

## OVERVIEW OF NEW YORK CITY'S HOLISTIC ENERGY MANAGEMENT PROGRAM

Michael Bobker, Director of the Building Performance Lab, City University of New York

Michael Dipple, Director of Operations and Maintenance, NYC Department of Citywide Administrative Services

Pat Impollonia, Director of the Office of Energy Conservation, NYC Department of Citywide Administrative Services

Ellen Ryan, Director of the Office of Agency Support and Special Projects, NYC Department of Citywide Administrative Services

Rino Trovato, Program Manager, New York Power Authority

Todd Wood, Project Manager, The Benham Companies, LLC - An SAIC Company

### ABSTRACT

This paper summarizes the City of New York's Greenhouse Gas Reduction initiative. This initiative was launched in October 2007 in response to the Mayor's Executive Order that required City agencies to reduce greenhouse gas emissions from buildings and other operations 30% by 2017. The paper focuses on the development and implementation of a comprehensive greenhouse gas reduction program for a municipal government that encompasses over 27 operating agencies and 4,000 facilities. It concludes with a review of lessons learned.

### OVERVIEW OF *PlaNYC*, NEW YORK CITY'S LONG-TERM SUSTAINABILITY PLAN

On April 22, 2007, Mayor Michael R. Bloomberg released *PlaNYC: A Greener, Greater New York (PlaNYC)*, a comprehensive, long-term sustainability plan to enhance the physical environment of New York City. *PlaNYC* contains ten goals focused on land use, infrastructure, transportation, energy, air and water quality, and climate change, as well as 127 initiatives to achieve the goals. One of these initiatives instructs the City to lead by example and reduce energy consumption and greenhouse gas (GHG) emissions from government buildings and operations 30% by 2017 ("30 x 17").

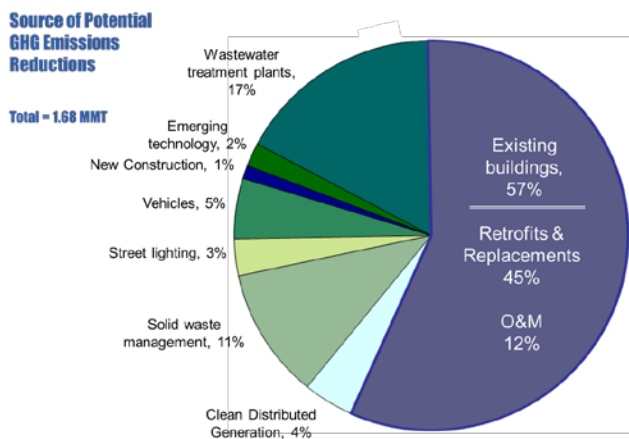
Following the release of *PlaNYC*, Mayor Bloomberg signed Executive Order 109, which formalized the organizational infrastructure to lead the 30 x 17 effort; created the Energy Conservation Steering Committee to oversee and manage initiatives; provided funding for the plan in the amount of approximately \$100 million a year for the remaining nine years of the program; and charged

the Steering Committee with creating a long-term action plan to achieve the reduction goal.

### *The Long-Term Plan to Reduce Energy Consumption and Greenhouse Gas Emissions of Municipal Buildings and Operations (The Long-Term Plan)*

Achieving 30 x 17 requires a 30% reduction from Fiscal Year 2006 emissions of 3.8 million metric tons. Accounting for a business-as-usual 1.2% annual increase in GHG emissions through 2017, the cumulative emissions reduction goal was set at 1.68 million metric tons, a 42% reduction from expected 2017 emissions if no action were taken.

With the goal established, the Energy Conservation Steering Committee, in partnership with the energy consulting firms AECOM Technology Corp. and KEMA Inc., assessed energy use and potential emissions reductions in City assets. The City and its consultants conducted extensive research, interviews, and analysis of reduction opportunities, including the relative cost effectiveness of each measure. Based on this analysis, the Steering Committee released *The Long-Term Plan* in July 2008, which provides a roadmap of the best emissions opportunities to achieve the 1.68 million metric ton reduction, as shown in Figure 1.



