF THE ROAD

8.32 M
TREES PLANTED

Carbon Reduction Index

Greenprint's mission is to lead the global real estate community toward value-enhancing carbon-reduction strategies that support global greenhouse gas stabilization by 2030 in line with the goals of the IPCC and ratified by the Paris Climate Accord. The Greenprint Carbon Index™ (GCX) was created to track progress toward this goal.

In order to achieve a 50 percent reduction in emissions by 2030, properties must reduce emissions by nearly 2.4 percent annually. Greenprint members are reducing emissions at a rate of more than 3 percent annually. If that pace is maintained, it would allow Greenprint members to meet the IPCC goals by 2024—a significant and valuable achievement toward mitigating the current and unsustainably high level of greenhouse gas emissions.

GREENPRINT CARBON INDEX
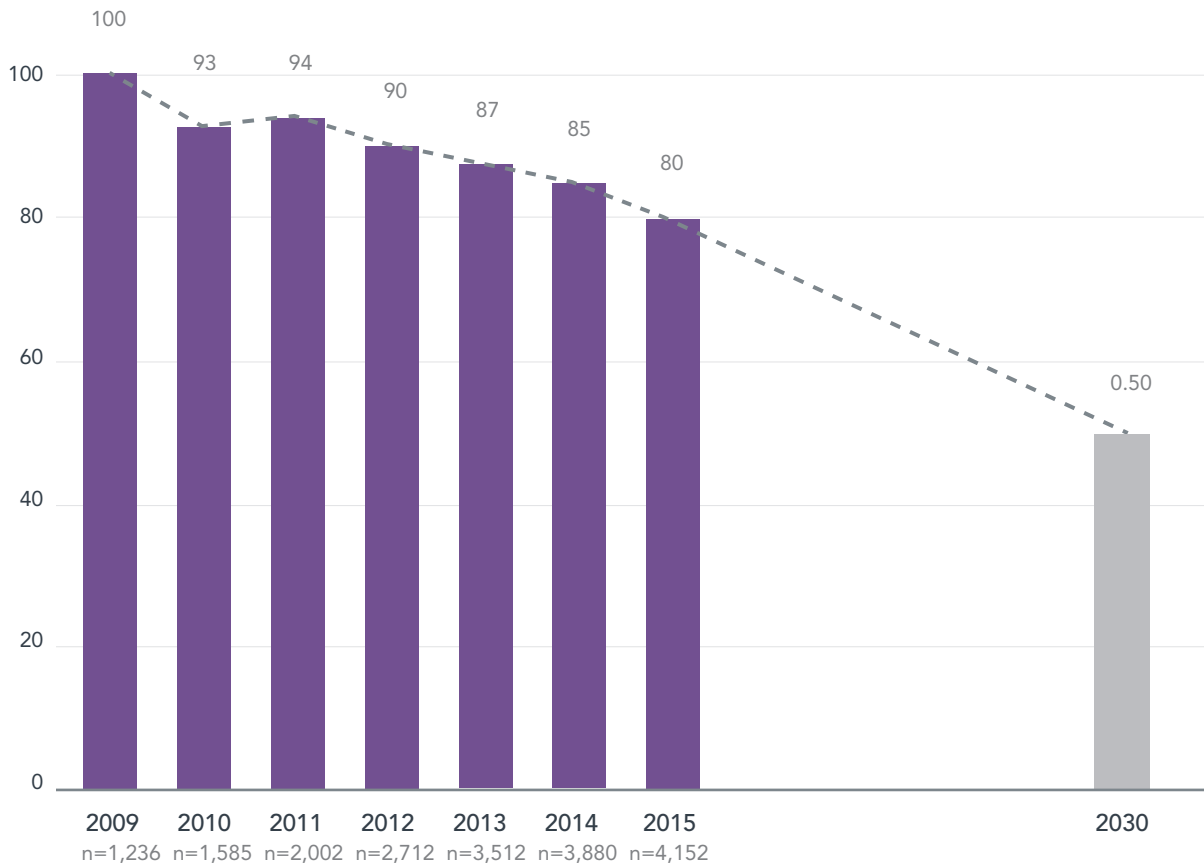
The GCX—with the base year of 2009 equaling 100—is calculated by dividing property type–specific greenhouse gas emissions by the associated total gross floor area of submitted properties. The results are measured in kilograms of carbon dioxide equivalent per square meter (kg CO_2e/m²).

Because the size and composition of properties in the Greenprint portfolio have changed over time, the index is weighted by a property-type mix sourced from a recognized global index company.

Water Use

By 2050, global demand for freshwater is expected to increase 55 percent from 2015 levels, while the effects of climate change, population growth, and urbanization all contribute to increased water stress.[5] Estimates indicate that two-thirds of the global population could face water stress by 2025.[6] Investment in water efficiency strategies and technologies will be necessary to ensure adequate water resources for maintaining the environment and the global economy. Also, given the rising cost of this increasingly precious resource, implementation of water efficiency strategies is an important part of driving bottom-line results for the real estate sector.

Greenprint members have reduced water use by 10.9 percent across the same properties since 2009. Properties with many occupants or visitors as well as water features or irrigated grounds are the largest consumers of water in the real estate industry. For example, multifamily, office, and retail properties have more occupants per square meter and more green space for irrigation than do industrial properties like warehouses and distribution centers.

Of note: only multifamily properties as a whole increased water use from 2009 to 2015. This may be attributable to higher occupancy rates and reflect challenges landlords face in affecting tenant behavior.

WATER USE INTENSITY BY PROPERTY TYPE
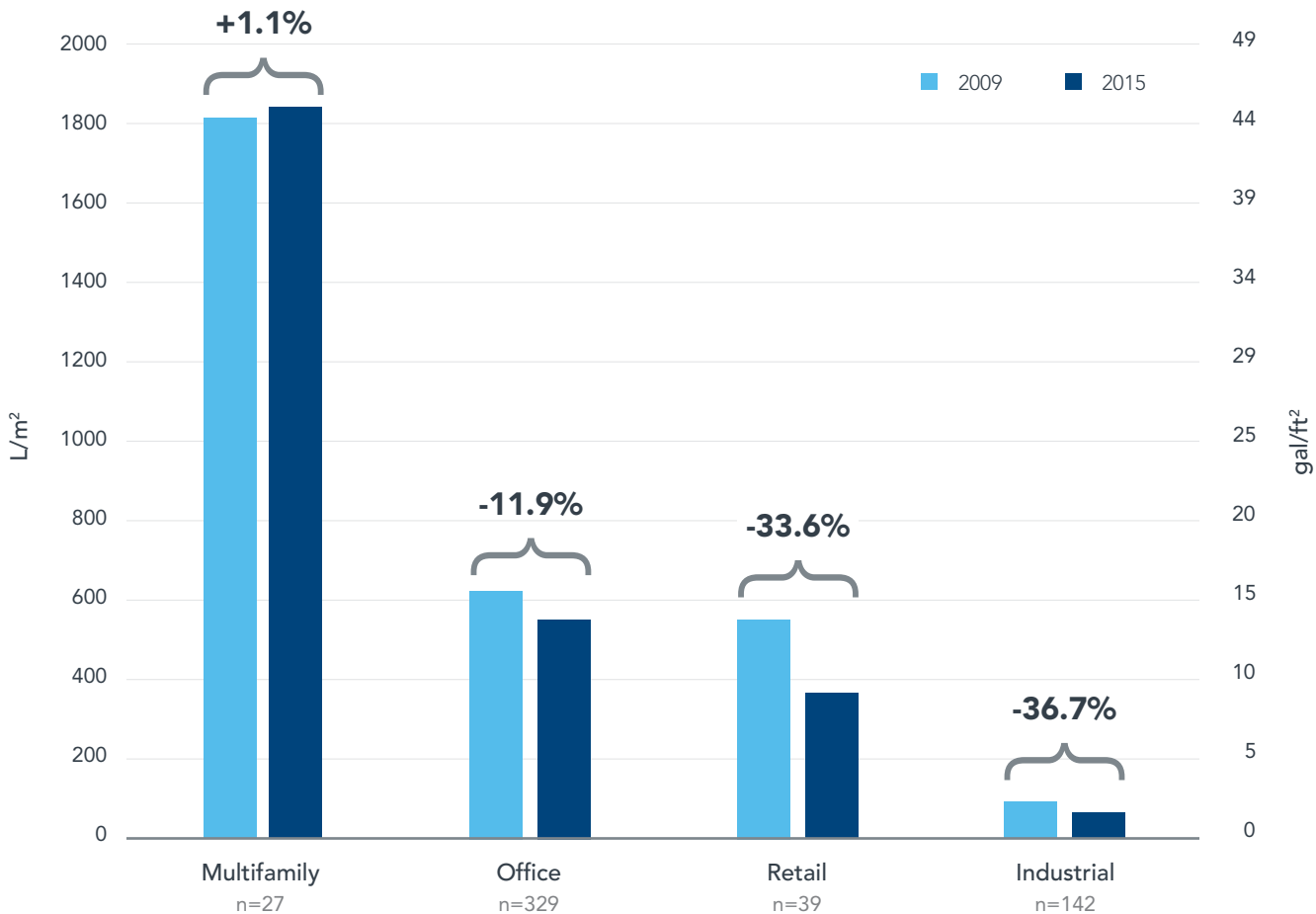
Trends

As a consortium of global real estate owners, investors, and strategic partners, Greenprint has insight into the trends leading the real estate industry toward improved efficiency and environmental performance. The following five trends are gaining traction and momentum, driving increased stakeholder engagement and the creation of more comprehensive sustainability programs.

For more specific examples of what has driven improved performance in this reporting year, see the Best Practices 2015 section of this report.

Tenant engagement is the next frontier

Tenants account for over **50 percent** of the energy consumed in buildings.[7]

Programs that integrate energy efficiency measures into the design and construction of tenant spaces deliver excellent returns in the form of energy conservation and cost savings.

To help property owners, tenants, and service providers improve the efficiency of occupied spaces, a number of tenant-focused programs are on the rise, including ULI's Tenant Energy Optimization Program. An extension of a program originally developed by the Natural Resources Defense Council, the program uses a 10-step process that integrates energy efficiency measures into the design and construction of tenant spaces, and delivers excellent returns in the form of energy conservation and cost savings. The U.S. Environmental Protection Agency and the U.S. Department of Energy will also be launching tenant-focused programs to recognize and promote efficient tenant spaces.

Embedding sustainability in the investment process

The goal is to create a cultural shift within an organization so that sustainability becomes part of every-day business.

Embedding sustainability throughout the investment life cycle is a way to institutionalize efficiency and high performance and to define how strong environmental performance can lead to value creation at every stage of the investment process. A number of Greenprint members are working on this topic. Jamestown's strategic responsible investment process begins with pre-acquisition and continues through disposition. Specific initiatives are identified during the due diligence phase, then over the course of ownership regular progress reviews are performed, and additional studies undertaken, including LEED gap analyses and ASHRAE-style audits. Similarly, Heitman designs and implements internal policies and business practices to account for environmental, social, and governance (ESG) impacts of their investments. Heitman believes that sustainability, resource conservation/efficiency, and climate change mitigation/adaptation are important goals to support and strives to incorporate ESG into the construction, acquisition due diligence, and asset management of all investments. By integrating sustainability with the asset life cycle, owners have been able to outperform relevant benchmarks.

Health and wellness are attracting more attention

Energy-saving opportunities that also support employee productivity can generate significant co-benefits.

