

The Siemens logo is displayed in a white rectangular box in the top left corner of the page. The word "SIEMENS" is written in a bold, teal, sans-serif font.

SIEMENS

The background of the entire page is a photograph of a city skyline at dusk. The sky is a deep blue, and the buildings are illuminated with warm yellow and orange lights. The buildings vary in height and architectural style, with some featuring prominent spires and others being more modern skyscrapers.

Smarter Neighborhoods Smarter City

Solutions for a More Sustainable New York—*Today*

www.usa.siemens.com/sustainablecities

An aerial photograph of New York City, showing a dense urban landscape with numerous skyscrapers and buildings. The city extends to the water's edge, where a large bridge is visible in the distance. The sky is clear, and the overall scene is bathed in a warm, golden light, suggesting late afternoon or early morning. The text is overlaid on the center of the image.

“New York is the city where the
future comes to rehearse...”

— Ed Koch

Third Mayoral Inaugural Address

“It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.”

— Charles Darwin



For the first time in human history, more than half of the global population lives in urban areas, a percentage which may increase to 70% by 2050. This trend is most pronounced in the developing world. Shanghai’s population has almost doubled in little more than a decade, from less than 13 million residents in 2000 to an estimated 23 million today, and by 2050 it is expected to exceed 50 million—twice as many as the New York/New Jersey/Connecticut metropolitan region. Every day some 50,000 people move into India’s cities, the equivalent of a new Staten Island every one and a half weeks.

In the New York metropolitan region, we are expected to grow by 3 million residents by 2030, even as we confront the need to reduce our carbon footprint. We are a growing metropolis in need of better transit, cleaner energy, more efficient public services and smarter schools. Fortunately, we are living in a period of rapid urbanization just as innovation, information technology and smart systems are fundamentally changing how we build and manage cities and metropolitan regions. It is this relationship between growth and sustainability that will determine what cities become in the 21st century.

New York City and the tri-state metropolitan region have an extraordinary history of innovation to build on, including investments in infrastructure and human capital. Great plans range from the

Commissioners’ Plan of 1811 to the nation’s first zoning ordinance in 1916; from Frederick Law Olmsted and Calvert Vaux’s Greensward Plan of 1858 to Mayor Bloomberg’s PlaNYC 2030. Transformative infrastructure projects include opening the Erie Canal in 1825 to create new trading routes and damming the Croton River in 1842 to provide clean drinking water.

To remain a global region, we must expand on this tradition and learn to adapt to new challenges. Charles Darwin’s insight applies just as much to communities as to species. Cities must be able to adapt to changing environments—whether this means a warmer planet, or higher cost of electricity, or tighter budgets. To paraphrase Darwin, it is not the richest, strongest, or most beautiful cities that will thrive and survive in the urban century. It is the smartest ones that can best adapt to change. And just as DNA is the means that species use to adapt to changing environments, so then information technologies and sustainability are the instruments for building the cities of the 21st century.

Fortunately, as Siemens demonstrates in this compelling report, we have the tools and applications to make our neighborhoods and cities more resilient, more efficient, and more livable—today.

— **Thomas K. Wright**
Executive Director
Regional Plan Association



The New York City Neighborhood

Smarter Schools

City schools can become smarter with performance contracting, intelligent lighting and smart building controls. More energy-efficient and better-lit schools mean healthier learning environments for New York City's students.

Performance Contracting

Guaranteed performance-based solutions allow capital improvements to be funded through energy savings, often eliminating capital outlays and reducing operating costs.

Smart Building Controls

Optimized power usage balances comfort in commercial, residential and public buildings with cost savings and environmental protection.

Demand Response

New York's power grid sometimes struggles to match supply with demand. Neighborhoods actively linked to utilities via demand response are able to temporarily cut back power consumption thereby reducing the possibility of an outage while still maintaining reliability, comfort and security.

Intelligent Lighting

Smart lighting knows whether building spaces are being used or not—saving energy when rooms are empty. On sunny days, smart lighting can adjust to maintain optimal light levels, thereby saving energy.

LED Lighting

Efficient LED lighting enables better use of neighborhood streets and parks at night while improving security, reducing energy consumption and substantially cutting costs.

