

GREENING AMERICA'S BUSIEST CONVENTION CENTER



JAVITS
CENTER®

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I.

LETTER FROM ALAN STEEL



As a convention center, the Javits Center has a clear mission—to generate new business and create employment opportunities. As a *sustainable* convention center—our role is rather broader. We seek to achieve our primary goal while reducing the impact of the building and its operations on the community’s health and environment. The Javits Center is a 30-year-old building in one of the world’s greatest cities. It has been and will be an economic engine for New York City and New York State. How do we achieve our goals while harmonizing with the local environment, the local climate and the local culture? What must we do to ensure that we provide the best possible experience for our customers while, at the same time, minimize our effect on our neighbors? At some level, this is a philosophic question. Our views on what is achievable are open to examination

and enquiry, and we do not profess to have all the answers. But we are continually searching for those answers through a practical examination of the structure of the convention center itself, a broad examination of our current operating practices and a detailed investigation into how we can influence those practices. In 2017, the Javits Center will continue our partnership with the New York City Audubon to study the biodiversity on our green roof. This data will help to evaluate how green roofs change over time and the impact the roof has on wildlife, including the migratory patterns of birds. In addition, Drexel University will continue to conduct climate studies, including evaluating the impact the roof has on storm water runoff, urban heat island effect and the insulative properties the roof has on the building. Since this is such a large roof, the far-reaching goal of this data will be to influence other green roofs in New York City and extrapolate the data to other densely populated areas throughout the United States.

Looking forward to the Javits Center’s expansion project, this 1.2 million square-foot addition will continue the sustainability mission through LEED certification. This report seeks to identify the measures by which the Javits Center has become more sustainable in recent years. It records where we have made progress, and it identifies where progress needs to be made. It outlines our thinking with regards to further development of the building. It is not, by any means, a final report. It is a report on a work in progress. Please join us on our journey.

President and CEO,
Alan Steel

II.

INTRODUCTION

The Javits Center is widely regarded as the busiest convention center in the United States. Located on Manhattan’s West Side, the six-block convention center first opened its doors in 1986 and encompasses 2.1 million square feet, of which 840,000 square feet is exhibition space.

Each year, the facility typically hosts more than 175 events, including trade shows, conventions and special events, and two million visitors, as well as nearly 40,000 exhibiting companies from around the world. With a mission to spur economic activity, the Javits Center generates up to \$1.9 billion in economic activity for New York and more than 17,500 jobs each year.

The New York State building is operated by the New York Convention Center Operating Corporation (NYCCOC), which employs 5,000 full-and part-time employees, including carpenters, cleaners, electricians, engineers, teamsters and public safety officers, as well as event coordinators, sales managers and various administrative staff.

At the Javits Center, sustainability has become a critical focus in an effort to improve the quality of life for our employees, visitors, the surrounding neighborhood and its ecosystem. Ultimately, the Javits Center is striving to be a model of sustainable practices for the exhibition industry, buildings across New York City and the surrounding community.

From 2009 to 2014, the Javits Center underwent a significant renovation that upgraded the building’s core infrastructure, including the installation of a new façade, flooring, mechanical and sustainability systems. Led by the New York City Convention Center Development Corporation, architectural firm FXFOWLE and Tishman Construction, the \$463 million renovation facilitated the development of new sustainability practices, including:

- Utilizing the 6.75 acre green roof for building insulation
- Creating an innovative means of sustainable pest management
- Updating metric tracking with New York State and New York City reporting
- Communicating with exhibitors on ways to improve sustainability
- Developing a full-building recycling program
- Facilitating a post-show donation program
- Launching a comprehensive energy management and conservation program
- Establishing a community outreach program

The benefits of the sustainability program are multifaceted. From Calendar Year 2013 to 2016, the energy conservation and management component has saved the Javits Center nearly \$2 million in energy costs. These financial savings have helped to fund new energy conservation projects throughout the property, which are expected to generate additional savings in the years to come. Beyond financial gains, the Javits Center also has offset 4,660 metric tons of carbon dioxide (CO2) through a reduction of 6,631,524kWh. Reducing our carbon footprint is essential to creating a healthier experience for our staff, our customers and our global community. As we continue to increase the building’s sustainability, so the benefits will also increase – from a financial and environmental perspective.

In March 2017, Governor Andrew M. Cuomo broke ground on the first phase of the Javits Center’s expansion project, which will add an additional 1.2 million square feet to the iconic facility. The expanded convention center will include more exhibition and meeting room space, the largest ballroom in the Northeast, an outdoor rooftop terrace and an intensive green roof. An on-site, four-level truck garage also will be constructed to house all event-related trucks delivering materials to the building, significantly improving traffic safety, reducing noise and carbon pollution and increasing the efficiency of overall operations. The intent is that the expansion will be built to the same LEED Silver standard that the existing building has achieved.

THE ROOF
RETAINS UP TO
81%
OF RAIN WATER

III.

CREATING A NEW ECOSYSTEM

Completed in 2014, the Javits Center's green roof spans 6.75 acres and is the second largest of its kind in the United States.

The roof has been instrumental in creating a haven for area wildlife, including birds, bats, bees and arthropods. The roof also has played a role in mitigating the urban heat island effect, reducing storm water runoff and insulating the building—while serving as a tool for community outreach.

Climate and ecological data collected from the Javits Center green roof is integral to understanding how it affects the operation of the building but a further goal is to aggregate this data so the impact of green roofs on city environments can be better understood. Green Roofs NYC is a consortium of scientists, students, researchers and green roof owners who are working together to do this. Javits Center is included in this group with Drexel University, New York City Audubon, New York City Parks Department, Columbia University, the New School, New York State Department of Environmental Conservation, Barnard College and Fordham University. Each group shares their research with the others in hopes of creating a citywide green roof database to evaluate the impact on building temperatures and the urban heat island effect. As a result, several ongoing projects and studies are currently in progress.

Upon the completion of its installation in 2014, New York City Audubon began studying the green roof with the intention of evaluating it as a wildlife habitat through monitoring biodiversity. Susan Elbin, PhD, Director of Conservation and Science at New York City Audubon, has spearheaded the study, along

with Dr. Alan Clark, Associate Professor of Biological Sciences at Fordham University, Dustin Partridge, PhD candidate at the Department of Biological Sciences at Fordham University, Debra Kriensky, Conservation Biologist at New York City Audubon, and Kaitlyn Parkins, Director of Education at the Lower East Side Ecology Center. Studies include arthropod sampling, a visual and acoustical bird sampling and bat monitoring using a recorder that detects bat vocalizations.

BIRDS

New York City Audubon has conducted three seasonal studies on the green roof since 2014.

Over the course of the study, New York City Audubon has spotted 26 bird species on or near the green roof, including 24 bird species that have utilized the roof and two others that have been observed flying over it. Some birds used the roof for foraging while gulls were seen using the roof for nesting. Other birds selected the roof as a spot to stop and rest during their migration. Six new species of birds utilized the roof during the 2016 monitoring season. The following pages include a brief description of some of the more commonly spotted birds on or near the roof.