**FIGURE 1. POTENTIAL FOR ANNUAL GREENHOUSE GAS REDUCTIONS BY PROJECT GROUP**  
**TOTAL = 1.68 MILLION METRIC TONS (MT) PER YEAR**

The analysis found that retrofits and replacements of inefficient equipment in existing buildings offered the largest opportunity for cost-effective energy savings, accounting for 45% of the potential savings. Improvements to operations and maintenance procedures at existing buildings was another large reduction category, with potential savings of 12%. Altogether, energy efficiency projects in existing buildings offer over half of the reduction opportunities.

### **TURNING THE LONG-TERM PLAN INTO AN IMPLEMENTATION STRATEGY**

After the Steering Committee released *The Long-Term Plan*, it became clear that implementation responsibility needed to be assigned to a single organization to support a more integrated approach to energy management. The Deputy Mayor for Operations assigned this responsibility to the Department of Citywide Administrative Services (DCAS) and created the Division of Energy Management (DEM) with a new Deputy Commissioner reporting directly to DCAS's Commissioner and to the Steering Committee. DCAS DEM was built upon the Office of Energy Conservation, which was already responsible for paying the City's energy bills and managing energy conservation retrofit projects.

### **DATA DRIVEN APPROACH TO IMPLEMENTATION**

In order to turn the *Long-Term Plan* into an actionable, comprehensive strategy, DEM needed to improve access to good data, develop a strategy for deeper emissions reductions, and stretch its dollars as much as possible to achieve the 30 x 17 goal. Without reliable data, it would be difficult to identify the best opportunities for efficiency gains. Additionally, it was clear that the previous strategy

of targeting only "low-hanging fruit" for quick paybacks, such as lighting retrofits, would not allow the city to achieve the full 30% reduction. As a result, DEM is targeting energy conservation measures and City facilities with the most opportunity for energy efficiency improvement in order to achieve maximum savings with limited resources.

To support a data driven approach to comprehensive efficiency efforts, DCAS DEM conducted energy benchmarking on all City-owned buildings over 10,000 square feet. Benchmarking is a process of analyzing the total electricity, natural gas, steam, and fuel oil consumption of a building and adjusting for other factors, such as building type, year of construction, number of workers, gross square footage, and other operational data, to determine how efficiently a building is operating. Following the Department of Education's effort to benchmark public schools, DEM benchmarked all remaining City facilities larger than 10,000 square feet using the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager online benchmarking tool. In total, the City benchmarked almost 3,000 buildings, including libraries, police stations, firehouses, courthouses, cultural institutions, government offices, and health, community, and family centers. The benchmarking information allows the City to understand the relative efficiencies of its facilities, prioritize buildings for comprehensive energy efficiency investments, and monitor building performance over time. In December 2009, the City's benchmarking initiative was codified into law with the passage of Local Law 84, a component of the landmark legislation known as the Greener, Greater Buildings Plan, which requires that the City benchmark its buildings annually by May 1<sup>st</sup> of each year. DEM completed its initial benchmarking of City facilities over 10,000 square feet on April 30, 2010.

To further provide the data needs of 30 x 17, in early 2011 the City expects to deploy the Sustainability Energy and Property Tracking System (SEPTS), a database that will centrally collect, track, and report on information concerning the energy and environmental performance of City government buildings and capital projects. SEPTS will act as a one-stop shop for all City building data and analysis information and will provide a single home to the building and sustainability datasets currently housed in agencies across the City. Among other functions, the program automates the benchmarking process and enables DCAS DEM to better select and track its retrofit projects.

### **CAPITAL PROJECT PLANNING PROCESS**

Using the benchmarking data, DEM has launched a capital planning process to create achievable agency action plans to put the City on track to meet the 30 x 17 goal. This

planning effort allows DEM to prioritize its audit and retrofit activities based on Energy Star scores and Energy Usage Index (EUI) ratings. The capital planning process is also helping ensure that City buildings meet the requirements of Local Law 87, which requires energy audits on all buildings over 50,000 square feet with Energy Star scores less than 75 or EUI ratings below a certain threshold (depending on building type). Local Law 87 also requires the City to implement any retro-commissioning and retrofit recommendations with a payback of seven or fewer years.