Recent research showed how indoor air quality can improve cognitive functions and occupancy productivity.

New research, certifications, and technologies promote the comfort, health, and productivity of employees, as well as ways to make spaces more desirable to lease. The 3-30-300 model is a rule of thumb that estimates that a typical U.S.-based organization spends $3 per square foot per year on annual utility expenses; $30 per square foot per year on annual rent; and $300 per square foot per year on employee payroll. Therefore, energy-saving opportunities that also support employee productivity can generate significant co-benefits. Recent research conducted by Harvard University, United Technologies Corporation, Syracuse University, and the State University of New York Upstate Medical University showed how indoor air quality can improve cognitive functions and occupancy productivity.[8] To address this at the building level, some property owners are turning to Delos's Well Building Standard, a certification program focused on building performance that affects health and well-being. The ULI Building Healthy Places Initiative has developed the Building Healthy Places Toolkit, which showcases ideas for integrating health at both the building scale and in larger communities.

Technology is evolving

The "Internet of Things" optimizes performance by connecting occupants directly to building systems to facilitate the use of resources when they are specifically needed.

The "Internet of Things" (IoT) connects occupants directly to building systems to facilitate the use of resources when they are specifically needed, thereby optimizing performance. Building owners can also receive direct and actionable insights from data collected through the IoT by using software that integrates and analyzes multiple data sources. Greenprint member Rudin Management uses a software platform called Nantum to inform real-time building management recommendations. The platform provides a wide array of real-time data (including elevator use, number of building occupants, electricity demand, weather, etc.) that Rudin uses to manage energy use and cost.

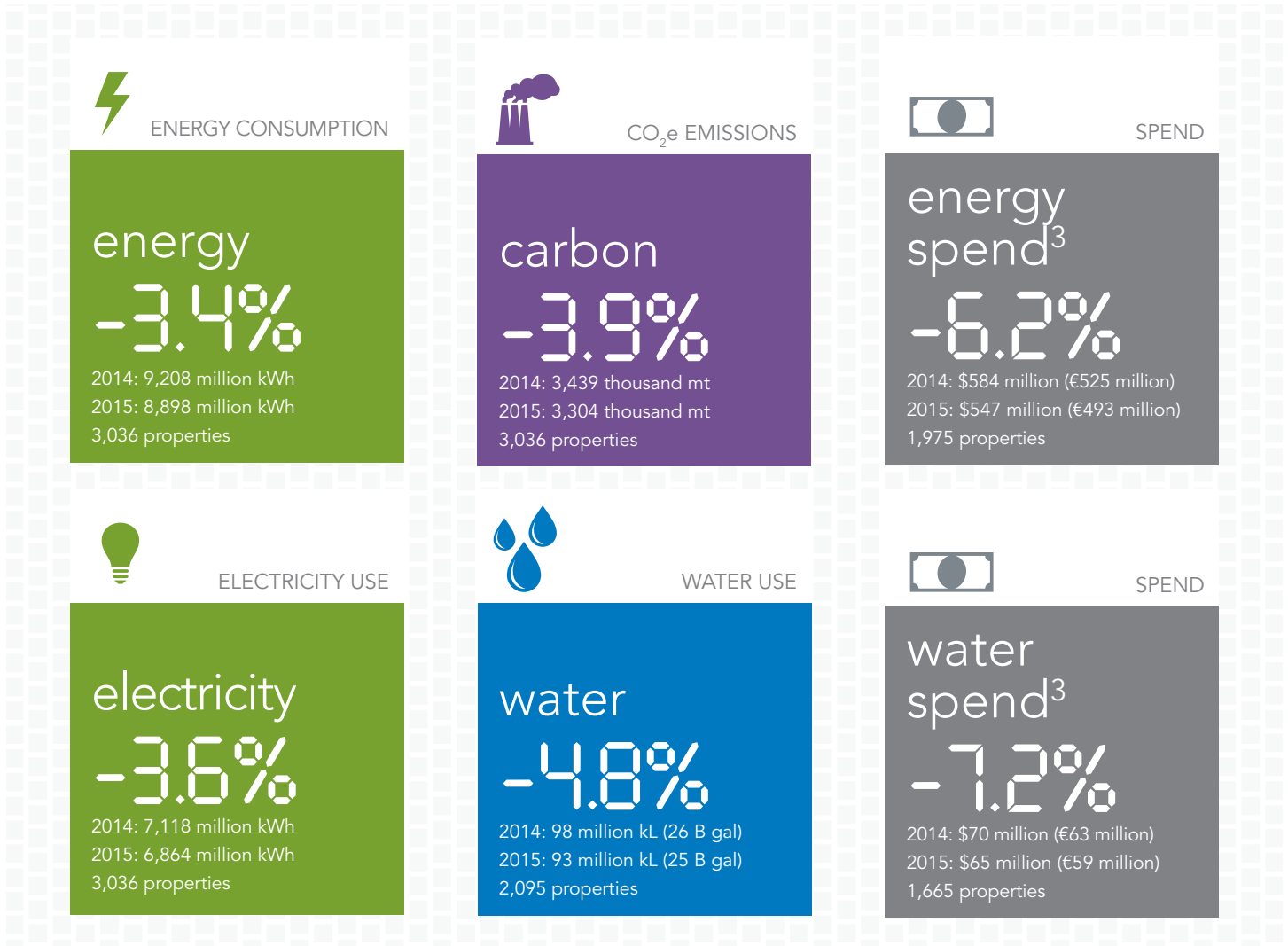# Interest in net-zero-energy buildings is increasing

A number of organizations are focusing on the adoption of net-zero construction methods, developing buildings that consume only as much energy as they produce from clean, renewable resources.

Evolving technology and building methods have led to increased interest in net-zero-energy buildings. Hines, a Greenprint member, recently implemented net-zero strategies in the largest net-zero-energy commercial office building in the United States, the 415,000-square-foot Tower II at La Jolla Commons in La Jolla, California. The building achieves net zero through high-performance design and use of biogas and on-site fuel cells. A number of organizations in the energy efficiency space are focused on advancing the adoption of net-zero construction methods. For instance, the New Buildings Institute, a nonprofit organization committed to improving the performance of commercial buildings, promotes energy efficiency and net-zero building strategies. Architecture 2030, founder of the 2030 District Network, runs a program titled "2030 Challenge for Planning," which offers a practical path for carbon neutrality by 2030 by focusing on achievable energy use–reduction targets for new and existing buildings.

Annual Results

ULI Greenprint Performance, 2014–2015

For 2015, Greenprint member properties experienced reductions in both energy use and emissions. Rates of annual improvement are consistent with previous reporting periods, which indicates that Greenprint members continue to implement substantial and cost-effective strategies to advance their environmental performance.

ENERGY CONSUMPTION

energy
-3.4%

2014: 9,208 million kWh
2015: 8,898 million kWh
3,036 properties

CO_2e EMISSIONS

carbon
-3.9%

2014: 3,439 thousand mt
2015: 3,304 thousand mt
3,036 properties

SPEND

energy spend[3]
-6.2%

2014: $584 million (€525 million)
2015: $547 million (€493 million)
1,975 properties

ELECTRICITY USE

electricity
-3.6%

2014: 7,118 million kWh
2015: 6,864 million kWh
3,036 properties

WATER USE

water
-4.8%

2014: 98 million kL (26 B gal)
2015: 93 million kL (25 B gal)
2,095 properties

SPEND

water spend[3]
-7.2%

2014: $70 million (€63 million)
2015: $65 million (€59 million)
1,665 properties

2014–2015 Emission Reduction Equivalents[4]

312,554
BARRELS OF OIL
NOT CONSUMED

14,256
HOMES NOT
CONSUMING ENERGY

28,517
CARS TAKEN
OFF THE ROAD

3.5 M
TREES PLANTED

Emissions and Water Use, 2014–2015

The entire portfolio decreased its emissions, but differences across property types were observed. Offices use significantly more energy than other commercial property types and therefore create more emissions per square meter. High energy use in offices can be attributed to the high total occupied hours with high-energy-intensity space use (computer rooms, trading floors) and high lighting densities. Yet, office properties saw the greatest decline in their emissions last year, in part through implementation of some of the best practices highlighted in this report.

Within the Greenprint portfolio, industrial was the only property type to increase median energy use and associated emissions in 2015. This increase could be due to macroeconomic factors driving higher utilization of industrial properties. ULI's *Emerging Trends in Real Estate® 2015* report noted that industrial properties were perceived as the most promising for both investment and development among any commercial property type. This is largely due to rising demand, the changing relationship between retail and industrial space, and the rebound of the U.S. manufacturing sector.

EMISSIONS INTENSITY BY PROPERTY TYPE
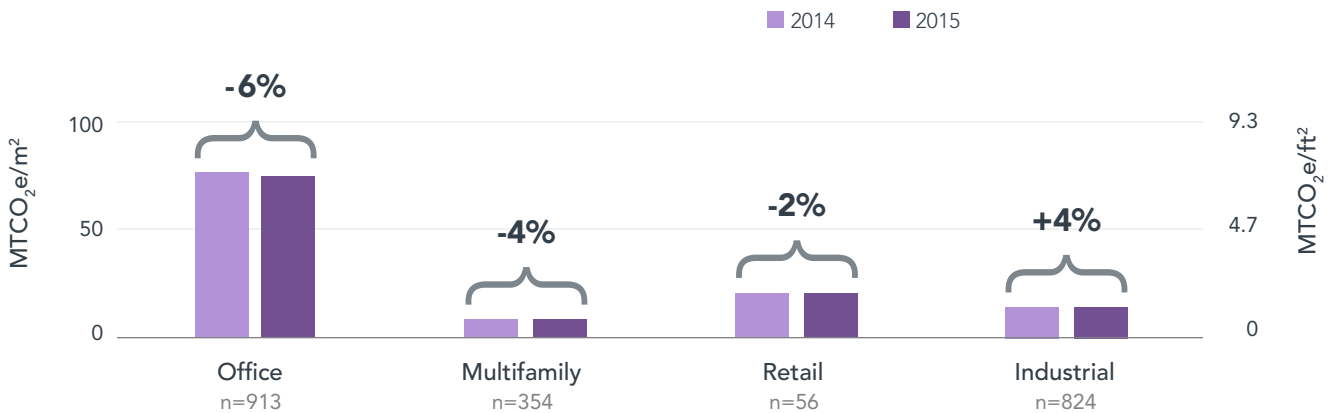
Industrial properties use the least water per square meter, whereas multifamily properties use the most. This is not surprising given the uses for water in multifamily properties, such as laundry, bathing, cooking, and landscaping. Though multifamily properties have showed a slight increase in water use since 2009, sizeable reductions took place from 2014 to 2015.