Rooftop Solar

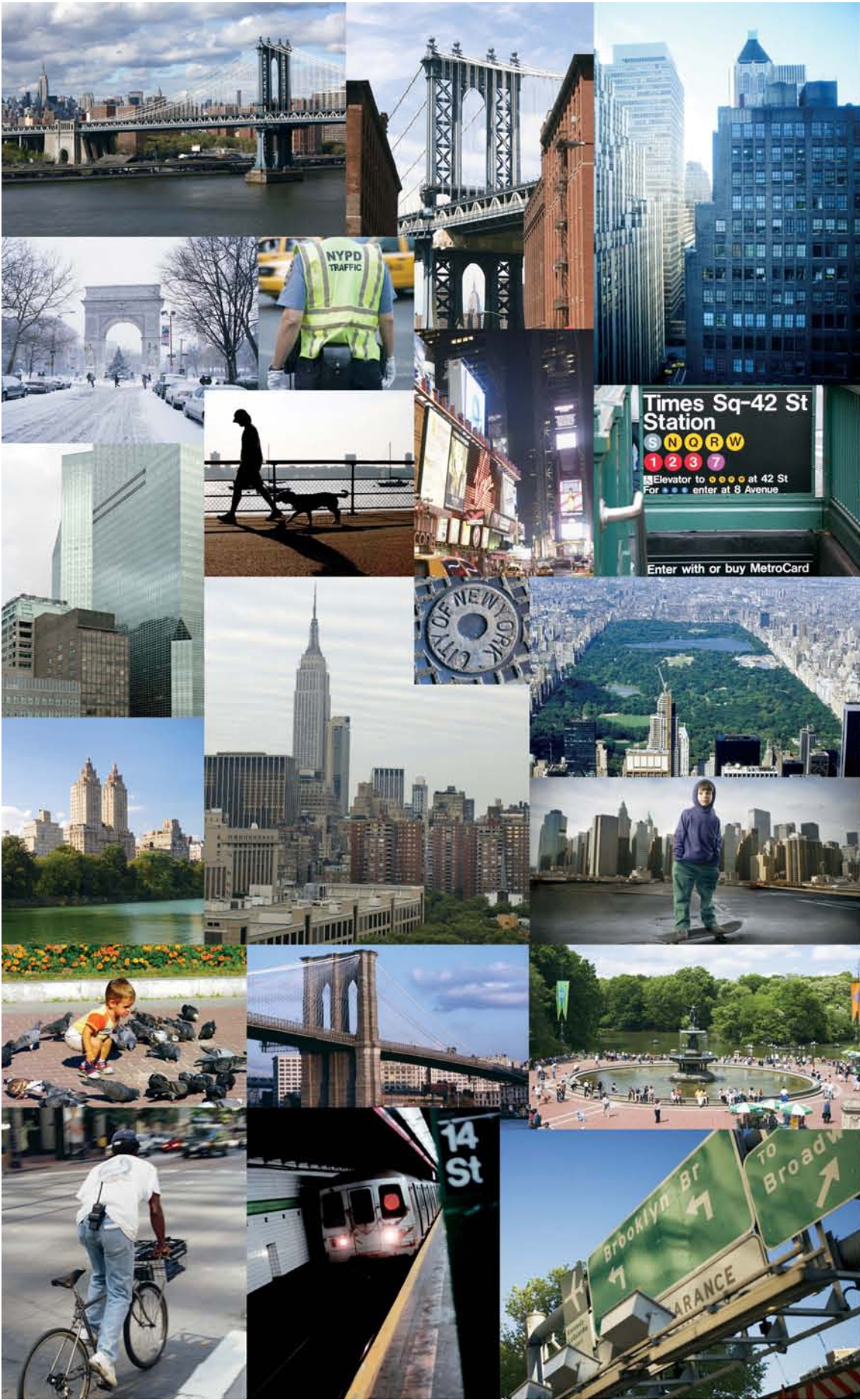
Owners can tap into the power of the sun and reduce their neighborhoods' energy consumption by installing these solutions on city rooftops.

Electric-Car Infrastructure

As more electric vehicles hit the road, charging stations connected to the power grid will increase as well. NYC neighborhoods could benefit from this major shift.

Community Intelligence

Linking publicly available data and social network data to computers and information displays can empower neighborhoods with real-time community information while also promoting civic involvement.