BIRD SPECIES FOUND ON/NEAR GREEN ROOF

Common Name

American Crow	Fish Crow
American Goldfinch	Great Black-backed Gull
American Kestrel	Herring Gull
Barn Swallow	Mourning Dove
Brown-headed Cowbird	Northern Mockingbird
Canada Goose	Osprey
Common Grackle	Peregrine Falcon
Common Raven	Palm Warbler
Double-crested Cormorant	Ring-billed Gull
Eastern Kingbird	Rock Pigeon
Eastern Phoebe	Song Sparrow
English House Sparrow	Swamp Sparrow
European Starling	White-throated Sparrow

(New York City Audubon, Fordham University, 2015)



GULLS

Three of the four species common to New York are seen on the Javits Center green roof: the large Great Black-backed Gull, the smaller Herring Gull, and the acrobatic Ring-billed Gull. If competing for food, gulls will readily steal the meal of another bird. Look closely at their bills, size, and coloration to identify the different species. These gulls will tolerate the presence of humans and are often spotted around landfills, plowed fields and anywhere they can gather food. It is anticipated that the nesting gulls will become permanent residents of the green roof.

EUROPEAN STARLING (*Sturnus vulgaris*)

These birds were brought to North America in 1890 and are now found across the continent. Their adaptability can be partially attributed to their feeding behavior. European starlings will eat arthropods from the ground, fruit from trees or grab insects from the air.

BARN SWALLOW (*Hirundo rustica*)

These acrobatic birds can be seen flying low over the green roof, catching insects mid-air. Barn swallows feed on several different arthropods such as bees, beetles, wasps, flies, moths and ants.

AMERICAN KESTREL (*Falco sparverius*)

The American Kestrel is the smallest falcon and one of the most colorful of all raptors. These birds of prey perch on poles and railings as they hunt insects on the green roof. Kestrels prefer open areas with short ground vegetation, much like the Javits Center's green roof. They can be found in meadows, grasslands, deserts and parks. There are two kestrel nest boxes made especially for them on the roof since these birds tend to nest in cavities in urban settings.

ROCK PIGEON (*Columba livia*)

Rock Pigeons are a common sight in cities around the world—including New York City. Introduced to North America from Europe in the early 1600s, city pigeons can easily live with people and thrive on food discarded or presented by humans such as seeds, bread crumbs and fruit. One of the most spectacular skills pigeons have is their ability to "home." Homing pigeons can learn different routes back to their home from long distances.



CANADA GEESE
(*Branta canadensis*)

These familiar large birds are usually seen on fields or at lakes, ponds and other bodies of water. However, in 2015, one pair of Canada Geese was observed on the green roof building a

nest. They were likely attracted by the flat, green vegetation close to the Hudson River. Flat, grassy land is appealing to the Canada geese because they can digest grass and the expansive lawn allows the geese to have a clear view of approaching predators.

FISH CROWS (*Corvus ossifragus*)

There are two types of crows that can be found here in New York: the American Crow and the Fish Crow. Practically identical, the best way to tell them apart is by sound. The Fish Crow makes a nasal “ah-ah” call and can usually be found near water. Being close to the Hudson River, Fish Crows have been observed on the green roof.

MOURNING DOVE (*Zenaida macroura*)

Closely related to Rock Pigeons, Mourning Doves are predominantly gray birds that can often be found on the roof—either perched on a railing, a cooling unit or foraging amongst a flock of pigeons. Mourning Doves prefer to be in fields or patches of bare ground—making the green roof a perfect resting spot for them.

NORTHERN MOCKINGBIRDS
(*Mimus polyglottos*)

These slender-bodied gray birds have a reputation for singing and mimicking other birds’ songs. During the spring and summer, they sing almost endlessly, even sometimes at night and under a full moon. Unmated males sing loudest and most often from February to August. Mockingbirds will eat arthropods they find on the Javits Center roof.

HOUSE SPARROW (*Passer domesticus*)

A non-native species, the House Sparrow will displace native species from their homes. In an urban environment, the House Sparrow thrives as it forages, not only on insects and the seeds of weeds and grass on the green roof, but also on the crumbs of food left behind by humans. House sparrows are common in New York and are frequent visitors to the roof.

OSPREY (*Pandion haliaetus*)

The Osprey is noted for its mating courtship involving both the male and female flying above the nesting site together and both contributing to the building of the nest. The nests are usually open to the sky but built high and near water since their diet consists mainly of fish. The Javits Center’s proximity to the Hudson River is a prime location in the path of Ospreys as they catch their prey and take to a nearby site to eat.

BATS

Five different species of bats have been observed utilizing the green roof through the duration of the Audubon studies. These include the Big Brown, Eastern Red, Silver-Haired, Hoary and Tri-Colored Bats. Bats eat arthropods, making the green roof a prime spot for them to forage.



SILVER-HAIRED BAT (*Lasiycteris noctivagans*)

Silver-Haired Bats are among the most common bats in forested areas of the country. Though their diets vary widely, these bats feed chiefly on small, soft-bodied insects—many of which can be found on the roof.

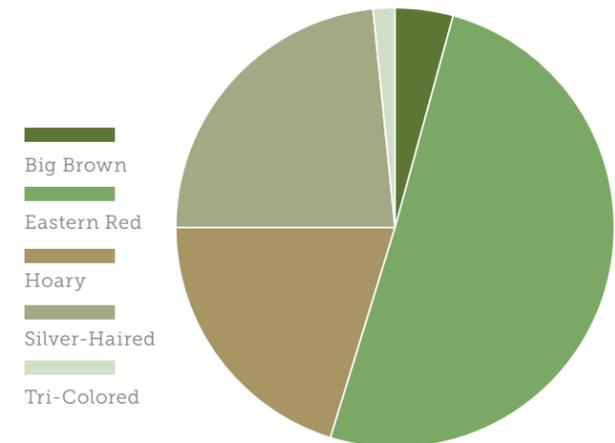
EASTERN RED BAT (*Lasiurus borealis*)

Eastern Red Bats are North America’s most abundant “tree bats.” In the summer, Eastern Red Bats are among the earliest evening fliers, typically feeding around forest edges, in clearings or around street-lights where they consume predominantly moths.

BIG BROWN BAT (*Eptesicus fuscus*)

The Big Brown Bat is found in virtually every American habitat ranging from timberline meadows to lowland deserts, though it is most abundant in deciduous forest areas. They are generalists in their foraging behavior and habitat selections, and like all insect-eating bats, Big Brown Bats contribute mightily to a healthy environment.

PROPORTION OF BATS PASSES OVER ROOF
APR 22-OCT. 31, 2014





**300,000
BEES HAVE
UTILIZED
ROOF HIVES**

TRI-COLORED BATS (*Perimyotis subflavus*)

The Tri-Colored Bat was historically one of the most common species of bats found throughout the eastern forests of the country. These bats are among the first to emerge at dusk each night, and their appearance at tree-top level indicates that they may roost in foliage or in high tree cavities and crevices.