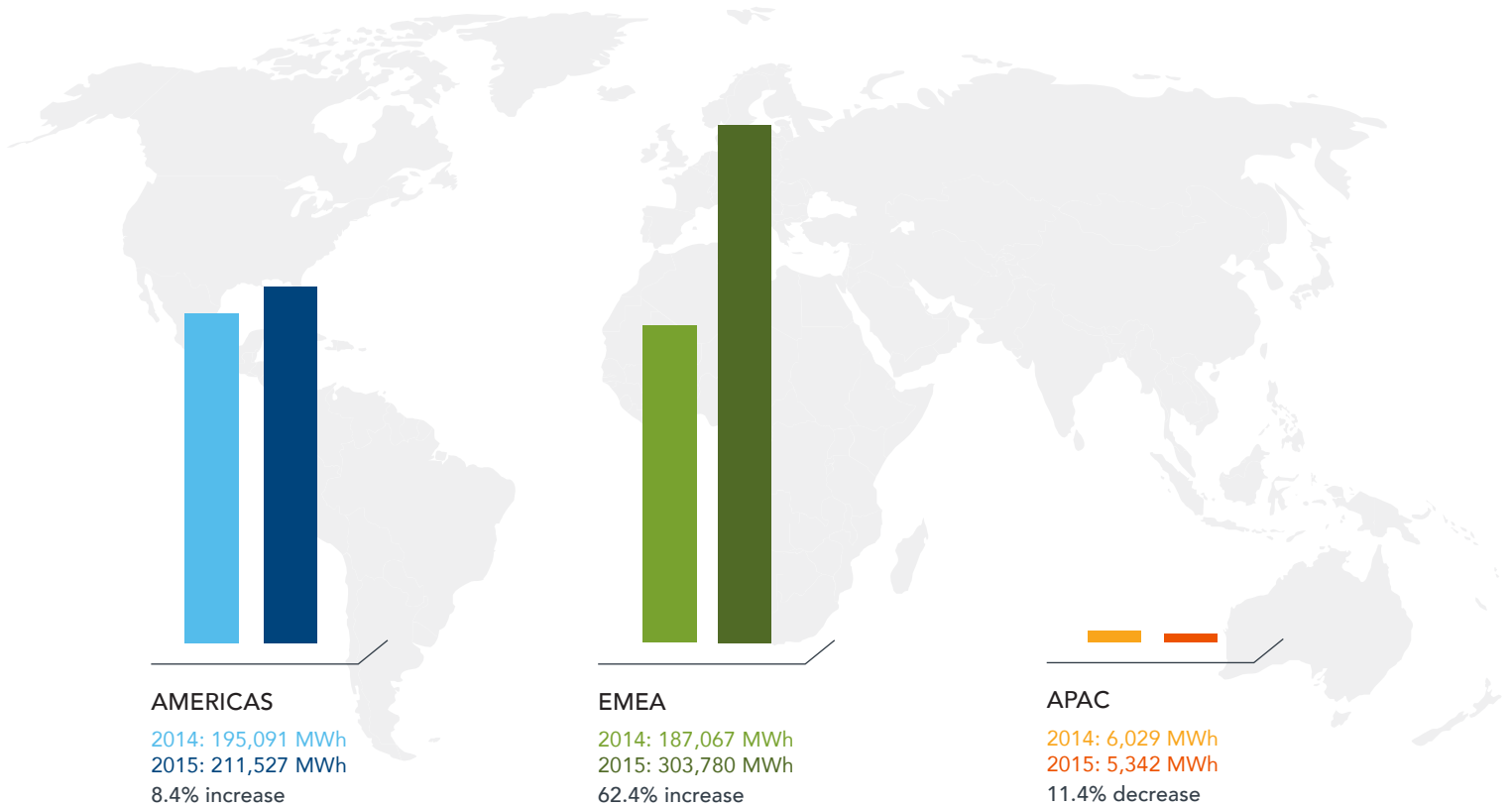## WATER INTENSITY BY PROPERTY TYPE
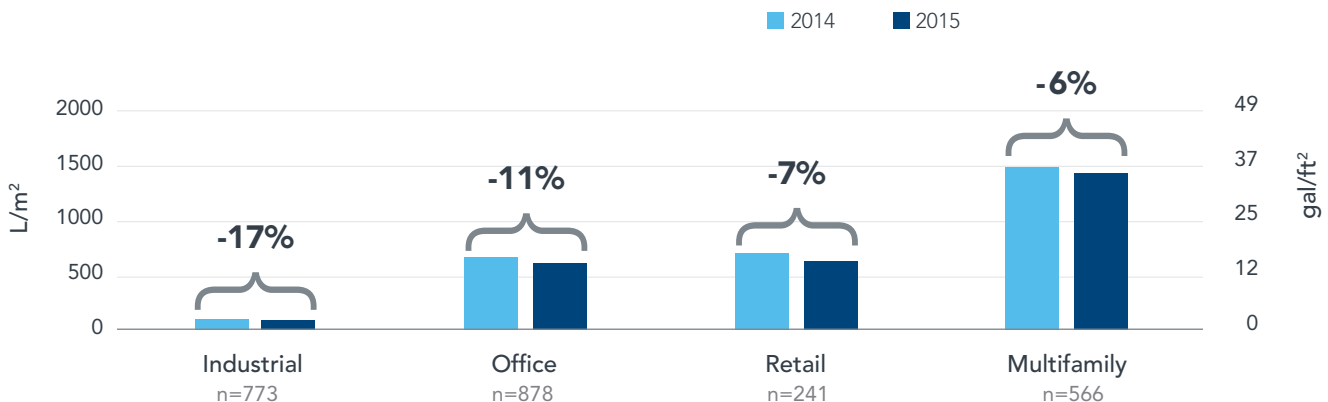
Renewable Energy Use, 2014–2015

While reducing energy use is one way of driving down emissions from buildings, switching to renewable energy sources is another. Using energy from renewable sources is a growing best practice for Greenprint members to achieve their carbon reduction goals. Greenprint members install on-site renewable energy systems, purchase renewable energy credits, and procure energy generated from renewable sources. In 2015, Greenprint members increased use of procured off-site renewable energy by 8.7 percent and on-site renewable generation by 65 percent.

"The 122GW of wind and solar installed in 2015 made up about 50% of the net capacity added in all energy generation technologies (fossil fuel, nuclear and renewable) globally. An expanded list of emerging countries committed billions to clean energy last year with record increases, including Mexico ($4.2bn, up 114%), Chile ($3.5bn, up 157%), South Africa ($4.5bn, up 329%) and Morocco ($2bn, up from almost zero in 2014)."

Bloomberg New Energy Finance

RENEWABLES BY GEOGRAPHIC REGIONS

AMERICAS
2014: 195,091 MWh
2015: 211,527 MWh
8.4% increase

EMEA
2014: 187,067 MWh
2015: 303,780 MWh
62.4% increase

APAC
2014: 6,029 MWh
2015: 5,342 MWh
11.4% decrease

2015 Avoided Emissions Equivalents[4]

591,541
BARRELS OF OIL NOT CONSUMED

6.62 M
TREES PLANTED

Waste Generation, 2014–2015

Waste generated in a developed country contributes 1 to 8 percent of total greenhouse gas emissions. The primary method of waste disposal is landfills, where the waste breaks down into methane, a greenhouse gas whose global warming potential is 20 times more powerful than carbon dioxide. Other waste disposal methods include incineration, composting, and recycling—each also contributing emissions to global warming.[9] The best way to mitigate the environmental impact of waste is to reduce the amount created.

Retail properties in the Greenprint portfolio generated significantly more waste per square meter than any other property type, most of which was material for recycling—likely cardboard and plastic packaging used during the distribution and transport of retail products. Waste generation by property type shows that only industrial properties have increased waste generation per square meter. As with the increase in median energy use for industrial properties, this trend is likely due to increased use of the properties.

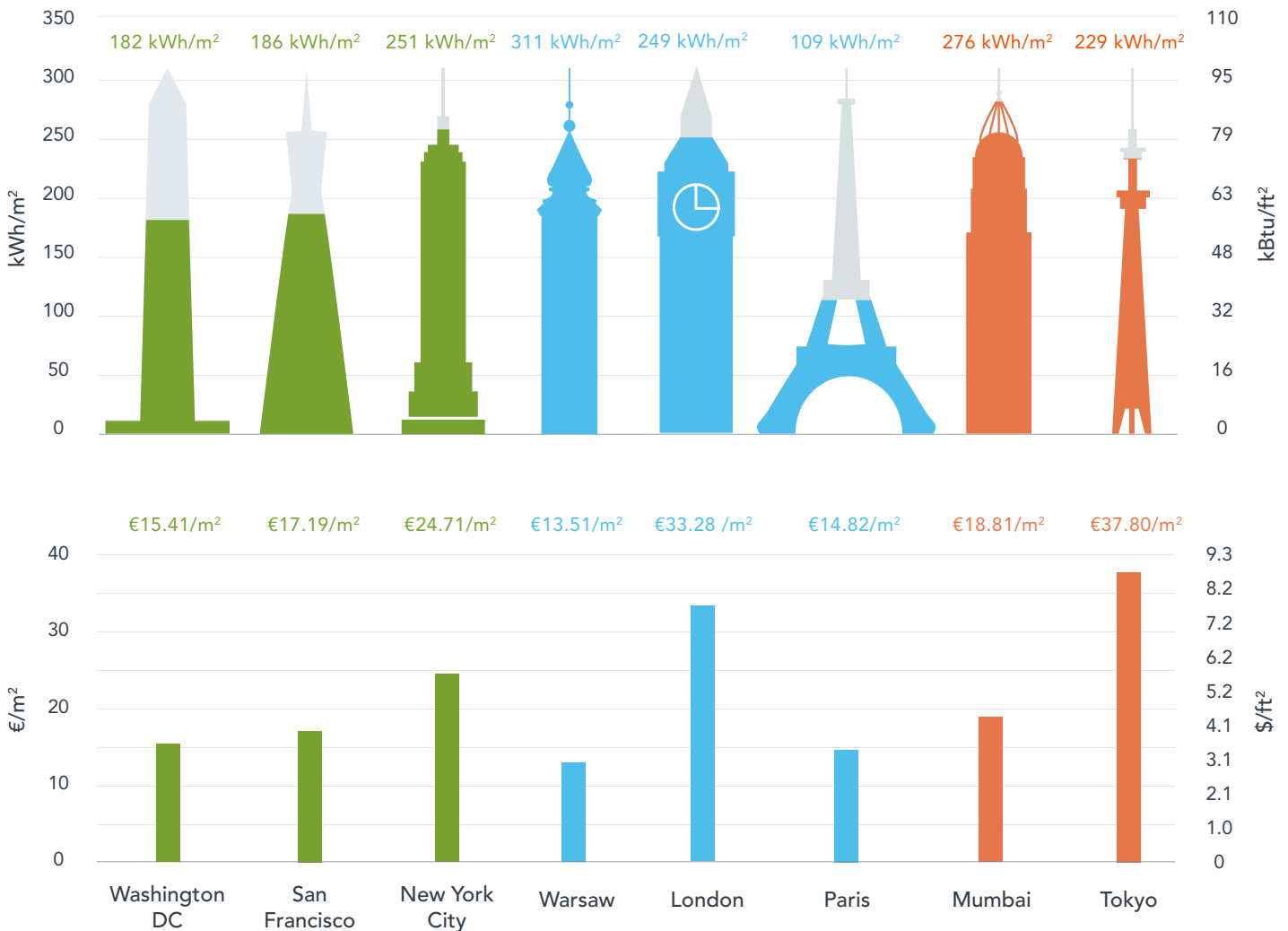## WASTE GENERATION INTENSITY BY PROPERTY TYPE
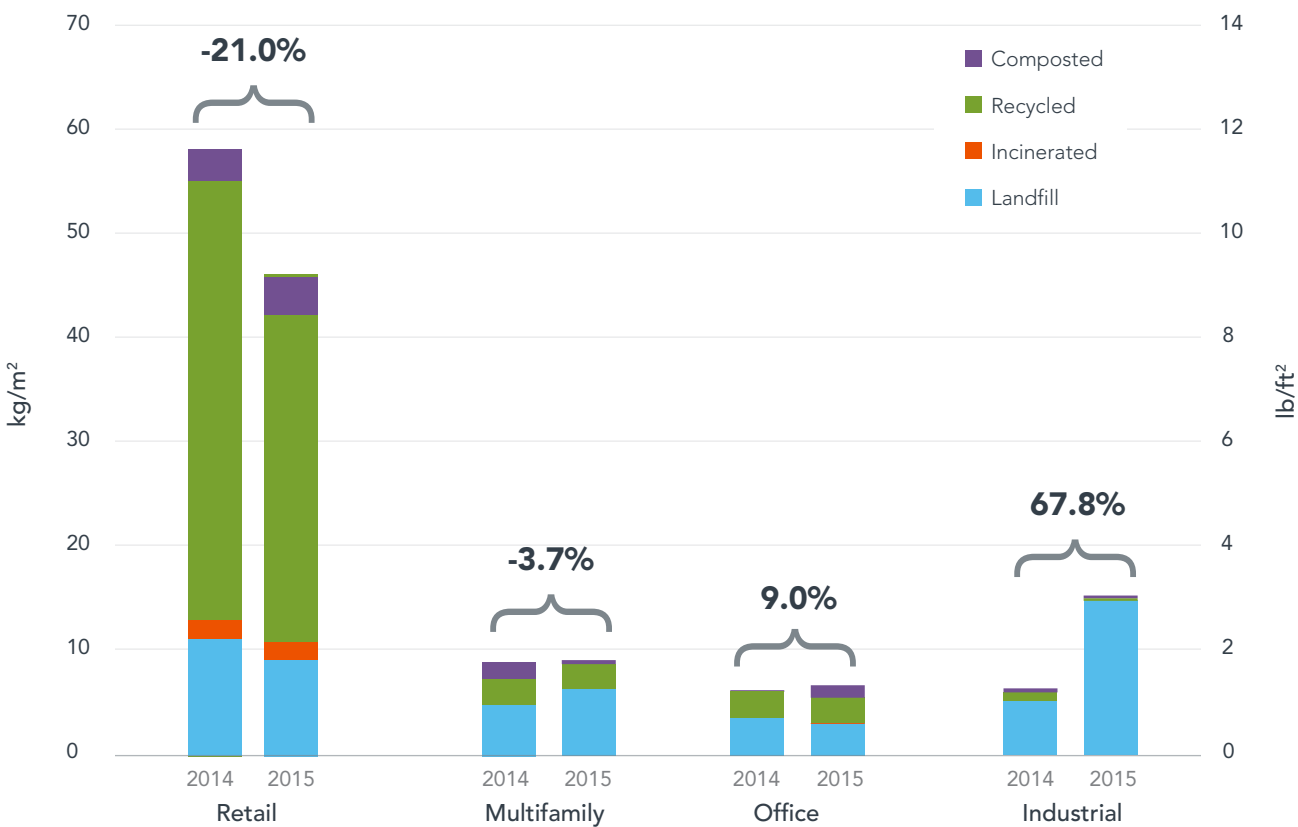
704 Total number of properties reporting waste performance in 2015, a 6% increase from 2014