Solutions Summary

Smarter Schools



Performance Contracts



Smart Building Controls



Demand Response



Intelligent Lighting



LED Lighting



Rooftop Solar



Electric-Car Infrastructure



Community Intelligence



Stronger Sustainability



Weaker Sustainability



Technologies with stronger sustainability have greater combined social, economic and environmental benefits.

Smarter Schools



Partnering with NYC schools on facility improvements represents a great opportunity for the City to drive neighborhood sustainability across all five boroughs. Schools can achieve benefits in all sustainability categories—economic, social and environmental—with the biggest bang-for-the-buck coming from combining energy-efficient technologies with performance contracting. Using this approach, capital improvements can be paid for with energy savings that result from long-term sustainability improvements. This methodology evaluates all possible areas for improvement from water to heating oil to energy. It also provides a comprehensive and individualized plan for each building, clearly detailing facility improvements as well as the savings potential that can result.

Numerous performance contracting projects are currently underway throughout New York State. About 200 school buildings have generated some \$47 million in energy savings to date. None of these schools, however, are in New York City.



Social Benefits

Students learn more and achieve at higher levels when attending schools that are safe, properly lighted and in good condition. Technologies that enable energy savings also provide a safer learning environment by providing better lighting, cleaner heating and overall healthier buildings.

Environmental Benefits

New York City is home to America's largest public school system serving more than one million students in nearly 1,700 schools. The City is putting forward a plan to reduce greenhouse gas emissions by as much as 200,000 metric tons—roughly equivalent to taking 40,000 cars off the road. Cutting emissions throughout City schools can go a long way in helping the City meet its goals.

Economic Benefits

While savings vary based on specific facility improvements, it is possible to save up to 30% on energy costs. These savings can be used to implement longer-term facility improvements that would otherwise have been left out of shorter-term projects. For example, NYC currently plans to simultaneously address energy efficiency and environmental risk (PCBs) in older light fixtures.

Difficulty

Medium difficulty to implement.

Typical Payback Period

The payback period for generally older buildings such as schools using performance contracting is typically less than a year. The guaranteed energy savings are then used to pay for the improvements.

Hendrick Hudson School District in Westchester County expects an annual savings of \$250,000 as a result of implementing guaranteed energy improvement measures.

The Orange & Ulster Boards of Cooperative Educational Services will reduce emissions the equivalent of taking some 175 cars off the road annually.

Barriers have existed preventing New York City from leveraging energy savings through performance contracting in public schools. NYC is taking action, however. It recently announced its "Comprehensive Plan to Increase Energy Efficiency and Environmental Quality at Schools." By leveraging guaranteed energy performance contracting, there may be an opportunity to scale the program faster, deploy more comprehensive improvement measures and enable NYC schools to participate in energy demand response programs.

Performance Contracting



Guaranteed performance-based solutions allow building and capital improvements to be made and funded through a building's ongoing energy savings.

Sustainable and self financing. What's not to like?



The City of Houston, Texas, is saving \$5 million over a ten-year period by implementing energy-efficiency improvements and eliminating the equivalent of more than 2,600 tons of greenhouse gases annually.

New York City currently does not leverage performance contracting as Houston does. Reasons vary, but thought leaders from the City's public, private and non-profit sectors could form a task force to identify barriers and suggest solutions for leveraging Performance Contracting with the goal of driving job creation and creating positive sustainability changes for NYC.

Social Benefits

Energy-efficient buildings are typically more attractive for residents and employees. They have higher property values and are healthier due to better environmental controls. By using more performance contracting, new jobs could be created throughout New York City.

Environmental Benefits

Solutions are designed in a collaborative process with building owners, school districts and city agencies to set—and achieve—sustainability goals. They include obtaining nationally recognized classifications like ENERGY STAR™ labeling or LEED Certification by optimizing energy and water efficiency; reducing greenhouse gas emissions; improving indoor air quality and occupant comfort; installing meters, sub-meters and energy management systems; modernizing heating systems and boilers as well as providing renewable energy.

Economic Benefits

Savings can be guaranteed under an energy savings performance contract. A preliminary analysis is conducted to determine current energy use and identify areas for maximizing energy savings. If potential savings are found—which is usually the case in

older buildings—a detailed, investment-grade, energy analysis is made to determine the specific improvements that make the most business sense and have the greatest environmental impact. By the end of the contract, if there is a shortfall, the commercial provider picks up the tab. If applicable, savings are passed on directly to the city, commercial, or residential building owner.