HOARY BATS (*Lasiurus cinereus*)

Hoary Bats are one of America's largest and most widespread bat species. Humans rarely get the chance to see these bats; they are not attracted to houses or other human structures, and they stay well-hidden in foliage throughout the day.



(Hoary Bat)

HONEY BEES

In 2016, three honey bee hives were installed on the south part of the roof. Honey bees are critical to the ecosystem since they pollinate plants used as food sources.



Bees further integrate the Javits Center into the ever-evolving environment of our surrounding neighborhood. Because honey bees will travel two to three miles to forage, it is assumed that they are feeding from the green roof, as well as the nearby High Line and Hudson River Park. For 2017, the Javits Center has retained the services of an official beekeeper, New York City Beekeeping, which will look to study the benefits of the hives and establish new ways to foster and collect honey. In order to further advance the program, the Javits Center will provide bee keeping training to several of its own engineers and accompany the bee keeper on the roof for hands-on learning.

With the cooperation of an official beekeeper, 2017 will be considered the baseline year in terms of gauging hive success and production. Bees will be ordered in early February, and the hives will be selected shortly thereafter. In April, the bees will be introduced to their hives and monitored throughout the summer. If there is honey to harvest, this will likely take place in August. In September, the hives will continue to be monitored for "robbing," meaning bees stealing honey from other hives for their own. Once this period is over, the bees will begin to store food for the winter. The beekeeper and our engineers will winterize the hives in November, better ensuring their survival during the winter season.

ARTHROPODS

The number of arthropods decreased between the first and second study years. However, the Shannon diversity index and evenness reflect that the roof is becoming more stable as it matures.



Data analysis shows that the diversity and distribution of arthropods across the roof's expanse has become more stable with the age of the roof. Below is a description of the most commonly collected arthropods. Those orders with less than 50 individuals collected are not described, but their common names can be found in Table A1.

COLLEMBOLA

Collembola are small hexapods measuring 3mm to 6mm long, and they are commonly known as "Springtails." Most feed on decaying plant material, bacteria and fungi, and being decomposers, they are important for soil formation and the balance of the green roof.

THYSANOPTERA

Thysanoptera are very small hexapods measuring 0.5mm to 5mm, and they are known as "Thrips." Thysanoptera can become pests due to their ability to damage vegetation, but they are a common arthropod on New York City green roofs.

DIPTERA

Diptera is a large order generally known as "Flies." They are a very important component of the environment, with many species

A1. ARTHROPOD ORDERS/CLASSES

Order/Class	Common Name
Acari	Mites and Ticks
Phthiraptera	Lice
Aranaea	Spiders
Chilopoda	Centipedes
Collembola	Springtails
Coleoptera	Beetles
Hemiptera	True Bugs, Cicadas, Leaf Hoppers, Psyllids, Whiteflies, Aphids, Scale Insects
Orthoptera	Grasshoppers, Crickets, Katydid
Diptera	Flies
Hymenoptera	Wasps, Bees, Ants, Sawflies
Lepidoptera	Moths, Butterflies
Thysanoptera	Thrips

(New York City Audubon, Fordham University, 2015)

being pollinators and decomposers. They are a food source for other arthropods, birds and mammals.

HYMENOPTERA

Hymenoptera, which include wasps, bees, ants and sawflies, serve as a food source for birds, other arthropods and mammals. They also can have a predatory role in the arthropod community.

HEMIPTERA

Hemiptera include true bugs, cicadas, leaf hoppers, psyllids, whiteflies, aphids and scale insects. Some can be pests while others are beneficial, but all may be a food source for other animals.



ARANAEA

Aranaea are spiders. Spiders are not insects; they are in the class Arachnida, phylum Arthropoda. Spiders are predatory and feed on other arthropods.

COLEOPTERA

Coleoptera are beetles. Species feed on plants, animals or fungi. Some species are pests, while others can be beneficial to their ecosystem.

ACARI

Acari are mites and ticks. Some are scavengers, and others are plant feeders. Due to their ability to control pest populations, they are considered to be very important in integrated pest management.

ORTHOPTERA

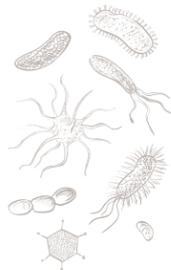
Orthoptera are grasshoppers, crickets and katydids. Post-fledgling American kestrels, a bird species found on the Javits Center roof, rely heavily on Orthoptera as a food source.

PSOCOPTERA

Psocoptera include the booklice and barklice and are considered the most primitive Hemipteroids. Some species live in the nests of birds and scavenge on feathers and skin cells; this is a commensal relationship, benefiting both the birds and the lice.

MICROBE STUDY

To provide a comprehensive, environmental assessment of the green roof, the Javits Center will partner with Barnard College in 2017 to complete a microbe study of the roof samples.



Scientists at New York City's Barnard College are looking at the microbial composition of the roof and studying the stress tolerance of the microbial soil community. They will determine if inoculation of the green roof with microbes adapted to the New York City environment and biota increases the efficacy and resiliency of the roof while reducing maintenance costs. This determination is based on the observation of Javits Center's green roof through the spring and winter seasons to examine how green roof microbial communities reanimate and respond to stress. If this study is successful, the roof will be the first of this magnitude to have such detailed studies conducted. Because of the size, this data will help scientists across the country evaluate information critical to the long-term success of green roof ecosystems.

CLIMATE AND STORMWATER ANALYSIS



The Javits Center works closely with Drexel University in Philadelphia, Pennsylvania and Cooper Union in Manhattan to measure and study the green roof's impact on storm water runoff, the building's thermographic properties and the urban heat island effect.

In order to evaluate such potential impacts, specialized equipment was installed on the green roof in 2013, including two weather stations, three lysimeters, three partial flumes, 15 soil sensors and one infrared camera. Led by Franco Montalto, PhD, P.E., Associate Professor in Drexel University's Department of Civil, Architectural and Environmental Engineering, in conjunction with Joseph C. Cataldo, P.E., Professor of Civil Engineering at Cooper Union, and Lauren Smalls-Mantry, PhD candidate at Drexel University's Department of Civil, Architectural and Environmental Engineering, members of research teams from both educational institutions retrieve and study data collected from these pieces of equipment and report results on a quarterly basis.

Data analyzed from modeling data and data retrieved from the climate stations indicate that the green roof is capable of retaining up to 7 million gallons of storm water on an annual basis, which is 81% of the mean event retention. Water retention was impacted by the soil moisture at the start of a rain event and the total amount of rainfall during the event (Drexel University, 2016). This water would otherwise be released into the local sewer system, which can lead to overflow and flooding. Evapotranspiration was highest in the summer months when the solar energy was highest despite the soil moisture being highest in the fall. Lower solar radiation will lead to lower actual evapotranspiration after a rain event (Drexel University, 2017).