Property Type Results
Office Properties | Energy Use

Most countries' carbon emissions are dominated by the energy used in cities. Focusing on improving the performance of urban centers is of the utmost importance as the world becomes more urbanized. In major cities, it is the office sector that uses the most energy and has the highest energy use intensity among commercial real estate properties. It is also the sector that attracts the greatest investment. Energy use intensity across markets varies significantly and is driven by many local factors, including the climate, economy, tenant mix, and property operating standards. Paris office properties, for example, use less energy per square meter than those in other cities in the Greenprint portfolio. This likely is due to the fact that Parisian office properties are subject to a comparatively mild climate year-round and can remain comfortable without significant mechanical interventions (e.g., large chillers), not to mention local norms that necessitate less heating and cooling. Understanding the relevant performance targets and potential savings can help property owners reduce energy use and emissions.

MEDIAN ENERGY USE INTENSITY AND COST BY CITY

Energy use intensity (top chart), kWh/m² and kBtu/ft²:
- Washington DC: 182 kWh/m²
- San Francisco: 186 kWh/m²
- New York City: 251 kWh/m²
- Warsaw: 311 kWh/m²
- London: 249 kWh/m²
- Paris: 109 kWh/m²
- Mumbai: 276 kWh/m²
- Tokyo: 229 kWh/m²

Cost (bottom chart), €/m² and $/ft²:
- Washington DC: €15.41/m²
- San Francisco: €17.19/m²
- New York City: €24.71/m²
- Warsaw: €13.51/m²
- London: €33.28 /m²
- Paris: €14.82/m²
- Mumbai: €18.81/m²
- Tokyo: €37.80/m²

Office Properties | Energy Use

In most major U.S. cities, properties in the Greenprint portfolio reduced their energy use, and in several cases those reductions significantly surpassed the average reductions across the entire Greenprint portfolio. Greenprint members reduced consumption in almost all markets where benchmarking ordinances were in place, as well as in cities with a wide range of climate and market conditions. Equally impressive as the reductions, Greenprint members achieved these reductions in properties that were already strong performers, as indicated by the high median Energy Star scores.

OFFICE ENERGY USE INTENSITY BY CITY

City	% Change in EUI	Median 2015 Energy Star Rating	City Benchmarking Policy
San Jose n=29	⬇ -10%	84	
Houston n=24	⬇ -6%	88	
San Francisco n=82	⬇ -6%	88	✓
Chicago n=26	⬇ -6%	79	✓
Washington DC n=91	⬇ -5%	82	✓
Los Angeles n=38	⬇ -5%	92	
New York n=48	⬇ -1%	76	✓
Seattle n=113	⬇ -1%	86	✓
Dallas n=18	⬇ -1%	84	
Miami n=19	⬆ 1%	91	
Atlanta n=23	⬆ 1%	83	✓

■ Median EUI - 2014   ■ Median EUI - 2015

Office Properties | Energy Use

Energy use profiles often vary widely across properties, even within the top half of performers in the office sector in the same city. In some of the strongest office markets in the world (e.g., London and New York City), properties have the highest energy use per square meter. This is likely driven by the types of tenants that occupy the properties (financial and professional service companies that have long operating hours, high plug loads, and high occupant densities), as well as the climates of those cities. In those same cities, it is possible that opportunities to boost financial returns are being overlooked because energy costs, although very high, represents a small percentage of total operating costs.

OFFICE ENERGY USE INTENSITY BY CITY

City	Median kWh/m²	Energy Cost intensity ($/m²/yr)
Seattle n=113	158	12.1
Los Angeles n=38	161	24.6
Houston n=24	171	14.4
San Francisco n=82	174	20.9
Atlanta n=23	176	18.1
Miami n=19	179	17.6
Washington DC n=91	185	18.6
Dallas n=18	194	14.7
San Jose n=29	193	20.3
Chicago n=26	225	6.3
New York n=48	268	30.7
London n=29	299	70.2

Legend: ■ Best Performers (top 25%) ■ Good Performers (second 25%) ■ Median kWh/m²
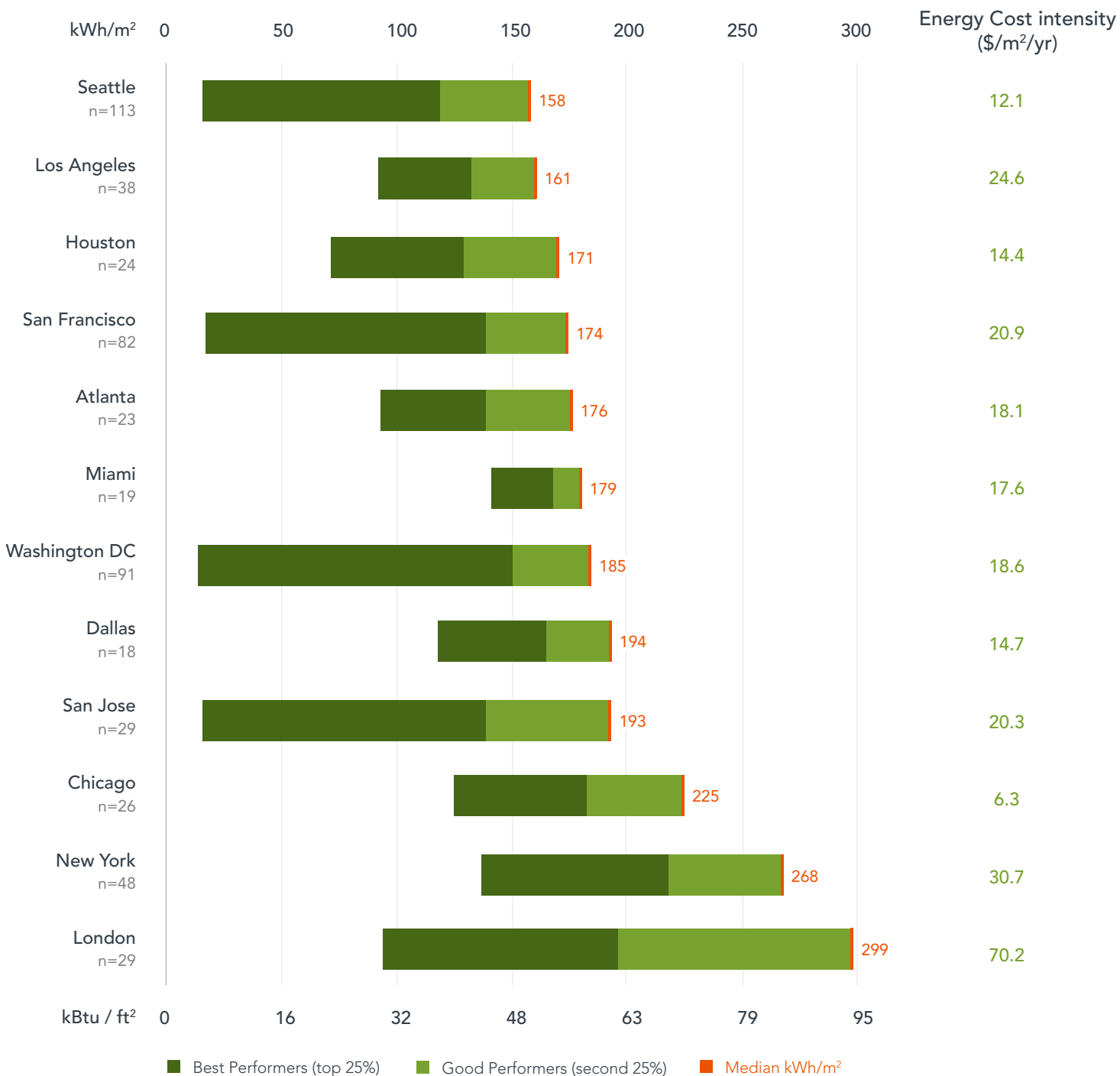
Office Properties | Water Use

Water use in office properties correlates with the number of full-time-equivalents (FTEs). Water use increases as occupant density increases, and often FTEs are a better predictor of water use than property size or other normalization metrics. Some cities (e.g., San Francisco, Seattle, and Boston) diverge from this trend. This may be due to stricter local regulation of water use, greater occupant awareness of water conservation, and/or a milder climate requiring less water use for cooling.