Difficulty

Medium difficulty to implement.

Typical Payback Period

The typical duration of a performance contract is 15 to 20 years. During this time, savings resulting from energy improvements are directed towards paying off implementation costs. From a customer perspective, positive cash flow is typically achieved in fewer than two years.

Smart Building Controls



Neighborhoods have a mix of building types—from residences to commercial spaces to public facilities—in some cases, all at the same address. Balancing energy consumption with personal comfort across a variety of building types requires the use of smart building controls connected to an intelligent building automation system which utilizes the building’s real-time environmental information.

Heating and lighting in buildings consumes 40% of energy worldwide.



A challenge for some New York City buildings is the fact that occupants are not the direct beneficiaries of the energy savings from smart building controls improvements. Enabling occupants to be responsible for their energy bills—as part of their budgets, for example—is a step in the right direction towards empowering energy consumers.

Social Benefits

Buildings change over time. Smart building controls can adapt to keep a comfortable energy efficient environment based on current conditions. People experience less eye-strain and fatigue and can be more productive in spaces that are better lit and where air quality is better controlled and healthier.

Environmental Benefits

Aging infrastructure typically uses more energy while also posing potential risks associated with older materials. Replacing old infrastructure makes for a

healthier building environment while newer technologies can reduce energy consumption and lower greenhouse gases. Buildings can also be optimized using intelligent control systems to provide light only when needed as well as reduce heating and cooling.

Economic Benefits

Cost savings of 10 to 40% are realistic from optimizing building controls depending on the type of structure. For example, retail spaces often have a higher savings potential while commercial buildings are often between 20 to 30%.

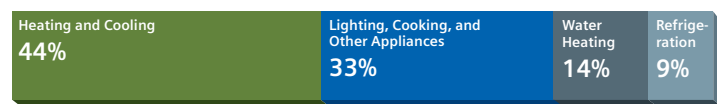
Difficulty

Medium difficulty to implement.

Typical Payback Period

Varies according to building age and infrastructure. Performance contracting reduces or eliminates the need for capital outlay and the facility’s energy savings can be used to repay the investment costs.

How we use energy in our homes (based on national averages):



“We must work together today to make the changes we need so that the lives of those who come after us are even better than our own. We must work together to share ideas, to promote innovation, to make pragmatic



change, to balance short-term costs and long-term benefits... We must continue to make progress to ensure that New York is a greener, greater city...”

— PlaNYC Progress Report 2010

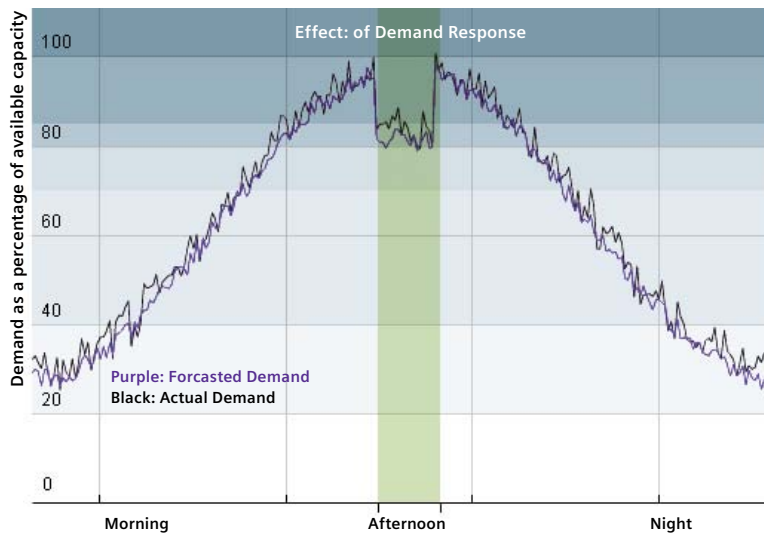


Demand Response



Automated Demand response—also known as “Demand-Side Management”—is the automated change in end-users’ power consumption compared with their normal usage. It’s often used to reduce power when prices change or when the grid is in jeopardy. This solution is able to continuously adjust energy consumption by reacting to changes both within a building and in the surrounding grid. It uses a continuous feedback loop based on collected energy data as well as actions taken to lower demand in response to utilities’ requests.