Drexel University's research also indicated that the green roof is beneficial for insulation of the building. This is one of the only studies where a complete section of a roof was compared to an asphalt section of the same roof. The north side of the roof sedum was completed earlier than the south side of the roof, and as a result, this allowed Drexel University to have a more accurate basis for comparison. Using infrared technology, members of the Drexel University research team were able to demonstrate that the summer indoor surface temperature under the green roof portion was lower than under the asphalt roof during 2014, thus supporting the hypothesis that the green roof is instrumental in insulating the building. In addition, studies showed that the outdoor air temperature was lower than the south roof and the concrete sidewalk 75 feet below it. Having this data will prove to be instrumental in determining the benefits of green roofs in mitigating the urban heat island effect.



IV.

REDUCING ENERGY CONSUMPTION



ENERGY MANAGEMENT AND CONSUMPTION

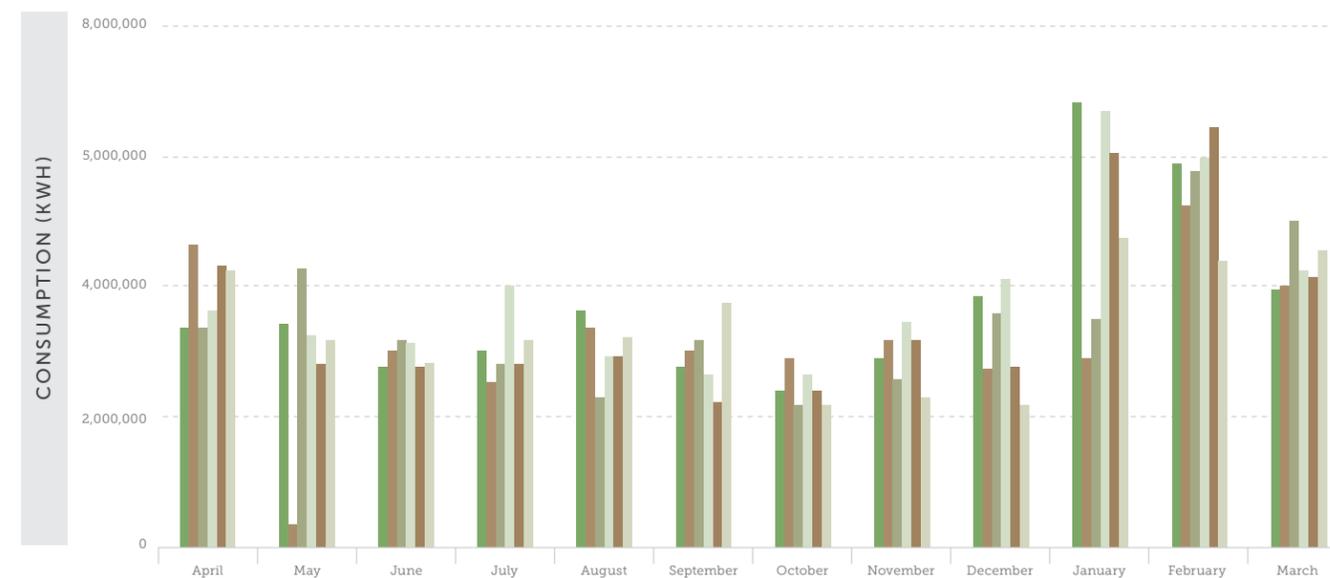


The Javits Center has a robust energy management and conservation program, one that has helped to significantly reduce energy consumption throughout the six-block structure.

From the inception of the program in 2013 to 2016, the Javits Center has reduced electric consumption by 6,631,524 kilowatts/hour (kWh). This is the equivalent of 4,660 metric tons of carbon dioxide and is comparable to emissions from the burning of 4,973,171 pounds of coal. These energy-saving initiatives have saved the Javits Center almost two million dollars since 2013.

Energy conservation measures (ECMs) were introduced through an ASHRAE II energy audit conducted in April 2015 by a third-party organization, and 16 ECMs were recognized. Of these 16 ECMs, parts of seven were implemented in 2016—in addition to projects initiated by Javits Center staff. Energy conservation measures with a longer return on investment are often funded through the energy savings of projects with a shorter return.

Ending March - 2011 Ending March - 2012 Ending March - 2013 Ending March - 2014 Ending March - 2015 Ending March - 2016



The New York Power Authority's energy dashboard, New York Energy Manager, helps the Javits Center monitor consumption. The above chart shows year over year monthly comparisons for kWh consumption. From this information, it can be determined in which months the most electricity is used, and if, over time, that consumption has decreased. Overall consumption metrics are run against different variables such as gross square footage days, heating degree days and cooling degrees days. Measurement against these variables helps to determine if changes can be made for the Javits Center to run more efficiently.

(New York Power Authority, 2017)



TABLE 1 - RECOMMENDED ENERGY AND WATER REDUCTION MEASURES (ECMS) AND OTHER IMPROVEMENTS

ECM Number	Energy Conservation Measures (ECMs)	Demand (kW)	Electric (kWh)	GHG Offset (Metric Tonnes CO2)	Simple Payback (yrs)
5.1*	Lighting Upgrade	900	3,160,000	1,035	4.1
5.2*	Lighting Controls	0	51,000	17	5.5
5.3**	Water Upgrades	0	50,000	16	5.9
5.4**	Retro-Commission Javits North RTUs	80	990,000	324	1.3
5.5**	Add / Expand DDC Controls	820	2,520,000	826	4.6
5.6**	New Sequence: VAC Occupancy Control	0	80,000	26	11.8
5.7**	Optimize RTU Sequences	600	2,750,000	901	0.1
5.8**	Stage RTUs Based on Space Demand	0	160,000	52	0.7
5.9**	Intall Fan VFD and Related Controls	1,800	2,660,000	871	5.5
5.10*	Install Pump VFD and Related Controls	53	50,000	16	9.4
5.11*	Add Cooler Controls / Evaporator ECM Motors	0	25,000	8	12.6
5.12*	High-speed Overhead Doors	39	1,020,000	334	12.1
5.13	Escalator Controls	48	300,000	98	35.2
5.14	Replace AHUs - Option 1	1,100	2,600,00	852	16.7
5.15	Replace AHUs - Option 2	2,000	3,740,000	1,225	13.7
5.16	Replace AHUs - Option 3	1,300	2,000	911	17.0
Capital Total - Base Scope		4,340	13,816,000	4,526	4.8
Capital Total - AHU Option 1		3,615	12,571,207	4,119	7.1
Capital Total - AHU Option 2		5,131	13,711,207	4,119	7.1
Capital Total - AHU Option 3		4,431	12,751,207	5,451	7.3

* In Progress

** Complete

Estimated Current Use:	44,513,153	10,000
Base Program Impact:	31%	45%
Program Impact - Option 1:	28%	41%
Program Impact - Option 2:	31%	41%
Program Impact - Option 3:	29%	55%

UPGRADING THE MECHANICAL SYSTEM



Variable Frequency Drives (VFD) are motor controllers that drive an electric motor by varying the frequency and voltage supplied to the electric motor.