As part of the capital planning process, DEM is also working with City agencies to refine the benchmarking data to ensure an accurate reflection of building energy performance. In parallel with this effort, DEM is cross-referencing the priority audit and retrofit lists with each agency's long-term capital plans. This allows DEM to take advantage of opportunities to include energy-efficient improvements in previously planned agency construction projects. It also provides insight into agencies' capital priorities and any potential change of use, demolition, or decommissioning of their facilities.

The benchmarking and capital planning efforts inform several other major DEM initiatives beyond the audit and retrofit program, including advanced metering and monitoring activities, training and outreach efforts, and operations and maintenance programs. By providing a clear picture of City facilities through this data driven approach, DEM's initiatives can target buildings with the greatest potential for savings.

#### **CONDUCTING ENERGY AUDITS AND IMPLEMENTING RECOMMENDED ENERGY CONSERVATION MEASURES**

One of DEM's central initiatives is the audit and retrofit program, which identifies and implements Energy Conservation Measures (ECMs) to improve energy efficiency and reduce greenhouse gas emissions. Retrofit projects include motor and drive replacements, building envelope improvements, heating and cooling system improvements, high efficiency lighting upgrades, and installation of lighting control technologies such as sensors. DEM prioritizes facilities for audits on a fiscal year basis using benchmarking scores and agency coordination through the capital planning process. The City aims to ramp up to approximately 70 energy audits per year. It has completed 42 audits to date, with an additional 64 audits in the pipeline.

Audits follow ASHRAE Level II guidelines and are followed by more targeted Feasibility Studies when necessary. An audit includes an assessment of electrical, HVAC, and building envelope systems to find all

opportunities for cost-effective retrofits and clean energy installations. During the audit process, an auditor surveys a building and analyzes the energy usage of each building system. The auditor then identifies feasible energy retrofits and assesses associated annual energy savings, implementation cost, and simple payback for each measure. DEM uses these recommendations to determine which retrofit projects will be implemented. Local Law 87 also requires an analysis of retro-commissioning opportunities; DEM will include this analysis as the audit process moves forward.

#### **Implementing Recommended Energy Conservation Measures**

Upon completion of a building audit, DEM reviews recommended ECMs and signs off on projects with an overall simple payback of 15 years or less. If an agency wants to complete capital projects with higher paybacks, DCAS offers to share the cost (up to the 15 year payback) as an incentive for the agency to move forward with system replacements. Once the ECMs have been finalized, DEM's contractors at the New York Power Authority (NYPA) begin project design and implementation. DEM works with NYPA project managers and their contractors throughout the retrofit implementation phase.

The City has worked to verify that these energy efficiency retrofit projects are achieving estimated savings. An analysis of energy efficiency lighting retrofit projects completed between 2003 and 2007 showed that the City's investments in 97 retrofits at 142 locations have resulted in annual energy cost savings of almost \$4 million. The study also found that these savings has been maintained years after the projects were completed. On average, the lighting projects resulted in a 22.7% reduction in energy use per building for a total reduction of 39,203 MWh annually. In addition, SEPTS, the City's new data tracking system, will continuously measure and verify the energy and financial savings from the 30 x 17 investments.

#### **Audits and Retrofits at City Buildings Smaller than 50,000 square feet**

Due to the increasing scale of the City's retrofit program, DCAS DEM is exploring options to expand its retrofit implementation vehicles beyond NYPA. DEM is presently developing a Small Buildings Energy Survey and Retrofit Program that will analyze the smaller building portfolio, identify project groups that achieve the greatest efficiencies and lowest costs, and conduct and/or oversee energy surveys. DCAS plans to release a Request for Proposals (RFP) to Energy Services Companies for energy audit and retrofit services in over 800 City-owned buildings smaller than 50,000 square feet, based on industry feedback to the Request for Information that was released earlier this year. The program aims to expand the

City's contracting capacity, streamline project implementation, and achieve better value by grouping facilities by type and geographical proximity. The RFP for this program will be released in early 2011.

### **REDUCING ENERGY CONSUMPTION THROUGH IMPROVED OPERATIONS & MAINTENANCE AND ADVANCED METERING & MONITORING**

Efficiency gains through improved building operations and maintenance (O&M) are expected to contribute 12% to the 30 x 17 goal. O&M consists of preventative maintenance (PM) and energy efficient operating practices, such as turning off lights and using appropriate thermostat settings. These measures offer the best energy savings paybacks as they often consist of no- and low-cost measures. Following a study and year-long pilot, DCAS DEM created a comprehensive Energy Efficiency Operations and Maintenance Plan to increase the energy efficient operations and maintenance of New York City's municipal buildings. The O&M Plan is currently being rolled out to the City's seven largest agencies.