The greenest kilowatt (kW) is the one never produced.



On hot summer days, energy demand can exceed normal capacity. Demand Response helps by temporarily lowering building and facility power in a sustainable manner.

For example, a large midtown complex participating in Demand Response has a 500 kW curtailment potential. It receives advance notification of the City’s power needs and makes proactive decisions to temporarily power down or setback systems, giving the needed capacity back to the City.

Social Benefits

New York City’s neighborhoods are especially vulnerable to blackouts due to the City’s need to power subways, elevators and lighting. Automated Demand Response enables greater reliability with minimal impact to neighborhoods’—and citizens’—daily routines.

Environmental Benefits

In peak-load situations where there’s too much demand and not enough supply, only two options are available: rapid supply increase or rapid demand reduction. Supply increases can be achieved either by power transmission from adjacent grids or by starting emergency reserve power plants—also known as “peaker plants”—which are not always environmentally friendly. By reducing consumer demand, the use of these plants can be avoided and money saved.

Economic Benefits

Residential and commercial users can receive financial incentives to participate in demand response programs. Gently reducing power consumption across a large number of consumers helps keep the power flowing and the lights on. Utilities win by not having to purchase additional power and can defer expensive upgrades to the grid infrastructure. Consumers win by being “paid” to cut consumption for a limited time.

Difficulty

Medium difficulty to implement.

Typical Payback Period

The payback period depends on incentives provided by the power utilities. Return on investment is possible within a year under current Demand Response programs.

Intelligent Lighting



Intelligent lighting combines energy-efficient lamps, modern lighting electronics, as well as thorough analyses to optimize illumination, increase comfort and reduce costs. “Re-lamping”—as it’s often referred to—is one of the simplest ways to upgrade old infrastructure and reduce the environmental impact of older lighting technologies such as incandescent bulbs and electromagnetic ballasts.

Lighting typically accounts for about 20% of a city’s total electrical consumption.



The Philipsburg-Osceola School District in Pennsylvania is today saving some \$70,000 annually following a lighting retrofit that was the equivalent of taking 100 cars off the road. (Before-and-after photos.)

Con Edison’s warehouse in Astoria, Queens, lowered its energy usage with integrated occupancy sensors. Lighting is automatically turned off in unoccupied areas.

Social Benefits

Intelligent lighting systems provide solutions that are closer to sunlight in quality, reduce eye-strain and fatigue and also create a more inviting environment for public spaces such as building lobbies and atriums.

Environmental Benefits

Buildings of all types can benefit from reducing greenhouse gases. For a typical school retrofit, for example, carbon dioxide (CO₂), sulfur dioxide (SO₂) and nitrogen oxide (NO_x) can be reduced by as much as 3 to 7 metric tons annually.

Economic Benefits

Linking lighting and controls enables lights to be used where they are most needed. For example, public school lights can be connected to sensors which detect when people are occupying a room, automatically turning lights on or off. Power consumption can be cut 20 to 40% depending on existing controls.

Difficulty

Easy to implement.

Typical Payback Period

Payback period is typically 2 to 3 years.

LED Lighting



LED street lighting is robust, weatherproof and economical—often lasting 3 to 5 times longer than traditional street lamps. By consuming only half as much power, this technology saves money and is better for the environment. LED lighting will also likely replace conventional lighting over the next years.

LED lamps can save up to 80% in energy costs compared to incandescent lamps.



In Lansing Michigan, more than 250 street lamps were retrofitted to improve lighting conditions with an expected savings of 270,000 kWh annually, the greenhouse gas equivalent to those from 23 cars per year. (photo)

Central Connecticut State University retrofitted 500 Victorian lamps in parking lot and pedestrian walkway fixtures with a projected savings of \$1 million during the next 12 years.

Pine Land Farms in New Gloucester, Maine, upgraded 200 lamps, saving some \$30,000 annually, cutting approximately 300,000 pounds of CO₂, 1,200 pounds of SO₂, and 600 pounds of NO_x emissions from the atmosphere annually.

Social Benefits

Poor street lighting reduces sky visibility by adding to a “sky glow” over the city that can be seen from miles away. LED light is more focused, properly controlled, and when re-directed, it can help bring our skies back to star gazing.