These were installed on mechanical equipment throughout the building in 2012. Since 2013, an additional four VFDs were installed in Mechanical Equipment Rooms 1, 2 and 3. Mechanical systems with the drives in place run more efficiently by not running the motor at full speed unless needed. Systems without a VFD in place will run the motor at full speed constantly and not according to need. VFDs will help to increase the life span of the equipment and reduce maintenance costs.

Between 2009 and 2012, variable air volume boxes (VAV) were installed on some heating, ventilation and air conditioning (HVAC) units. Since 2013, 425 additional VAVs have been installed. When combined with the upgrades to our Building Management System (BMS), VAVs are instrumental in energy saving. With the BMS, engineers have the ability to adjust the air flow through the VAVs and a computer interface which helps regulate temperatures throughout the building for occupants' comfort. The BMS indicates temperatures in each section of every hall or room—allowing for efficiency optimization. Engineers can then service a customer's needs faster without

physically having to travel through the building. In 2016, 43 new panels were added to the BMS, and the last three will be added in 2017.

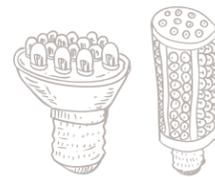
Also planned for 2017 is the switch in the BMS to BACNET technology. This is powered over Ethernet and will help the BMS operate quicker with the ability to add updated graphics and displays. In addition, BACNET will help BMS functionality by:



- Identifying equipment performance and highlighting problem areas, which often avoids emergency capital expenditures, reduces the need for repairs and extends the life cycle of fixed assets
- Identifying seasonal problem areas in order to anticipate problems before they happen
- Producing load profiles on the building, allowing energy consumption records for cost allocation such as departmental, zone or tenant billing
- Creating a detailed database of comparative analysis to look for variances, which may indicate a problem, and comparing building performance over consecutive years to identify efficiency losses

JAVITS CENTER REDUCED WASTE BY 11% FROM 2015-2016

ENERGY-EFFICIENT LIGHTING



Lighting is an integral component of any energy conservation strategy. Switching to light emitting diode fixtures (LED) from less efficient fixtures is a solution with a fast payback.

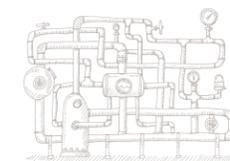
All newly renovated areas were equipped with LED lamps in 2014. The remaining parts of the building were subsequently retrofitted with more efficient fixtures. In 2015, 1,309 LED lamps were purchased to replace 45W halogen lamps in Halls 1A and 1E. This is a savings of 1,186,818 kWh annually assuming 4,380 annual hours of operation.

In 2016, LEDs were installed in 47 janitor closets, 22 electrical closets, 13 data closets and eight information technology closets. These lamps were installed with occupancy sensors, reducing the amount of "on" hours from almost 24 hours a day to one hour a day. This is a kWh savings of 28,327 kWh.

Goals for 2017 include continuing retrofits throughout the building and installing lighting controls in Halls 1A and 1E. With the addition of the controls in the two halls, it is expected that another 66,226 kWh will be saved. As older lamps burn out or fixtures require replacement, LEDs will be installed throughout public spaces and corridors.



ENERGY DASHBOARDS



Energy dashboards are one of the key tools utilized by the Javits Center to measure energy consumption.

There are two energy dashboards, New York Energy Manager (NYEM) and Enertrac. The former is offered by the New York Power Authority (NYPA) through the New York State Energy Consortium. The latter is offered through NuEnergy, a third-party vendor. NYEM collects data straight from NYPA, and the Javits Center then has the ability to run reports regarding energy consumption, billing and historical data from 2011 to the present. EnerTrac receives push data every five minutes from the same meters. The year 2011 is used because this is the baseline year for measurements against Executive Order 88 (New York Power Authority, 2017).

EnerTrac differs from NYEM in the types of information available. NuEnergy provides consumption data for electric, water and gas. This data is available via calendar year instead of fiscal year, making it easier to run variables against the consumption data. Commodity pricing is available on a daily basis so consumption can be adjusted accordingly. On an annual basis, NuEnergy provides a cost and consumption budget for all utilities on the energy dashboard.

Both dashboards provide live consumption data for electric, heating and cooling degree day reporting, cost usage and historical data. Because there is overlap in the data, having both



dashboards serves as a checks and balances system where the Javits Center can compare data input from both agencies to make sure consumption is the same from both sources.

NuEnergy also provides the Javits Center with enrollment in three separate demand response programs—the New York Independent Systems Operator (NYISO) Special Case Resource Program, the Con Edison Commercial Systems Release Program (CSR) and the Distribution Load Relief Program (DLRP). Demand response asks that customers reduce their energy consumption on days that there is a high demand on the electrical grid. The Javits Center has performed extremely well in the demand response events. During the summer of 2016 demand response period, the Javits Center reduced 4,400kWh during the event. This equates to the offset of power of more than 1% of the entire New York City load this past summer.

The Javits Center is enrolled in the demand response programs for the summer of 2017. It is the Javits Center's intent to enroll in the winter program in 2017 as well.



UTILITY AUDITING

Utility auditing monitors the accuracy of the meters and the billing. Account managers examine utility bills, and if discrepancies are indicated, recoup overcharges. Since 2015, 2% of the total bills for 2016 has been saved through utility auditing.



Staff at the Javits Center work diligently to identify and implement energy conservation measures to further reduce the building's consumption. In 2016, engineers recognized that freeze protection sensors were located outside of the event halls and would run according to the outside air temperature—thus providing an inaccurate result. Therefore, engineers relocated these sensors inside five halls and raised the set points. This allowed for the HVAC units to run more efficiently throughout the heating season, and in 2017, the remaining freeze protection sensors will be moved inside.

At the end of 2016, five Javits Center employees were trained in thermographic imaging and the use of infrared technology. This method has proved instrumental in identifying any potential issues in the electrical, mechanical or building systems and any roof moisture penetration points. By using the thermographic imaging, engineers will be able to implement preventative maintenance strategies, potentially generating savings.

Energy measurement and conservation strategies have been a source of revenue and savings for Javits Center. Since the implementation of the program in 2013, there has been a total combined savings of 35% of the 2016 total bill. The largest savings came from 2015–2016, which indicates the continued effort into energy programs are successful.



WASTE DIVERSION AND REDUCTION



In 2017, steps will be taken to improve the waste diversion rate. This includes the purchase of “smart bins” and the training of cleaners in the use and function of these bins.

Smart bins are self-compacting and include software that will alert cleaners via text message when the bin is full and ready for pick up. Implementing this technology in public areas will reduce the number of unnecessary trash pick-ups, improve the diversion rate and decrease overall waste.