### **ENERGY EFFICIENCY OPERATIONS & MAINTENANCE (EEOM) PLAN**

The implementation of the Energy Efficiency Operations & Maintenance (EEOM) plan will reduce Citywide energy usage in buildings by 10-15%, resulting in savings of at least \$51 million per year and GHG emission reductions of 185,000 metric tons annually. The EEOM plan will enhance the City's energy management program by focusing on three key objectives:

- (1) Repair, maintain, and operate existing equipment as efficiently as possible;
- (2) Increase training and outreach to improve skills and raise energy awareness; and
- (3) Provide management oversight, accountability, and transparency.

To keep equipment operating at optimal efficiency, the City must reevaluate current operating standards in every facility and implement a PM program. A good PM program includes the performance of regular maintenance tasks and record keeping of scheduled work. DCAS DEM is providing agencies with the tools to better organize and monitor the operations of their facilities, including reviews of equipment scheduling, building set points, temperature standards, and other easily adjusted, no- and low-cost operating parameters to reduce energy use. DEM will also support PM through Citywide requirements contracts. The City's PM work will focus on pneumatic control system repairs, pipe insulation, boiler efficiency testing and tune up, steam trap and radiator valve repair, lighting sensors, and weatherization measures.

While the EEOM plan was created for the complexity and diversity of New York City, it can be modeled and scaled to fit public or private organizations of any size.

### **EEOM Tools**

In addition to providing access to contracts and managing those contracts, DCAS DEM is offering agencies a comprehensive set of tools to support the repair, maintenance, and efficient operations of building systems. The tools, detailed below, include an Operations & Maintenance Planning Application, Computerized Maintenance Management Systems (CMMS), and an Energy Enterprise Metering System (EEMS).

### **Operations & Maintenance Planning Application Tool**

The Operations & Maintenance Planning Application is a planning tool that enables users to document, organize, and analyze information related to building systems and energy usage. DCAS built this temporary tool with the help of consultants and the staff of 16 O&M pilot facilities in two agencies. Once fully rolled out, SEPTS, CMMS, and EMMS will replace this application. The current tool allows facility staff to:

- Centrally maintain building system and staffing information;
- Track meter reading data by utility;
- Set target energy usage and track performance;
- Maintain preventative maintenance logs; and
- Assess preventative maintenance resource needs (materials and labor).

The tool also aids facilities in tracking and predicting energy consumption against benchmarks and goals. It provides charts and graphs so that facility operators and agencies will be better informed decision makers. Each agency is responsible for tracking and reporting its own data to DCAS DEM.

### **Computerized Maintenance Management Systems (CMMS)**

To better schedule, implement, and track PM efforts, the City is enhancing its use of Computerized Maintenance Management Systems (CMMS). Currently, most agencies use these systems to respond to demand maintenance and emergencies, but not for scheduled PM. The EEOM plan calls for the deployment of new CMMS programs or the upgrade of current CMMS units to ensure that PM efforts become standard practice. This is a significant departure from existing deferred maintenance paradigms.

### **Energy Enterprise Metering System (EEMS)**

The deployment of a Citywide enterprise monitoring system will enable the City to measure energy consumption in real time and deliver energy information to

end users. The City is currently developing an Energy Enterprise Metering System (EEMS) that includes electric meters and sub-meters to form the basis of a smart metering system. Unlike most enterprise metering systems, it will also include steam, fuel oil, and natural gas meters and the network devices to support them. The system will utilize enterprise software to measure real-time consumption and predict future trends, enabling the application of algorithms to automatically control peak load demand and energy consumption. The system's historical functions will record baseline information and perform analysis comparing historical, actual, and predicted usage.

EEMS will measure energy consumption at the facility and agency levels and will collect and push data to enterprise software through installed meters or utility databases. The enterprise software will deliver the information to various operating and management levels as required throughout the agency. EEMS will work with other interoperable control networks to automatically control energy consuming equipment through existing facility-based Energy Management Control Systems (EMCS).