With LEDs, there is a wide range of color temperature options from warm white to daylight. With more choices, we can use lighting more effectively to create environments that are well-lit and aesthetically pleasing. Well-lit conditions also evoke the feeling of safety over comparable dimly or poorly lit streets.

Environmental Benefits

Replacing just 12 street fixtures with LEDs is the environmental equivalent of taking one car off the road for a year. LED lighting is shatterproof and mercury free, reducing its environmental impact over traditional street lamps.

Economic Benefits

LEDs have a long life of 50,000 hours which helps reduce maintenance costs compared with traditional high-pressure sodium lamps. Energy savings of up to 33% or more can be achieved when combined with intelligent sensors.

Difficulty

Medium difficulty to implement.

Typical Payback Period

Payback period is typically 3 to 4 years.

Rooftop Solar



One of the cleanest forms of power generation is photovoltaic (PV) solar energy. NYC has a significant number of rooftops which could support solar installations. But does solar *make cents* for the City? Not under current circumstances. All solar installations depend on incentives, including federal tax credits which typically account for some 50% of any solar installation's capital costs. To break even in fewer than five years, state and local incentives are required. Without these incentives, the payback period can exceed 15 years, making solar economically unattractive for investors. In order to optimize the tax incentives, there needs to be an investment entity with the means to monetize the federal tax credits over the duration of the credit.

Does solar make cents?



Siemens' train manufacturing facility, Sacramento, CA; 2,300 kW installed (photo).

County of Sacramento: 100 kW rooftop installation.

Nashville MDHA I and II: Nashville, TN.

Jersey City Housing Authority: under construction.

Norwalk Housing Authority: Norwalk, CT, under construction.

Waterbury Housing Authority: Waterbury, CT, under construction.

The New York State Senate is currently considering the N.Y. Solar Industry Development and Jobs Act. Legislation such as this, as well as changes to the state's renewable portfolio standards, are necessary to help drive solar's adoption in New York City.

Social Benefits

Residents and commercial businesses feel a sense of pride in using green power to reduce their utility bills while also helping the environment.

Environmental Benefits

For every 300 kW of solar power generated, 20 tons of greenhouse gases are avoided.

Economic Benefits

Rooftop solar has the capacity to pay for itself faster in other states. In New Jersey, for example, a rooftop installation's costs can be recouped in as

few as five years thanks to the Garden State's solar utility incentives. In NYC, however, that same installation would take more than 15 years to pay back. The City also has unique urban challenges with shade created by buildings. Additional incentives would be needed to compensate sites with partial shading.

Difficulty

Medium difficulty to implement.

Typical Payback Period

Typically 4 to 5 years with local or state incentives; 15+ years without.

Where solar energy's payback comes from:



Electric-Car Infrastructure



Charging stations offer a safe method of transferring energy from the grid to different kinds of Electric Vehicles (EVs) providing benefits for both the charging station host and the e-car driver. Features include automated billing, station location and availability, charging status notifications and energy management as well as tracking capabilities.

“Those who can, build.”

— Robert Moses



E-Car charging station “fueling” a fleet van. Large fleets benefit from utilizing EVs and are less subject to rising oil prices. (photo)

U.S. utility pilot project: More than 75 units have been sold, of which, 25 are installed and ready for use. Additional units have been ordered.

Consortium Project: Edison—Danish Energy Association.

Building codes will need to be changed to address how charging stations are installed. Residential and commercial garages can expedite the deployment of electric vehicle infrastructure.

New York City also has one of the largest numbers of public parking garages in the country. To encourage EV adoption, an outreach and education program regarding EV infrastructure permitting and installation should be conducted.

Social Benefits

Parking is at a premium in NYC. Creating neighborhood electric vehicle-only charging spaces can create a demand for EVs as well as improve neighborhood access for those who already have an EV. Local public electric vehicle charging stations can also encourage the adoption of electric cars by providing locations for drivers to safely charge vehicles in their neighborhood or as a community hub for on-demand hourly rentals of electric vehicles.

Environmental Benefits

Electric vehicles and their charging infrastructures help to reduce greenhouse gas emissions while minimizing fossil fuel consumption. The amount of emissions created by a non-renewable energy source generating power for an electric vehicle is 30% less than the emissions emitted by a similar gas-powered vehicle.