In addition, the new bins will pair trash receptacles with recycling receptacles. Bins will display signage indicating what is recycling and what goes to landfill. Encouraging attendees to recycle will improve the diversion rate, bringing the building closer to the industry average. Starting in 2017, the Javits Center will aim to increase the diversion rate by 5% annually, reaching industry standards in under three years.

Although improving the diversion rate is among the 2017 goals, overall waste reduction by 10% is the priority. In 2015, 4,542 tons of waste left the Javits Center. In 2016, this number dropped to 4,047 tons—a decrease of 495 tons or an 11% reduction. The Javits Center will build on this progress by working with the sustainability programs of individual events and the event's contractors. Communication between the Javits Center and customers is key to a successful waste



diversion and reduction plan. Most of the waste leaving the building comes from the show floor during an event move-in or move-out period. Representatives from more than 20% of events at the Javits Center have requested a sustainability plan that includes waste diversion. Setting goals and plans surrounding mixed recycling and waste reduction with each of these events will help the Javits Center reach its goals, as well as raise awareness about these services during pre-event meetings with event management.

In May 2017, the New York State Office of General Services and the Rochester Institute of Technology has arranged for the Javits Center's cleaning and procurement staffs to receive training regarding New York State Executive Order 4. This executive order focuses on green purchasing and recycling. The training will focus on green cleaning and products, demonstrating how to use them and explaining what constitutes a “green” product.

The Javits Center's exclusive caterer, Centerplate, is researching the purchase of a digester to replace composting in 2017. In 2016, composted material accounted for 80.01 tons of waste. By reducing the compost from the waste stream, this will be a reduction of 2% in overall waste for the Javits Center.



JAVITS CENTER IS
DOWN 9%
 IN SOURCE EUI
 FROM THE BASELINE,
1% MORE
 THAN THE STATE AVERAGE

v.

REACHING OUT TO STAKEHOLDERS

With a robust sustainability program, the Javits Center has sought to incorporate its green-focused operations with its customers, specifically event managers and exhibitors, and share its progress with community members.

Public roof tours are provided by appointment, and interested individuals and parties can register for a tour on our website, www.javitscenter.com. Tours include discussions about building history, overall operations and the effects of sustainable building. On average, 12 tours are given each year, and in 2017, we are seeking to increase that engagement by including additional staff and resources.



JAVITS JUNIORS



Following the completion of the renovation, the Javits Center created a new educational program to engage with high school and elementary students across New York City, introducing them to the importance of the Javits Center, the exposition industry and sustainable building.

As a part of the program, various members of the Javits Center staff, including sales managers, electricians and engineers, provide tours of the main parts of the six-block structure, including the 6.75-acre green roof. In order to enhance the tour program, education signage illustrating the wildlife on the green roof will be installed in 2017. This content will give visitors a visual guide to the various wildlife utilizing the roof.

EVENT MANAGER AND EXHIBITOR OUTREACH



In order to advance our sustainability goals, the Javits Center has sought to work with our customers and discuss ways to increase the sustainability of individual events.

In 2016, 26 events submitted requests for sustainability reports, a significant increase from just three events in recent years. This change can be attributed to heightened awareness and shifting trends within the industry. Conversely, 80% of our customers do not request a sustainability report, a number we are seeking to reduce. These reports include gas, water and electric consumption from the beginning of the move-in period to the end of the move-out period for an event, as well as the waste diversion rates for that event.

In 2017, the Javits Center is expected to sub-meter all of the exhibition halls, and as a result, an even more accurate account of electric consumption will be collected and delivered to each customer who requests the information. After establishing a baseline during the first year of participation, event managers will be able to establish goals during future events, and the Javits Center will work closely with them to help achieve those goals. Event managers who have participated in the program have sought to decrease waste from the show floor and improve their diversion rates.

On an annual basis, several events at the Javits Center establish donation programs of various items offered or utilized during the particular event. The Javits Center facilitates this program through our Environmental Solutions team, which dedicates space on our loading docks during the move-out period and coordinates the removal of materials for donation. Partnerships between events and charities reduces the waste stream by thousands of tons a year and helps to improve the diversion rates of the building and individual events.

INDUSTRY REPRESENTATION



Under our sustainability program, the Javits Center has not only sought to conduct outreach in the surrounding neighborhood but across the industry as well.

As a LEED (Leader in Energy Excellence and Design) Silver Certified building, the Javits Center maintains its membership with the United States Green Building Council and has sent representatives to the annual Green Build conference. This conference helps strengthen relations with other green buildings, including other convention centers, and allows us to learn new green building practices and technologies.

The Javits Center is also represented at the Green Meetings Industry Council. Although there is crossover with the Green Build attendees, this conference is more focused on operating



VI.

A NEW PEST MANAGEMENT PROGRAM

sustainable events in a sustainable building. In February 2016, the Green Meeting Industry Council merged with the Conventions Industry Council, making the program more focused on the convention industry. Information gathered at this conference helps to better serve our customers who are looking for a sustainability program.

The Javits Center's sustainability program reaches beyond the footprint of the Javits Center. As part of the NYC & Company Sustainable Tourism Committee, the Javits Center is engaged with local retail, restaurants, hotels, museums, Broadway and transportation hubs to green visitors' trips to New York City. Employees at the Javits Center regularly volunteer for activities designed to beautify local neighborhoods and parks (photo right). This work will continue in 2017 as the committee seeks to make New York City a more sustainable destination.



and Managers Association of Greater New York awarded the Javits Center with the Pinnacle Award in 2015 for its renovation, as well as the recent energy-saving initiatives. The New York State Department of Environmental Conservation also has honored the Javits Center with an Environmental Excellence Award for its sustainable upgrades.

Not only has the physical building been recognized for sustainability measures, the Javits Center staff has been honored as well. For their contributions to increase sustainability and reduce energy consumption, Chief Engineer Rick Brown and General Electrical Forman James Yeager were invited to Albany in 2014 by the New York Power Authority where their work to reduce energy consumption was celebrated among leaders throughout the industry.

As part of the convention industry, the Javits Center participates in the Twirl Management Green Venue Report. This is an industry-wide survey of sustainability practices throughout convention centers. According to the 2016 report, which sampled 44 convention centers throughout the world, the Javits Center was among the 11% that had bees on the roof, one of 27% that had a green roof and one of 86% that held a building sustainability certification. As of 2015, Javits Center was LEED Silver Certified.

INDUSTRY RECOGNITION



The Javits Center has received a number of awards and accolades as a result of the recent renovation and its work to improve its sustainability.

In 2014, the New York City Audubon recognized the Javits Center at their Fall Roost for the bird friendly measures implemented at the building. This included the installation of more than 6,000 glass panels with energy efficient, bird friendly glass that has reduced bird deaths around the building by 90%. A year later, the Building Owners

Recognizing that harmful chemicals should be used at a minimum, the Javits Center has implemented several sustainable pest management techniques. Having open loading docks and office space in the same area poses a number of challenges with regard to insects.