EEMS will make real-time data available to inform decisions about building O&M. Similarly, this system will help building managers participating in peak load management programs to make operational adjustments to meet their energy reduction targets. Additionally, implementation of these systems will help prepare the City for better integration of emerging Smart Grid and other related technologies.

**MANAGEMENT OVERSIGHT, ACCOUNTABILITY AND TRANSPARENCY**

The EEOM plan's success depends on the full support of facility management staff to fully integrate enhanced O&M into an agency's responsibilities. To further this effort, DCAS DEM is funding Energy Managers to create agency-specific EEOM plans in each of the largest agencies. The tools described above will help these Energy Managers target buildings as they implement their specialized EEOM plans. The addition of Energy Managers, combined with the ability to measure energy consumption, will allow agencies to become accountable and take proactive steps to reduce energy use.

**Reduction Targets and Financial Incentives**

Given these tools to implement various no-cost and low-cost energy conservation measures, agencies should be able to achieve energy savings immediately. To ensure that agencies are following their EEOM plans, agencies will be required to meet energy efficiency targets beyond savings from any PlaNYC-funded energy retrofits. Table 1 shows

the agency reduction targets, which have been developed based on the scheduled rollout of EEOM tools.

**TABLE 1. REDUCTION TARGETS WITH FY 2010 BASE YEAR**

<b>Fiscal Year</b>	<b>Reduction Target</b>
2012	5%
2013	7%
2014	10%
2015	12%
2016	14%
2017	15%

The baseline measurement year is FY 2010 (data is weather normalized). All source energy will be converted to BTUs/square foot. Each fiscal year's consumption will be compared to the baseline, as shown above.

As an additional incentive for improved energy management, agencies that meet the yearly reduction targets are eligible for funding. DCAS will assess progress at the end of each fiscal year and allocate funding to agencies that meet their milestones and reduction targets. This policy allows agencies to benefit from the energy cost savings that they helped achieve. The City is also currently discussing linking the incentive directly to the City's energy budget. If this occurs, the additional funding will not be necessary.

The benchmarking data and other indicators will give a detailed picture of an agency's success in achieving energy use targets and reduction mandates. Energy Managers are required to report the following metrics to DCAS DEM:

- Number and percentage of agency facilities utilizing EEOM plan tools;
- Progress against training goals;
- Total agency energy usage per square foot;
- Facility and agency energy usage by energy type; and
- Facility and agency energy usage by energy type per square foot.

**Recognition for Success in Energy Conservation**

No plan can be successful without the cooperation of the people who occupy and operate facilities on a daily basis. Under the EEOM plan, agencies can nominate building tenants, including teachers, students, administrative support staff, and any others who have been instrumental in reducing energy consumption in their facility. Through

recognition certificates and awards ceremonies, the City will recognize the efforts and accomplishments of individuals, facilities, and agencies that have been especially successful.

### **INCREASE OUTREACH AND TRAINING TO RAISE AWARENESS AND IMPROVE SKILLS**

Skill development and increased awareness through training and outreach are an essential component of improved building operations. Energy conservation success depends not only on facility engineers, but also on management, building occupants and support services staff such as security and housekeeping.

#### **Outreach**

Energy awareness among building occupants is vital to reaching the 30 x 17 goal. The City is developing materials and programs that aim to increase energy awareness among City employees who are not normally involved with building operations. These efforts are ongoing throughout the year with season-specific materials. For example, at the start of the heating and cooling seasons, educational flyers are distributed to each agency. The flyers outline the City's heating and cooling guidelines, including standard thermostat settings, and offer suggestions to help building occupants stay comfortable in varying temperatures (i.e. raising or lowering window blinds, clearing papers off vents or ducts). Other outreach activities to date have included a recognition ceremony for O&M pilot participants, monthly energy updates to agency energy teams, distribution of light switch stickers that remind occupants to turn off lights, the formation of the City's first Green Team at the Manhattan Municipal Building to combine the sustainability efforts of the building's multiple tenants, and posters to encourage building tenant involvement in agencies that participate in Peak Load Management.