OFFICE WATER USE INTENSITY BY CITY AND FTE
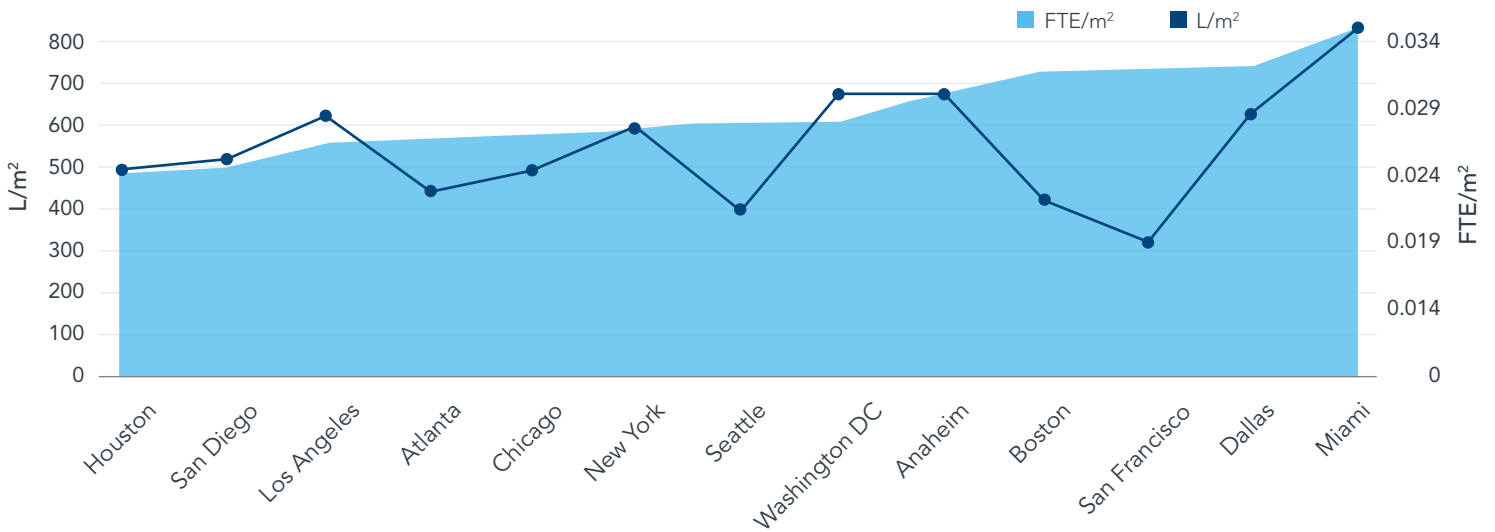
Across a wide range of cities, Greenprint office properties report a reduction in water use per FTE. Notably, median water use per FTE decreased by nearly 40 percent from 2014 to 2015 across Greenprint member properties in the San Diego market. This great accomplishment shows how property owners in water-stressed regions can achieve significant reductions by making water management a priority.

OFFICE WATER USE INTENSITY PER FTE
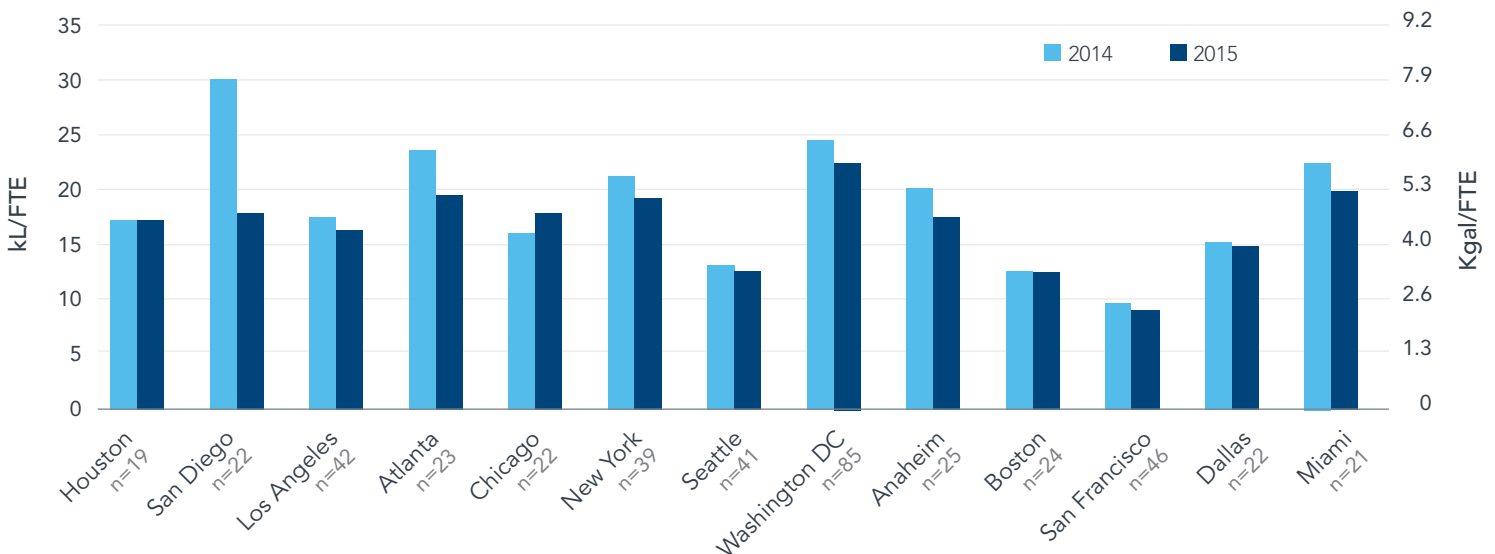
Hotel Properties

The Cornell Hotel Sustainability Benchmarking (CHSB) study is a collaborative initiative aimed at developing hotel industry–specific benchmarks for energy, water use, and carbon emissions. Greenprint partnered with the CHSB to expand its hospitality benchmarks. Resort hotels consistently use more energy than other types of hotels—likely because of larger amenities and grounds—and generally require more cooling. Examples of facilities at resort hotels that cause increased energy use include decentralized villas, large restaurants, and lobby areas with open-air elements.

HOTEL ENERGY USE INTENSITY BY SUBTYPE

Full Service
n=3,074 — 283

Limited Service
n=1,482 — 219

Resort
n=136 — 373

Legend:
- Best Performers (top 25%)
- Good Performers (second 25%)
- Median kWh/m²
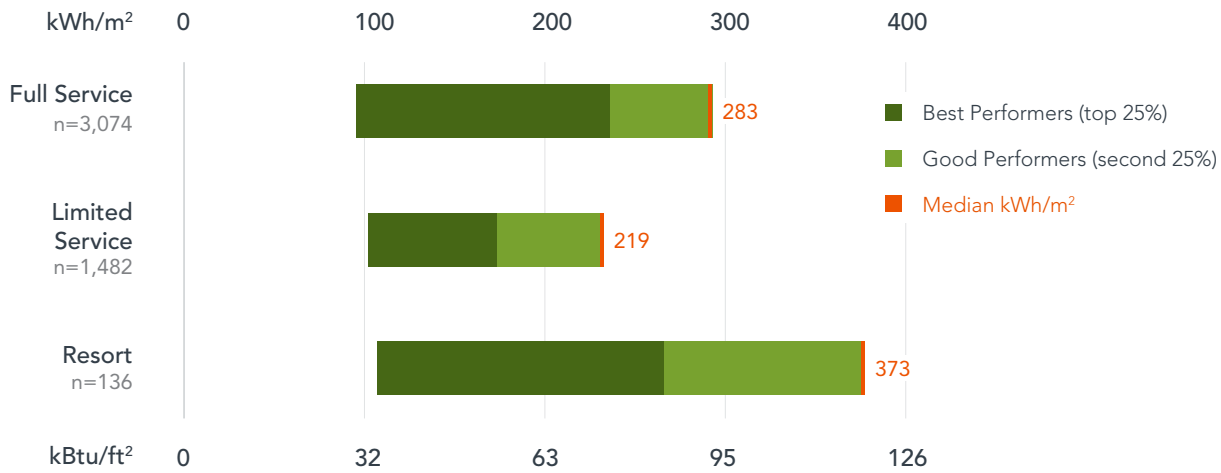
The chart below shows the water intensity per occupied room (OCRM) by city while also showing a baseline water stress rating as measured by World Resources Institute's Aqueduct program. Baseline water stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumption. Higher values indicate more competition for water usage. Shanghai, Istanbul, and Beijing show peaks in water intensity combined with higher ratings for water stress. Water use efficiency should be a priority for these locations and others with less-resilient water resources.