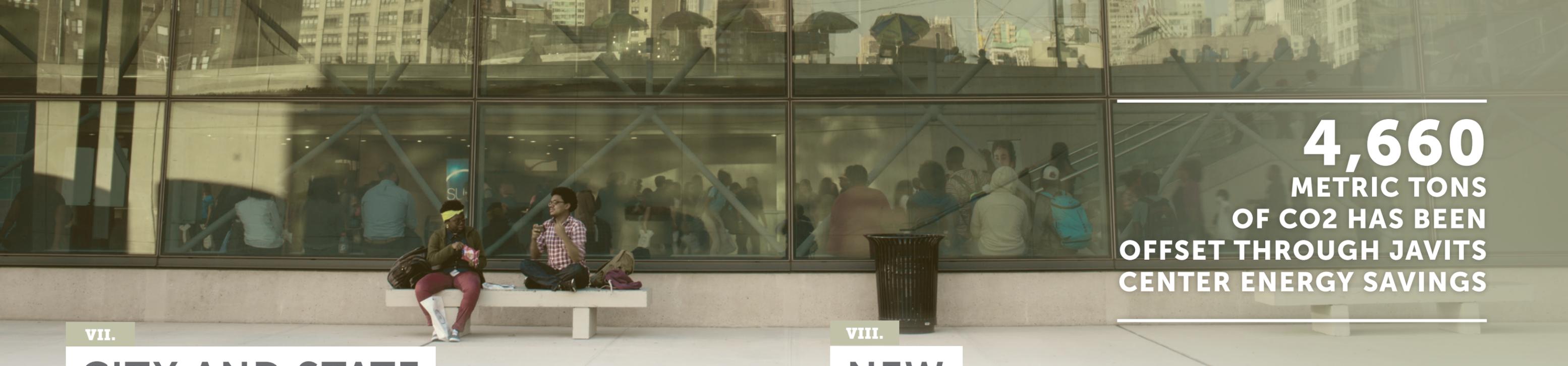


To reduce the use of chemicals, sticky traps and UV lamps are used to trap flies. For sustainable insect monitoring, the Javits Center utilizes the services of a company with an insect-sniffing dog. This helps to identify if there is a problem before using extraneous chemicals.

In 2014, the Javits Center introduced several feral cats as a sustainable method to rid our loading docks of rodents. Cats reduced the need for exterminator services, and by working with the NYC Feral Cat Alliance, volunteers were able to find cats that were accustomed to living in high-traffic areas such as the loading docks.

Upon their arrival, the cats remained in an enclosure so they knew food and shelter were available at their new home, encouraging them to stay in the general area.

This innovative program has been a great success, eliminating most rodents from the loading dock area and creating a healthier work environment for our employees, customers and business partners. In 2016, the program caught the attention of various media outlets, leading to positive coverage nationwide.



4,660
METRIC TONS
OF CO2 HAS BEEN
OFFSET THROUGH JAVITS
CENTER ENERGY SAVINGS

VII.

CITY AND STATE REPORTING

On an annual basis, the Javits Center submits reports to the State regarding the progress toward compliance with Executive Orders (EO) 4, 18 and 88.

EO 4 mandates that State agencies purchase sustainable products whenever possible, buy only post-consumer recycled paper, print all materials on recycled paper, appoint a designated employee to head a sustainability program, recycle to the fullest extent possible, provide green purchasing and green cleaning training and report metrics to the State on these issues. In November 2016, the Javits Center's Energy and Sustainability Manager participated in a State-run training for EO 4 compliance with other State sustainability managers. This was an opportunity to examine the challenges and opportunities of State agencies in dealing with compliance issues.

As per EO 4 and state laws, the Javits Center is required to recycle cardboard, aluminum, paper and plastic. The convention industry is typically a waste heavy industry, and there is a global effort to change this, which is reflected in the Green Venue report. There is an industry waste diversion average of 52%. At the end of 2016, the Javits Center diversion rate was 39%. This rate has been consistent for several years. To improve the diversion rate, several measures will be put into place.

In 2017, the Javits Center will train cleaning and purchasing staff in EO 4 procedures through the Rochester Institute of Technology and the Office of General Services. The State asks for EO 18 reporting along with EO 4 reporting. This is a simple mandate stating that State funds should not be used to purchase bottled water at meetings. The Javits Center does not use State funds for bottled water.

EO 88 indicates that all State entities should reduce source energy use intensity 20% by 2020 from 2010-2011 baselines. The Javits Center is ahead of the State as a whole. Since reporting for 2016, the Javits Center has reduced source EUI by 9% which is ahead of the State at 8%. Moving forward, the Javits Center is on track to accomplish the 20% reduction by 2020. In 2017, the Javits Center will continue with energy conservation measures and report accordingly at the end of each quarter.

The Javits Center has complied with all State reporting since 2013 and will continue to do so on an annual basis. Ultimately, the goal is to continue updating the State on progress being made and to comply fully with all mandates.

VIII.

NEW INITIATIVES

While our current energy programs have been successful and will continue in 2017, there are new programs that will also be implemented.

One of the most innovative and forward-thinking projects planned in 2017 is the Building Information and Modeling (BIM) program. BIM software is integral to showing how building systems work together and how inefficiency in one area can affect efficiency throughout the building. This software also will help manage the integration of existing facilities with the new expansion.

In 2017, exhibit halls will be sub-metered, meaning Javits Center staff will be able to monitor energy consumption in each individual hall. This will aid in determining where consumption is the highest, balancing loads and what ECMs can be implemented in these areas. In addition, it will help report consumption to the event managers who are using these halls. Currently, consumption data is estimated based on the number of days an event is in the building and the gross square footage rented for that time. By sub-metering halls, customers will have more accurate data, allowing for more detailed energy reduction plans.

The Javits Center also will have the cooling towers water metered. These meters will help monitor the amount of water evaporated opposed to the amount released into the sewer system. The Javits Center will receive credits for the water evaporated from the cooling towers.

The Javits Center also will undertake an energy audit of the Mechanical Equipment Rooms (MER). There are seven MER rooms that house the air conditioning units, as well as mechanical and electrical equipment pertaining to these units, such as pumps and electric panels. An energy audit of these rooms is expected to identify potential issues, and once corrected, the machines will run more efficiently and use less energy.

In 2016, two engineers, an electrician and two members of the Facilities and Operations Department were trained in Level 1 Thermography. Knowing how to use infrared technology will help locate potential problems in equipment, improving preventative maintenance procedures. Typically, when there is a hot spot in mechanical equipment, the machinery is not running efficiently, and this can lead to larger issues which result in having to replace entire systems. Periodic monitoring of mechanical equipment in 2017 will be part of the building's overall maintenance program. Currently, a third-party vendor is hired to scan electrical equipment for issues on an annual basis. By providing electricians with more infrared and thermography training, the goal is to move this scanning program internally as a part of the preventative maintenance program.