#### **Training**

The City's O&M program recognizes the building operator as a key player in sustaining energy savings over the long term. This role requires that the operator master new concepts and skills. DCAS DEM, working with the City University of New York (CUNY), has helped set a standard for the level of training required for energy efficient operations.

DCAS DEM and CUNY currently offer four training programs to help City employees develop the skills necessary for successful building operations and maintenance: Overview of Energy Management, Building Operator Certification - Level 1, Building Operator Certification - Level 2, and the Certified Energy Manager Program. To date, over 300 City employees have enrolled in these courses. DCAS DEM and CUNY are also working

with individual agencies to develop agency-specific strategies to train a higher number of City building operators. Additionally, DCAS DEM is looking into union-sponsored training opportunities where appropriate.

### **FOCUS ON BUILDING OPERATOR CERTIFICATION TRAINING**

The primary learning objectives of the BOC courses are documentation of existing systems, team-based improvement processes, and observation, measurement, and interpretation of performance. Building operators learn to optimize systems based on an understanding of the energy use of major HVAC and electrical systems and components. To help operators more effectively report and analyze energy consumption data and audit reports, the courses emphasize quantitative skills, which enable staff to recognize equipment or system performance that is below specification and other issues that waste energy.

The CUNY Building Performance Lab is a local representative of the national Building Operator Certification (BOC) program and oversees the development of training content and instruction of BOC courses at the Citywide Training Center. The City's BOC courses are aligned with national BOC content and project requirements and are offered in two semester-length courses, each with 45 hours of class contact. The BOC Level 1 course is offered one day a week (six classroom hours) over a 15 week period. An additional 45-hour course meets the BOC Level 2 requirements.

BOC classroom sessions combine lecture, discussion, and in-class exercises. The City has found that the most effective teaching tool is a series of hands-on projects that students are required to carry out in their own facilities. The initial project emphasizes system recognition and documentation through the development of system schematics and site sketches. These schematics facilitate the observation and notation of existing operating conditions. Hand-held tools and data loggers are made available for student use. The second project requires students to characterize an operating condition, quantify its energy use compared to whole-facility energy use, and identify and quantify an upgrade of the existing condition. The Level 2 program continues this process with a more formal testing framework, using resources like the [PECI Functional Test Guide](#).

#### **Customizing for Specific Audiences**

The BOC's broad learning objectives are common to operators across all agencies. However, to make training most effective for each individual agency, the curriculum is customized for agency-specific needs. For example, Department of Sanitation facilities are dominated by vehicle garages, so the course identifies special needs in

managing the high ventilation rates of such facilities and the particular difficulties of heating and lighting high-bay spaces. The Police and Fire departments operate numerous smaller facilities that operate 24/7, many of which lack a skilled operator. In these agencies, centralized managers need to understand how to move towards remote monitoring of building system conditions. Finally, school custodial engineers are asked to prepare an annual facilities plan with the school principal, with an emphasis on communication with building occupants. CUNY and DCAS, in partnership with the Department of Education (DOE), are also opening a specialized training center for DOE's over 1,000 school custodial engineers.

### **Conforming to a National Certification**

The BOC training sequence qualifies individuals with suitable experience for the national Building Operator Certification Level 1, with additional training required for Level 2 certification. Certifications help to standardize expectations about workforce skills. Building sector programs and legislation are increasingly specifying necessary skill levels for functions like energy audits and retro-commissioning via certifications. The City's use of a certification-based training mechanism supports this trend and can serve as an example to the private sector of how to incorporate energy management into the building operator's role. Certification also provides a means of recognition for those completing training and provides a way to set standards for employee advancement.

The certification system supports ongoing learning and enrichment via continuing education requirements. The City's BOC program is developing a Maintenance of Certification mechanism that will provide for specific skills focus along with feedback from operators about what they have been able to accomplish and to help them in planning ongoing initiatives.

### **Evaluation**

Beyond traditional course evaluations, each BOC class also conducts pre- and post-evaluations of operator attitudes and self-evaluation of student skills. These have generally revealed increasing levels of awareness, knowledge, and skills among operators around O&M energy management issues and practices. Course evaluation to date has shown a strongly positive response to the curriculum. This rigorous program has had a high completion rate, at least in part due to institutional support such as scheduling training classes during work hours and providing individual encouragement and recognition by superiors.