WATER USE INTENSITY BY OCRM & LOCAL WATER STRESS RATINGS

- Median Water Intensity (L/OCRM)
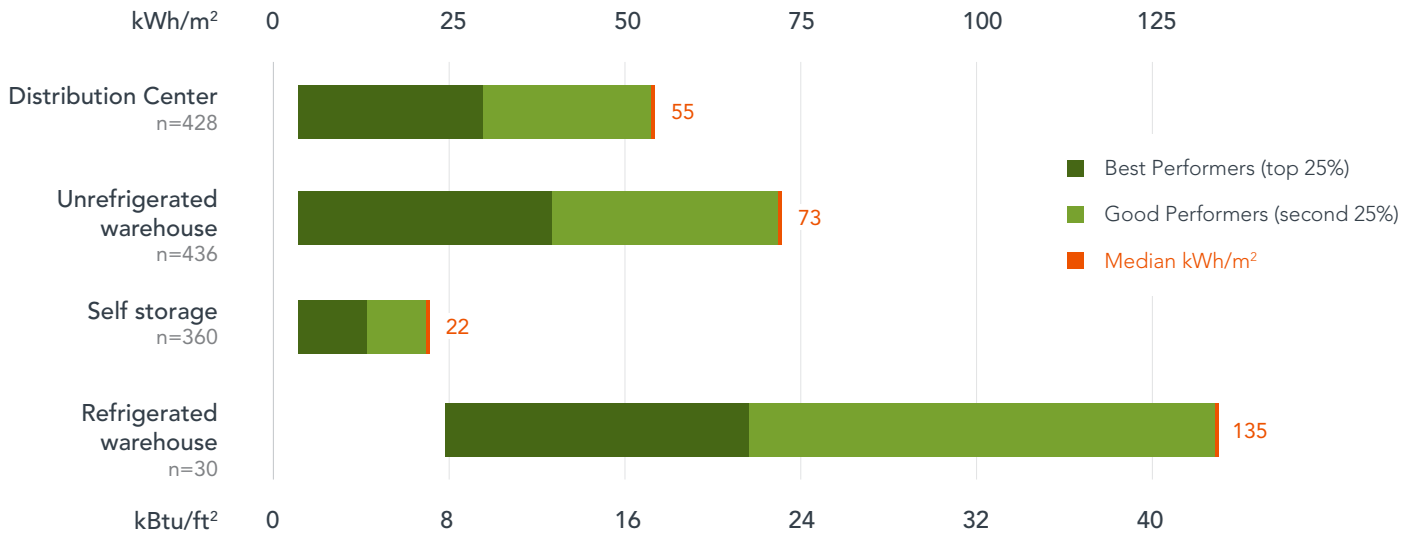- WRI Aqueduct Baseline Water Stress Rating
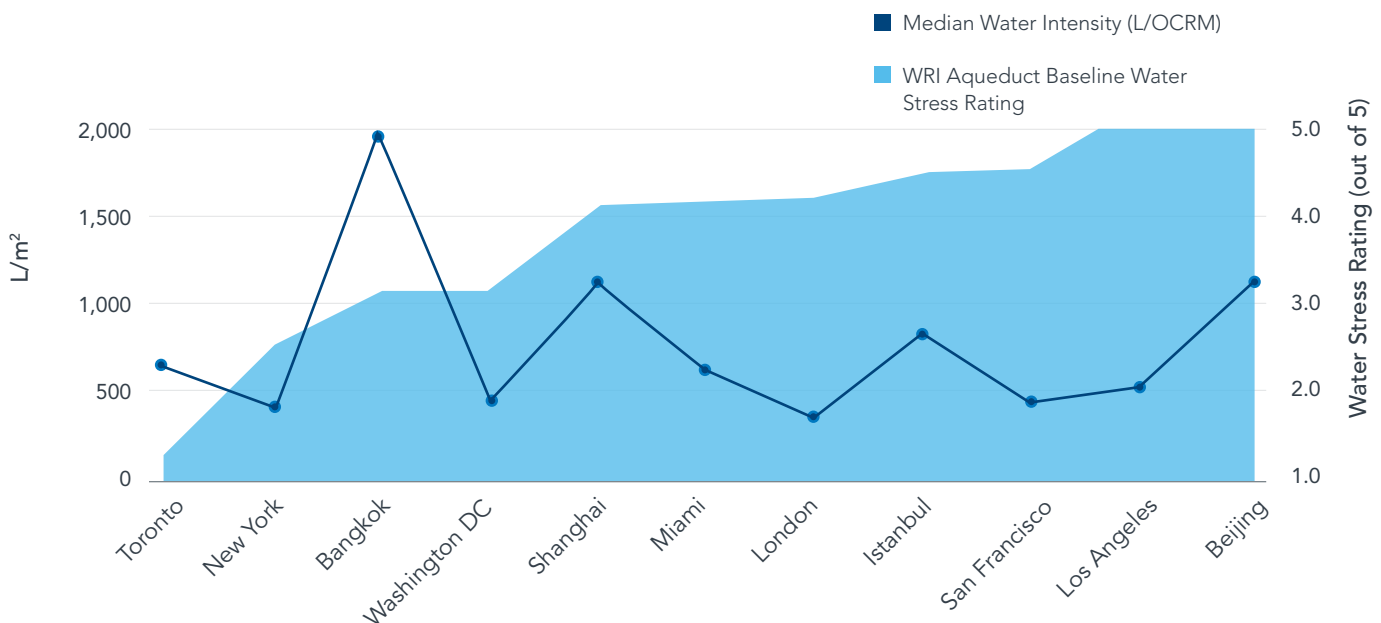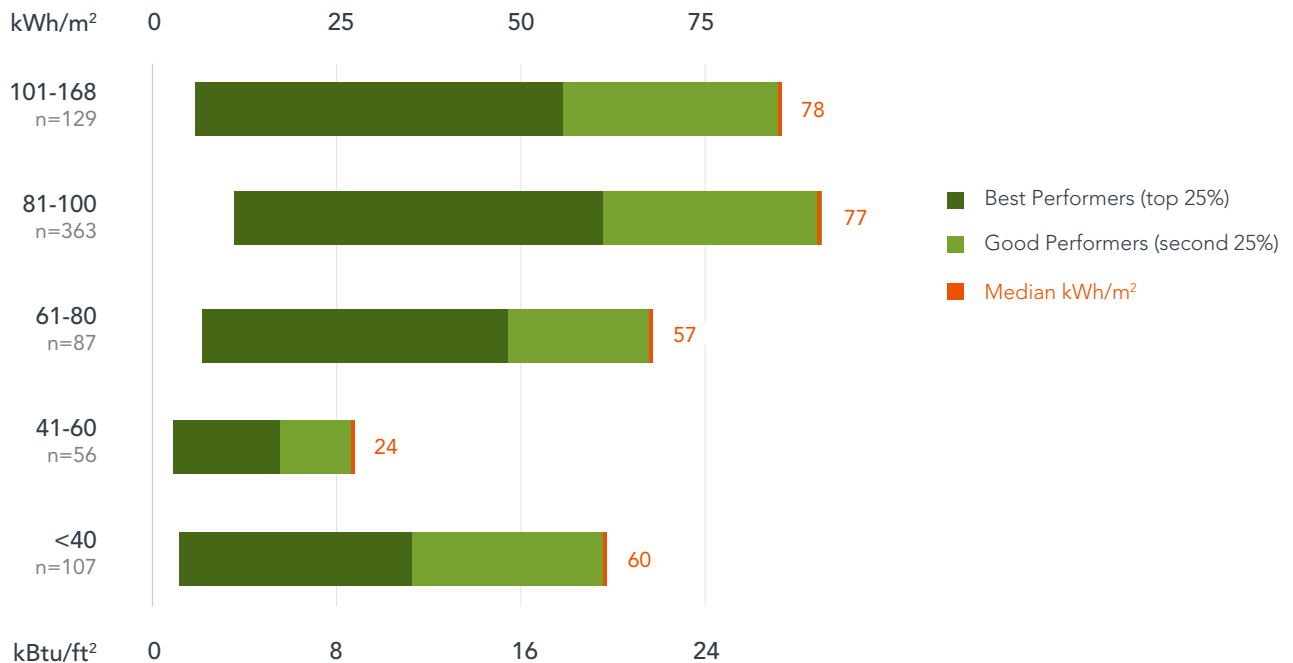
Industrial Properties

Refrigerated warehouses have a higher energy intensity due to the high amounts of cooling required for their operation, whereas self-storage facilities require less energy due to limited occupancy and limited use of lighting and heating/ventilation/air-conditioning (HVAC) equipment for the infrequent visitors.

ENERGY USE INTENSITY BY SUBTYPE

kWh/m²   0   25   50   75   100   125

Distribution Center n=428 — 55

Unrefrigerated warehouse n=436 — 73

Self storage n=360 — 22

Refrigerated warehouse n=30 — 135

kBtu/ft²   0   8   16   24   32   40

- Best Performers (top 25%)
- Good Performers (second 25%)
- Median kWh/m²

Median energy use by number of operating hours shows a general increase in energy use per square meter as the number of operating hours increases. Where reported operating hours increased this year, energy consumption also increased, which speaks to the high utilization of the industrial property sector.

ENERGY USE INTENSITY BY OPERATING HOURS

kWh/m²   0   25   50   75

101-168 n=129 — 78

81-100 n=363 — 77

61-80 n=87 — 57

41-60 n=56 — 24

<40 n=107 — 60

kBtu/ft²   0   8   16   24

- Best Performers (top 25%)
- Good Performers (second 25%)
- Median kWh/m²

Retail Properties

Enclosed air-conditioned retail centers used more energy per square meter than did all other property types because of the heating, cooling, and ventilation required for such facilities.

ENERGY USE INTENSITY BY SUBTYPE

kWh/m²	
Enclosed air conditioned n=34	124
Enclosed non-air conditioned n=12	27
Retail store n=11	34
Unenclosed shopping area n=20	29

■ Best Performers (top 25%)
■ Good Performers (second 25%)
■ Median kWh/m²
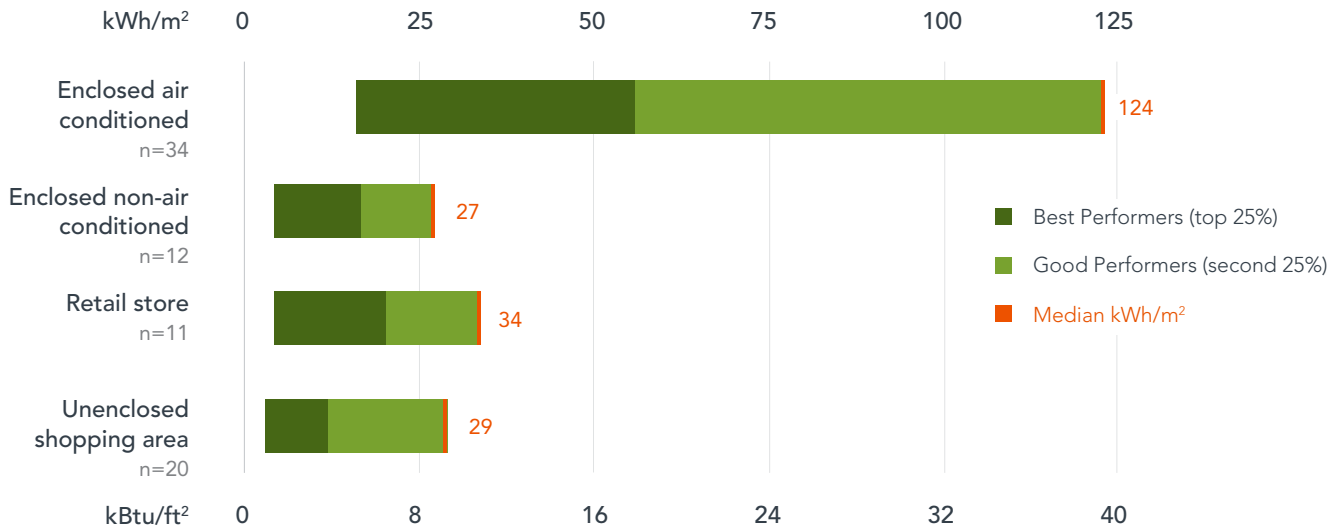
Unenclosed shopping areas use more water per square meter than all other retail subtypes. This is most likely due to the water features, such as fountains and other amenities at the properties.

WATER USE INTENSITY BY SUBTYPE

L/m²	
Enclosed air conditioned n=106	424
Enclosed non-air conditioned n=14	381
Retail store n=23	223
Unenclosed shopping area n=136	964

■ Best Performers (top 25%)
■ Good Performers (second 25%)
■ Median L/m²
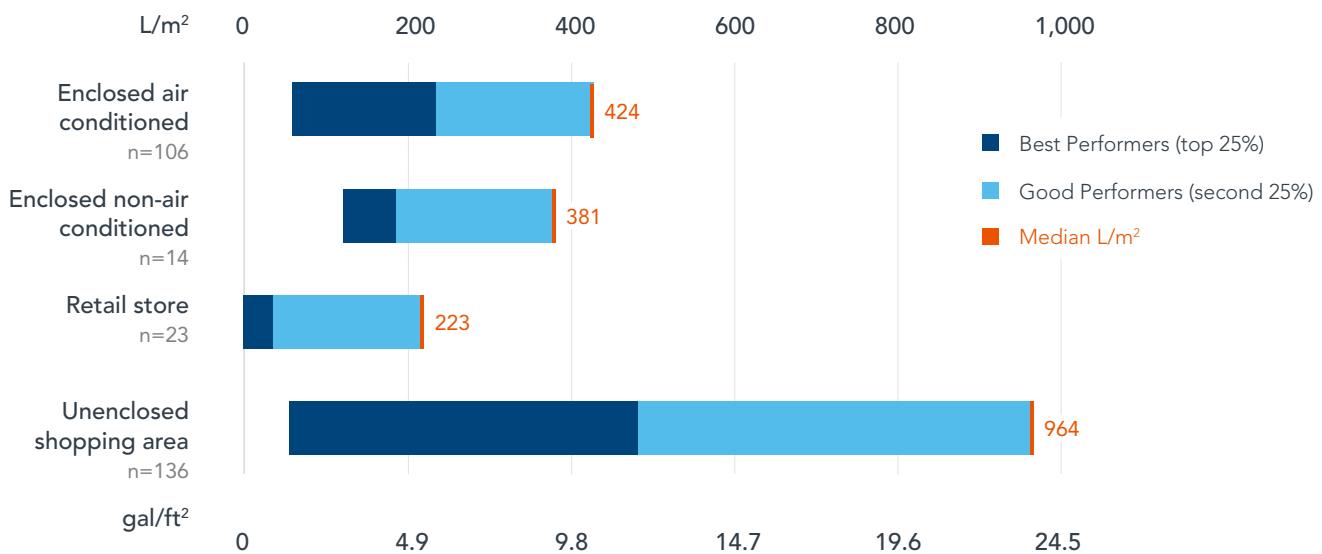
Multifamily Properties

High-rise properties use more energy per square meter than all other multifamily properties. This is likely due to the energy required to heat, cool, and ventilate interior corridors, as well as to operate elevators.