IX.

CONCLUSION

Although its primary mission as a convention center is to generate economic activity, the Javits Center has expanded that mission to become a leader in sustainability.

Home to the second largest green roof in the United States, the Javits Center has risen above its purpose to help improve the quality of life for those who live and work around the building. By creating a wildlife habitat, reducing the carbon footprint through comprehensive energy management, expanding partnerships with local universities, scientists and students and increasing employee and attendee outreach, the convention center seeks to become an inspiration to other convention centers and buildings throughout New York and the country. Through our energy-saving programs, the Javits Center reduced its carbon footprint by 4,713,704 tonnes of CO₂e (carbon dioxide equivalent) from 2015 to 2016—a remarkable achievement by any standard.

Our focus on sustainability is also being incorporated into the Javits Center's expansion project, which broke ground in March 2017. Thanks to Governor Andrew M. Cuomo and his team, the New York Convention Center Development Corporation and all of our project partners, this expansion will add 1.2 million square feet to the facility. The project will include more exhibition and meeting room space, a state-of-the-art ballroom, a rooftop terrace and a four-level, on-site truck garage that will improve area traffic flow and pedestrian safety.

In addition to implementing sustainable measures for the project's LEED certification, the creation of a new truck garage will create a more efficient move-in and move-out process, reducing the amount of greenhouse gas being released into the atmosphere. All lighting specified for the expansion will be LED and controlled by smart technology—allowing for precise show-lighting scenarios while using the least amount of energy.

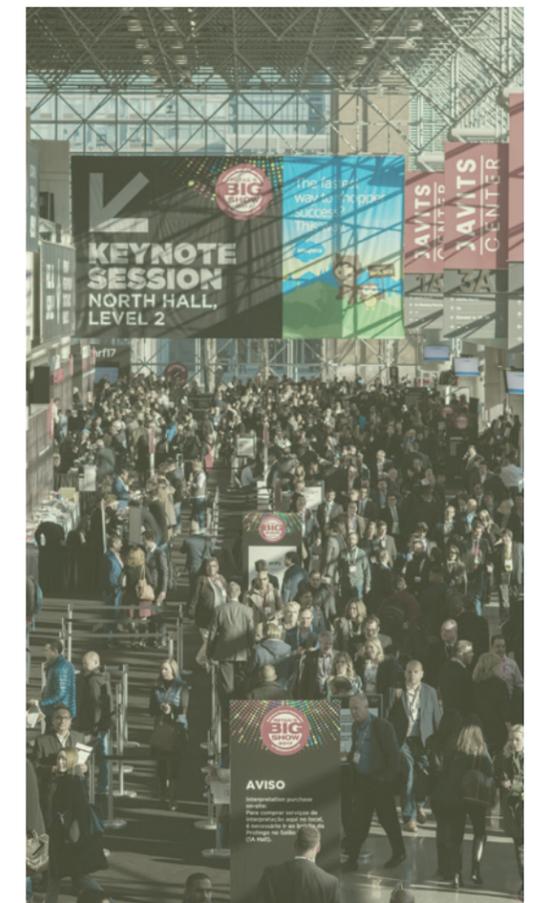
The expansion project also will include the construction of an intensive green roof, which allows for a deeper root structure of the plants than the existing roof. Having an extensive and intensive green roof on the same site will prove valuable to the research community as the differing habitats attract different species of flora and fauna. It also will allow research teams to monitor a new roof from inception through maturity, much like the studies being done on the existing green roof.

Another major component of a sustainable building is accessibility through public transportation, and the opening of a new subway station on West 34th Street near 11th Avenue has made the Javits Center more accessible than ever. Ridership on the 7 Line continues to grow on a daily basis, and some event managers have even reduced the number of rented buses for their events as a result of the new underground transportation. With new bus routes, nearby ferry service and a CitiBike station accommodating a rapidly changing West Side neighborhood, the Javits Center is now connected to all parts of New York City like never before. And with a growing sustainability program, we hope to enhance the community's quality of life like never before—creating a healthier environment for our employees, customers and neighbors.

THANKS

The ongoing success of the Javits Center's sustainability program would not be possible without the creation of partnerships with many organizations that have provided invaluable insight and support to our program. We would like to thank the following organizations:

- ➔ New York City Audubon
- ➔ Drexel University
- ➔ Fordham University
- ➔ Barnard College
- ➔ Columbia University
- ➔ New York City Bee Keeping
- ➔ Friends of the High Line
- ➔ New York City Feral Cat Alliance
- ➔ NYC & Company's Sustainable Tourism Committee
- ➔ United States Green Building Council
- ➔ Green Meetings Industry Council
- ➔ New York City Department of Parks and Recreation
- ➔ New York State Department of Environmental Conservation
- ➔ Friends of Hudson River Park Trust



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GLOSSARY

ACRONYM	WHAT IT STANDS FOR	WHAT IT MEANS
BIM	Building Information and Modeling	Software that gives a comprehensive visual, showing how mechanical and electrical systems interact with each other
BMS	Building Management System	Computer-based control system for mechanical and electrical equipment
CSRP	Commercial Systems Release Program	Demand response program from Con Edison which provides a 21 hour window of notice for an event. Financial incentives are paid out based on performance beyond pledged amount of enrolled kWh
DLRP	Distribution Load Relief Program	A Con Edison program under which customers receive two hours notice before a demand response event and are paid out according to the tier of consumption
ECM	Energy Conservation Measure	A project aimed at reducing electrical consumption
EO 4	Executive Order 4	Executive Order issued by the New York State Governor mandating that State entities apply green purchasing practices, green cleaning practices and recycling to their facilities
EO 88	Executive Order 88	Executive Order issued by the New York State Governor mandating that State entities reduce their source energy use intensity 20% by the year 2020 using Fiscal Year 2010-2011 as a baseline
EUI	Energy Use Intensity	A way to measure a building's energy usage by its square footage per year
HVAC	Heating Ventilation and Air Conditioning	Heating and Air Conditioning units
kWh	kilowatts per hour	Unit of measurement for electrical consumption
LED	Light Emitting Diode	Two-lead semi-conductor light source
LEED	Leader in Energy Efficiency and Design	A third party certification from the United States Green Building Council indicating sustainable buildings
MER	Mechanical Equipment Room	Rooms that house air conditioning units and the associated equipment
NYEM	New York Energy Manager	Energy dashboard provided by NYPA
NYISO	New York Independent Systems Operator	Manages the flow of electricity from the electrical grid throughout New York State
NYPA	New York Power Authority	Agency that supplies electric power
SCR	Special Case Resource	Demand response program managed by NYISO that provides financial incentives for electricity consumers larger than 100 kW to reduce their electricity use or operate on-site generation during periods of electricity reserve shortage
VAV BOX	Variable Air Volume	Heating Ventilation and Cooling equipment that vary airflow at a constant temperature
VFD	Variable Frequency Drive	Adjustable speed drive placed on equipment to modulate motor speed



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