The City is developing plans for a more formal training evaluation process to gain insight into knowledge transfer, the application of new knowledge through changes in on-the-job behavior, and the ultimate outcomes of resulting

changes in energy consumption. This evaluation will make use of opportunities to designate formal comparison groups among City operators across the training cycle. This will help to more accurately gauge the training program's impact on energy savings in relation to the City's other energy efficiency programs. In addition, this evaluation will help to better identify other factors that enable or hinder the transfer of training to on-the-job behavior change, including support from supervisors, rewards for improved performance, work culture, issues with procedures and paperwork, and political concerns.

### **CONCLUSION: LESSONS LEARNED**

The City of New York has made significant progress towards meeting the ambitious GHG reduction goals set in *PlaNYC*. Throughout implementation of its data driven and integrated approach to energy management, DCAS DEM has learned what is necessary to execute an aggressive program over a large portfolio. DCAS is incorporating these lessons to strengthen efforts to reduce emissions 30% by 2017 and to continuously improve energy performance.

First, DCAS DEM has learned that setting an aggressive yet achievable goal is essential to catalyzing the entire City into action. The fact that 30 x 17 is an ambitious target pushes staff to work extremely hard to squeeze every last pound of emissions reductions out of each program. The target has also driven the City to create a comprehensive strategy that identifies all cost effective energy reduction opportunities, rather than relying solely on one program to achieve this goal.

Second, the importance of good data cannot be overemphasized. Data is the foundation of the City's energy efficiency strategy, and is critical to the ability to compare and track the performance of the City's buildings, prioritize projects that yield the most impact, inform facility staff and tenants how their actions impact energy usage, and reward those who take initiative.

Additionally, strong leadership and support from the top is crucial when motivating multiple agencies with varying priorities to actively participate in any large-scale program. Mayor Bloomberg demonstrated his commitment to this program when he secured its funding stream, which is essential to motivate ongoing agency participation and to ensure the implementation of 30 x 17 initiatives.

In addition to high-level support, there must be a strong and clear organizational infrastructure to manage implementation and to make sure that the various components of the program are integrated and coordinated. DCAS DEM, as the lead on the 30 x 17 program, is responsible for this management and is held accountable for progress towards the goal. This allows the City to

reduce duplicative and conflicting implementation activities and ensures streamlined, effective emissions reduction efforts.

Finally, it is essential to engage, educate, and motivate everyone from top managerial staff to building operators to building tenants. With this collaboration, DCAS DEM is confident that the City will achieve the 30 x 17 goal. New York City's experience can inform similar efforts and replicate results in cities throughout the United States.

## **AUTHOR BIOS**

### **Michael Bobker**

Michael Bobker is the Director of the Building Performance Lab at the City University of New York (CUNY), Institute for Urban Systems. Prior to joining CUNY in 2006, Mr. Bobker had over twenty five years of experience as a practitioner analyzing, developing, designing, and implementing energy projects in NYC buildings. His present research and application interests focus on IT-based systems for enhanced building performance, the introduction of new technologies into building operations, and the interface of building operators to building automation systems. He is a Certified Energy Manager through the Association of Energy Engineers, is active in ASHRAE on building performance issues, holds a Masters in Energy Management from the NY Institute for Technology, and a Masters in Sociology and Anthropology from Oberlin College.

### **Michael Dipple**

Michael Dipple is the Director of Operations & Maintenance for New York City's Division of Energy Management. He holds a B.S. degree from Texas A&M and a MBA from the University of Central Florida. He is a Certified Energy Manager, LEED-AP and State of Florida licensed contractor.

Mr. Dipple brings over 30 years of extensive knowledge of facilities design, administration, construction, operations and maintenance from many diverse projects in the public, education and corporate sectors. He is responsible for citywide efforts in the areas of Operations & Maintenance, Computerized Maintenance Management Systems and automated energy Metering and Monitoring Systems.

Prior to coming to New York, Michael served as Associate Director of Physical Plant at Georgia Southern University where his numerous innovative projects included the development and implementation of a network-based, campus wide energy metering system that enabled a proactive energy management culture. Mr. Dipple also successfully managed a Building Management Systems contracting business for many years and installed one of

the first networked energy management systems for the U.S. Air Force in the 1980's. Mr. Dipple is a contributing author to the Association of Energy Engineers *Handbook of Energy Management*.