ENERGY USE INTENSITY BY SUBTYPE AND DATA COVERAGE

kWh/m² axis: 0, 25, 50, 75, 100

Garden
Whole building n=168 — 18
Common Area n=101 — 17

Mid-Rise
Whole building n=78 — 42
Common Area n=46 — 51

High-Rise
Whole building n=125 — 55
Common Area n=136 — 92

kBtu/ft² axis: 0, 8, 16, 24, 32

Legend:
Common Area
- Best Performers (top 25%)
- Good Performers (second 25%)

Whole building
- Best Performers (top 25%)
- Good Performers (second 25%)
- Median kWh/m²
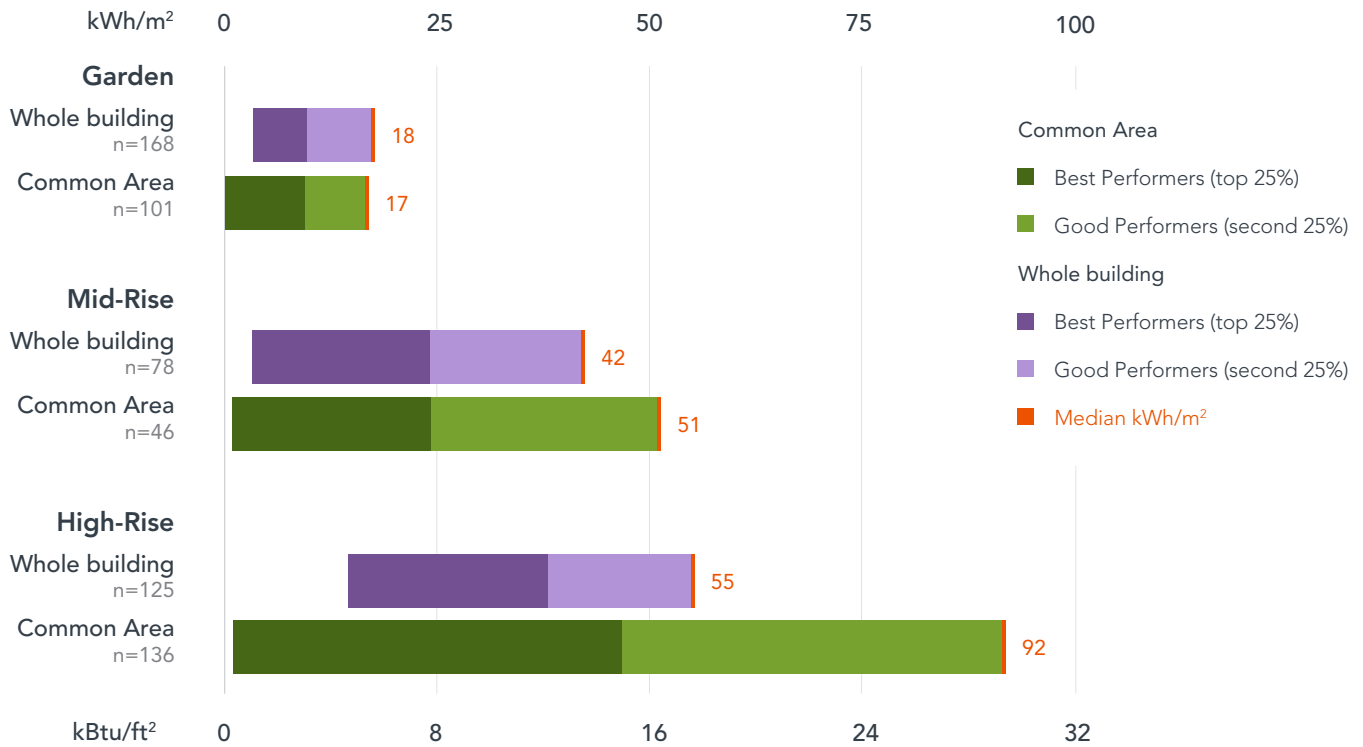
Garden properties use the most water per square meter in part because of the larger landscaped area requiring irrigation. Second in water use intensity is high-rise properties, possibly due to high occupant density.

WATER USE INTENSITY BY SUBTYPE

L/m² axis: 0, 500, 1,000, 1,500, 2,000

Garden n=213 — 1,551
High-rise n=127 — 1,386
Mid-rise n=219 — 1,248

gal/ft² axis: 0, 12, 25, 37, 49

Legend:
- Best Performers (top 25%)
- Good Performers (second 25%)
- Median L/m²
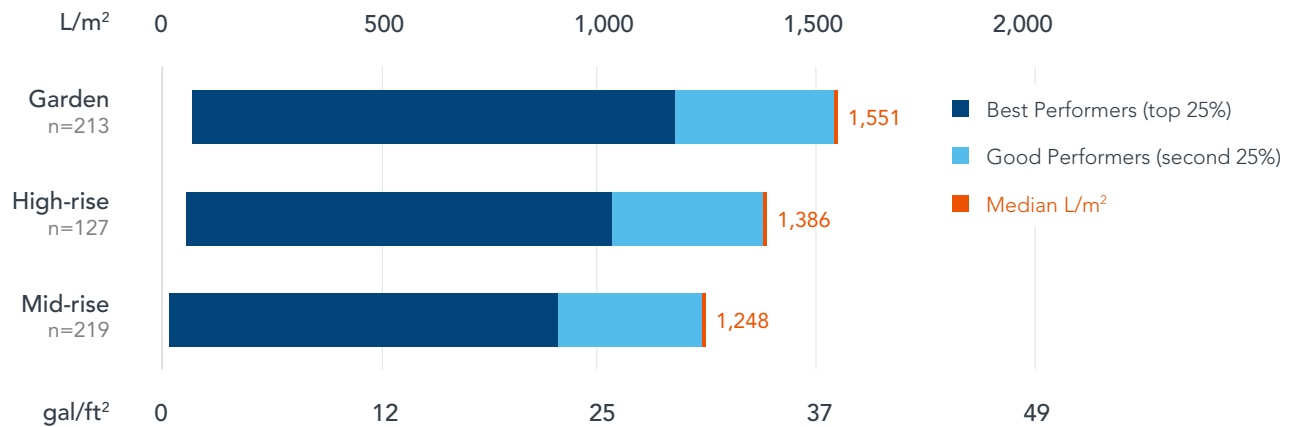
Best Practices 2015

As a group, ULI Greenprint members have achieved consistent year-over-year emissions reductions through a wide range of efficiency measures. This section highlights specific energy, water, and waste measures used by Greenprint members to achieve their impressive results this past year. Project descriptions in this section will be expanded upon in the case study section of the *ULI Greenprint Performance Report* website at uli.org/greenprintperformance.

Use Data to Drive Decisions

Data tracking, benchmarking, and analysis are the foundation of Greenprint's environmental programs. Over the past seven years, Greenprint has observed that organizations that collect and analyze building-level environmental metrics successfully identify retrofit opportunities and continuously improve performance.

PGIM REAL ESTATE

For PGIM Real Estate, a review of property performance data for 20 identically designed buildings at the Bayshore Technology Office Park in Burlingame, California, allowed property management to identify buildings that presented clear low-cost/high-return opportunities. Five buildings were selected for improvement projects. After a three-year implementation period, data tracking showed decreases of 23 percent in energy consumption, 15 percent in use of potable water, and a 26 percent in absolute waste generated.

SAN ANTONIO

The city of San Antonio, a member of the 2030 Districts Network, collected meter-level utility data on each of the city's 26 public pools and conducted energy audits at each site to determine whether it was suitable for installation of variable speed pump control technology and other hydraulic upgrades. After analyzing estimated energy and cost savings, projects were implemented at 22 pools. By continually collecting and reviewing data, the city was able to not only identify pools with the potential for meaningful returns, but also to ensure that purchased equipment was performing to the projected specifications. San Antonio's pool retrofit cut annual energy use by 707,517 kilowatt-hours—about 50 percent—reducing costs by $62,847, representing a payback period of less than one year.

Energy

- Undertake Lighting Retrofits
- Use Battery Storage
- Reevaluate Operations and Maintenance Schedule
- Install Alternative Energy Sources

Water

- Employ Xeriscaping
- Conduct Tenant Outreach
- Track and Analyze Consumption
- Install Low-Flow Fixtures

Waste

- Partner with Property Management
- Organize the Waste Room
- Leverage Technology

Best Practices | Energy

During implementation of energy efficiency upgrades, project goals include reducing operating costs, maintaining occupant comfort, and reducing emissions.

Undertake Lighting Retrofits

Lighting accounts for over 30 percent[10] of energy use in buildings, making lighting retrofits an important strategy to drive environmental performance. By 2027, widespread use of LEDs could save about 348 TWh (compared to no LED use) of electricity, equivalent to the annual electrical output of 44 large electric power plants (1,000 megawatts each), and a total savings of over $30 billion.[11]

COMMONWEALTH PARTNERS

Commonwealth Partners, when looking to improve the efficiency of an office property that already had achieved an Energy Star Portfolio Manager score of 94, determined that a lighting retrofit on more than 200 fixtures would produce significant energy savings. This project reduced annual energy costs by $35,000, representing a full return on investment within two months.

SONAE SIERRA

Sonae Sierra undertook lighting upgrades at several shopping centers as a cost-effective way to reduce electricity consumption. In a property in Portugal the upgrade consisted of substituting LED lighting for 135 fluorescent lights and installing built-in motion sensors in its technical areas.

This project reduced energy use for lighting by more than 85 percent—an annual electricity savings of 63,500 kilowatt-hours. The retrofit required a fairly low capital investment, and a full return on investment was achieved in less than one year, not including the reduced maintenance costs associated with the 15-to-20-year life of LED bulbs.

Reevaluate Operations and Maintenance Schedule

Scheduling regular operations and maintenance for unconventional times can optimize building performance for both occupant comfort and efficiency.

JONES LANG LASALLE

Jones Lang LaSalle developed a daytime cleaning program for multiple facilities previously operated under traditional nighttime cleaning programs. Night cleaning requires extending occupied hours, thereby increasing energy use through longer HVAC run times and higher lighting loads. By partnering with the vendor to shift cleaning times, building operating hours were reduced two to four hours per night, saving the occupants 1.1 million kilowatt-hours and $123,695 annually.