### **Pat Impollonia**

Pat Impollonia began implementing and promoting Energy Conservation and Renewable Energy technology in 1977, working as an Energy Specialist for Nassau County's Bureau of Energy Resources. In 1988 he took a position as the Chief Physical Plant Administrator for the New York State's University College at Old Westbury, and moved to Columbia University in 2000, administering and managing the University's Energy Master Plan and Conservation Program.

Mr. Impollonia is presently the Director of Energy Conservation Planning and Programs for New York City's Division of Energy Management. He has a Master's Degree in Energy Management, is a Certified Energy Manager and a long time Board Member and Past President of NYC's Chapter of the Association of Energy Engineers.

### **Ellen Ryan**

Ellen Ryan is the Director of Agency Support and Special Projects for New York City's Division of Energy Management. Prior to joining the City in 2002, Ms. Ryan spent 11 years with the City of San Jose, CA's Environmental Services Department as deputy director. During those 11 years she was involved with developing the City's Clean Bay Strategy for reducing wastewater flows into San Francisco Bay, and led the department's solid waste management program.

Ms. Ryan has a degree in English from West Virginia University and is past president of the U.S. Conference of Mayor's Municipal Waste Management Association.

### **Rino Trovato**

Rino Trovato has over 20 years of experience in the fields of engineering, energy efficiency & conservation services, project and construction management, resource management, administration and marketing. As an Associate Engineer, Mr. Trovato surveyed and designed several projects for NYPA's High Efficiency Lighting Program (HELP). As project manager in the SENY Group, he was responsible for overseeing the implementation of the ENCORE Program throughout the New York City and Westchester County area, including commercial, industrial, institutional, educational and public transportation facilities. Since 1994, as Manager of the Design and Implementation Group, Mr. Trovato has led a team of project managers, engineers and support staff to complete more than 400 turn-key energy conservation



projects in over 600 facilities totaling over \$350 million in construction costs. The technologies applied include, but are not limited to, energy efficient lighting, occupancy and day-lighting sensors, LED lighting, premium efficiency motors, variable speed drives, building management systems, steam traps, compressed air systems, solar thermal systems, HVAC systems & controls, building envelopes (windows, insulation, roofing and window film), Nitrogen tire inflation, remote/wireless switching controls and other emerging/developing technologies.

Mr. Trovato has a Bachelor Degree in Electrical Engineering from Pratt Institute and an Associate's Degree in Engineering Technology from CUNY – College of Staten Island. He is a member of the Association of Energy Engineers, a Certified Energy Manager (CEM), a Certified Energy Purchaser (CEP) and a Certified Business Energy Professional (CBEP).

Mr. Trovato has been part of the New York Power Authority Energy team for over 20 years, serving in several capacities in different areas and departments. He is currently serving as Program Manager of the Design and Implementation Group in the Project Management & Development Group of the Energy Services and Technology Department. He has served as Manager of this Group for over 16 years. During this time he has been responsible for the expansion of services to our customers and the growth of the group from three individuals to the current staff of 22 and the additional resources of seven consulting firms.

### **Todd Wood**

Since joining Benham/SAIC in 1997, Todd Wood performed services as Project Manager, Technical Lead, Project Engineer, and Systems Engineer for various projects. His qualifications include a B.S. in Electrical Engineering and Computer Engineering from Michigan State University. He is a certified Project Management Professional (PMP) that specializes in Energy Management Systems including functional, preliminary, and final design and implementation. Mr. Wood has also earned the Certified Energy Manager (CEM®) credential which has become widely accepted and used as a measure of professional accomplishment within the energy management field.

Mr. Wood's diversified experience includes Energy Performance Contracting services at 100+ state facilities in Fulton, Missouri. He was also essential in the General Motors Real Time Commissioning and Energy Savings Project Implementation (E\$PI) programs along with a 10 year Performance Contracting project for Ford Motor Company. He has lead numerous energy efficiency audit programs for various clients, most notably at over 25 bases for the United State Air Force.

Most recently Mr. Wood has worked with New York City to determine the proper methods, infrastructure and architectures that should be used to implement an advanced metering solution for city owned facilities.