JAMESTOWN

Jamestown's property management team implemented quarterly night walks, or nighttime energy audits to evaluate how buildings were operating at night. Property management can better hear leaks, identify malfunctioning occupancy sensors, and notice unnecessary energy use when buildings are closed and empty of occupants. Significant energy reductions can be achieved from this no-cost strategy.

Best Practices | Energy (cont.)

Install Alternative Energy Sources

Alternative on-site energy sources reduce emissions and dependence on strained utilities. According to the U.N.-backed International Renewable Energy Agency (IRENA), global renewable energy capacity grew by 8.3 percent in 2015. The increase in installed renewable energy technologies, which was driven in part by falling construction costs, saw total worldwide capacity reach 1,985 gigawatts at the end of 2015—a 33 percent increase since 2010.[12]

PROLOGIS
Prologis is an industry leader in building property-integrated solar photovoltaic systems, adding economic and environmental value using underutilized resources like roofs. As of 2015, Prologis had a global solar footprint of over 149 megawatts, a 91 percent increase since 2011, and is currently on track to meet its goal of 200 megawatts of solar power in its portfolio by 2020.

SHERATON[13]
At the Sheraton New York Times Square, the recent design and installation of a high-efficiency steam plant allowed the facility to make the transition from less-efficient steam utilities to self-generated steam. While steam infrastructure in the United States is aging and expensive to repair, the Sheraton New York Times Square's investment of $7.6 million will result in estimated annual energy savings of $1.1 million and a 20 percent reduction in greenhouse gas emissions.

PHOENICIAN[13]
At the Phoenician in Scottsdale, Arizona, a partnership between Starwood Hotels and NRG installed 2,000 photovoltaic panels totaling 568 kilowatt of electricity demand—the equivalent of enough energy to power 90 homes. Starwood hopes that installing these panels will help it meet key performance environmental goals, including a 30 percent reduction in energy consumption by 2020.

Use Battery Storage

Intelligent energy storage combines predictive analytics and battery storage to automatically reduce electricity costs and support a more sustainable grid. Automated software controls tell batteries to charge when energy costs are low and deploy power when building consumption peaks or grid demand is high. The result is decreased energy costs and improved grid reliability, without added staff effort or effects on tenant comfort.

In 2015 companies, universities and commercial property owners installed more than 250 energy storage systems with total capacity of 64.1 megawatt-hours of power.[14]

STEM
Stem, a ULI Greenprint Innovation Partner, installed and operates intelligent energy storage at more than 500 commercial properties. Stem was recently activated at Park Place, a 2.1 million-square-foot corporate complex in Irvine, California, owned by LBA and Principal Real Estate Investors. At 1.3 megawatts, the storage system is the largest indoor deployment of its kind, and began generating net-positive cash flow from day one.

Best Practices | Water

Climate change has had a substantial impact on global weather patterns, with areas like Southeastern Brazil, Southwestern U.S., and Southeast Asia experiencing increased water scarcity and areas like Northeastern U.S. and Western Europe facing more frequent flooding from extreme weather events. These global water issues have raised awareness of the importance of responsible water use.

BENTALL KENNEDY

Bentall Kennedy has focused on responsible water consumption at properties in drought-stricken regions. In 2015, its office portfolio achieved a 14.6 percent reduction in normalized water intensity per square foot across its entire U.S. portfolio (over 11 million square feet of space). Though many techniques were used, the following best practices were most prevalent.

14.6%

reduction in normalized water intensity per square foot across Bentall Kennedy's entire U.S. portfolio

Employ Xeriscaping

Landscaping and irrigation can account for over 20 percent of water use at an office property. Use of drought-tolerant plants in landscaping reduces water use for irrigation.

Install Low-Flow Fixtures

Building owners can reduce the amount of water used by plumbing by adding aerators to faucets, installing sensors to measure consumption, and replacing inefficient fixtures.

Conduct Tenant Outreach

Building owners can engage with tenants through signage or email to promote water-efficient behaviors. Bentall Kennedy's ForeverGreen platform provides resources such as posters and newsletters with monthly environmental themes to promote collaboration among property managers and tenants.

Track and Analyze Consumption

Through daily monitoring, Greenprint members are better equipped to quickly identify leaks and spikes in water consumption.

Best Practices | Waste

Reducing waste creates both environmental and financial benefits for real estate owners. ULI Greenprint members implemented low- or no-cost projects at their properties that increased waste diversion rates while reducing costs. The first step in managing the waste flow and increasing the diversion rate was for each member to have a clear understanding of its properties' waste stream from generation to disposal. Though each member implemented different initiatives at a diverse range of property types, a number of best practices emerged.

Partner with Property Management

Obtaining property management support can help drive success when implementing waste programs.

SONAE SIERRA
Sonae Sierra improved the recycling rate at a shopping centers, labeled waste containers, and provided tenants with bins for separation of organic material.

Organize the Waste Room

Provision of clearly marked and well-organized receptacles for specific waste types is an easy way to help tenants improve their recycling rates.

COMMONWEALTH PARTNERS
At a CommonWealth Partners office property, an impressive 88 percent waste diversion rate was achieved by distributing well-marked receptacles for Styrofoam, electronics waste, and textiles, as well as by strategically locating bins for compost, recycling, and trash.

Leverage Technology

Technology and equipment can help streamline waste management processes. Investments in smart waste technology are expected to grow to $42 billion from 2014 to 2023.[15]

AVALONBAY
At two AvalonBay multifamily complexes, the purchase of a cardboard baler, compressor, and pallet jack reduced the number of scheduled weekly waste pickups by 33 percent, resulting in $14,400 in annual savings, 12 tons of cardboard recycled, and more space in trash rooms.

Guide to Report Terms and Charts

ENERGY STAR PORTFOLIO MANAGER
An interactive energy management tool that allows building owners to track and assess energy and water consumption data for a single building or across an entire portfolio.

ENERGY USE INTENSITY (EUI)
Annual energy consumption divided by gross floor area. This report uses site EUI, which is equal to energy used on site divided by floor area.

FULL-TIME EQUIVALENT (FTE)
The number of employees working an eight-hour interval that aggregates to a 40-hour week—e.g., one employee working eight hours five days per week equals one FTE, as does two employees working four hours five days per week. This does not include visitors such as clients or customers, but may include subcontractors and volunteers.

GREENHOUSE GAS (GHG) EMISSIONS
Carbon dioxide (CO_2) and other gases released into the atmosphere as a result of energy consumption at the property. Emissions are expressed in carbon dioxide equivalent (CO_2e), which normalizes global warming potential of each gas to an equivalent quantity of carbon dioxide.

LIKE FOR LIKE
A year-over-year comparison of properties that have complete data available for each year in the analysis.

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. Normalization in this report generally refers to an environmental metric divided by gross area or FTEs.

OCCUPIED ROOM
A metric used to evaluate lodging/hospitality performance. It is the number of rooms occupied over the course of the period analyzed—a figure allowing comparison of hotels that have different levels of occupancy and/or utilization.

WASTE DIVERSION
Reducing waste sent to a landfill through reduction of waste generation, recycling, reuse, or composting.

READING THE CHARTS

The data presented in charts throughout this report, unless otherwise noted, are 2015 data median values, and like-for-like comparisons.

HOW TO READ MEDIAN CHARTS
Median charts are used throughout this report to show energy and water use intensities by property subtypes. The furthest right end of the bars indicates the median of the dataset. The darker section of the bars represents the top 25 percent of the range (i.e., the best performance/lowest consumption of either energy or water). The lighter colored bars represent the second 25 percent data range. Where feasible and to support the international nature of Greenprint stakeholders, the median charts provide the data in metric and imperial units. In the example below, the energy use intensity axis labels are provided in metric on the top axis and imperial on the bottom.

29
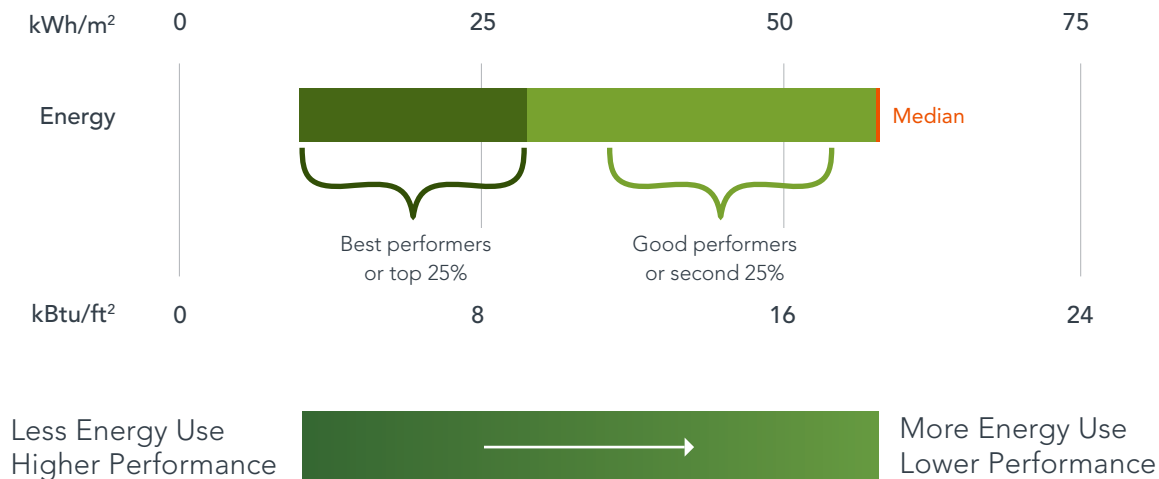
Notes

1 United Nations (2015) "Paris Agreement" http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf (accessed July 2016).

2 International Energy Agency (2013) "Transition to Sustainable Buildings: Strategies and Opportunities to 2050" http://www.iea.org/publications/freepublications/publication/Building2013_free.pdf (accessed July 2016).

3 Oanda, www.oanda.com/currency/historical-rates/.

4 U.S. Environmental Protection Agency, Greenhouse Gas Equivalencies Calculator, www.epa.gov/cleanenergy/energy-resources/calculator.html.

5 Deloitte, "Water Tight 2.0: The top trends in the global water sector," http://www2.deloitte.com/global/en/pages/energy-and-resources/articles/water-tight.html.

6 UN-Water Decade Programme on Advocacy and Communication, "A 10-Year Story: The Water for Life Decade 2005–2015 and Beyond," www.unwaterbestpractices.org/WaterforLifeENG.pdf.

7 U.S. Environmental Protection Agency, "Engage employees and other occupants," www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/engage-occupants.

8 Harvard T.H. Chan School of Public Health News, "Green office environments linked with higher cognitive function scores," www.hsph.harvard.edu/news/press-releases/green-office-environments-linked-with-higher-cognitive-function-scores/.

9 http://www.grida.no/publications/vg/waste/page/2871.aspx.

10 https://www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH6_Lighting.pdf.

11 http://energy.gov/energysaver/led-lighting.

12 The International Renewable Energy Agency, "Renewable Capacity Statistics 2016," http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Capacity_Statistics_2016.pdf.

13 The hotel case studies were provided through Greenprint's partnership with the Cornell Hotel Sustainability Benchmarking Group.

14 Cassandra Sweet, "To Cut Energy Bills, Companies Tap Battery Power," *Wall Street Journal*, September 13, 2016.

15 Heather Clancy, "$42 Billion For Smarter Waste Management," *Forbes*, September 29, 2014.

Acknowledgments