Economic Benefits

Public charging stations can generate revenue for New York City from the combined parking fees and EV charging costs. A driver subscription model that provides access to unlimited charging is an option which can create a reliable revenue stream for NYC. Combined with incentives, models such as this may allow the City or investment groups to recoup capital and service expenses.

Difficulty

Medium-to-high difficulty to implement as the power infrastructure for a neighborhood needs to be evaluated and potential upgrades may be required. Parking regulations need to be evaluated to allow for long-duration parking time and zoning allowing cars to charge during the day.

Payback Period

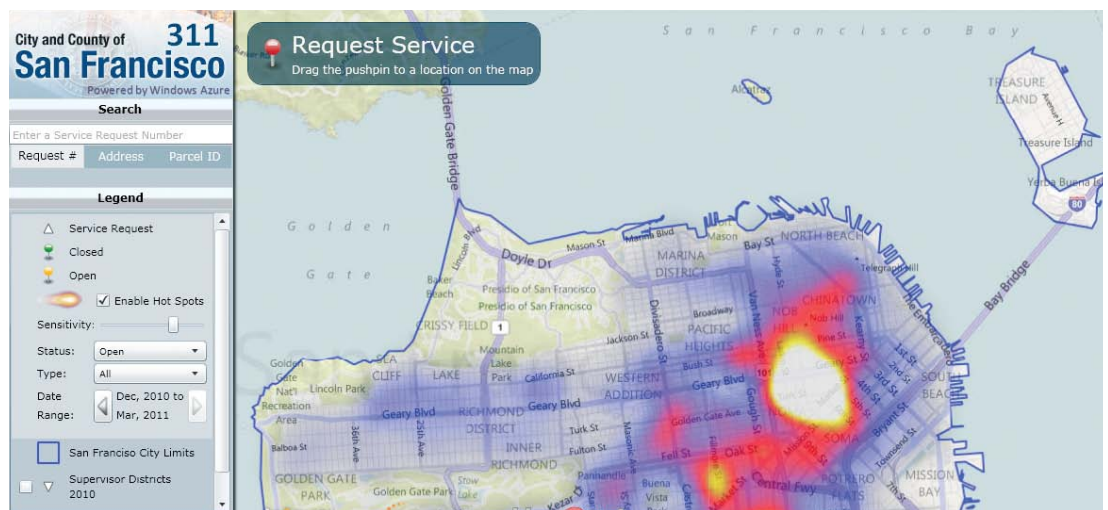
Varies. Dependant on revenue model and available incentives.

Community Intelligence



Being a part of a community meets a basic human need. Knowing your surroundings, having access to relevant local information, and feeling closely connected to your neighborhood—and to the City—builds trust. As New York City continues to grow, residents are at risk of losing their sense of community. Community Intelligence represents a unique solution to meet our basic need for community in the digital age. By linking multiple sources of information—mobile phones, computers, and information displays—in a useful, personalized and interactive way, we enable more meaningful connections to the City while building a greater sense of community.

Knowledge empowers!



Social Benefits

Community Intelligence is the umbrella covering two-way, personalized communications bringing residents closer to their neighborhoods via publicly available data. It enables more commerce; empowers citizens to reduce power consumption and greenhouse gases; and it keeps citizens better informed about local events and transit conditions. Citizens can also be seen as an active extension of the City by reporting concerns and issues in real-time—improving quality of life for all New Yorkers.

Environmental Benefits

Thanks to environmental transparency, efficient communities today can produce less waste while preserving the environment. But most NYC residents and businesses today neither know how much—nor exactly when—they are consuming power, heat or water. By providing information on how a neighborhood is impacting the environment in real time, residents can take appropriate actions to become more efficient as a community—leading to a higher quality of life and a deeper civic engagement.

Economic Benefits

Greater transparency using dashboards or scorecards enables city management to improve operations efficiency and to make better decisions. Community Intelligence can

include personalized public service announcements; pushing digital messages to help prevent a brownout or blackout; asking the community to watch for suspects in real time; as well as soliciting public opinion, for example, on where to begin a construction project, what roads to fix first, etc. According to NYC BigApps2.0, the release of data can also provide important transparency encouraging greater government accountability and accessibility.

Difficulty

Easy to medium depending on the application and number of data sources integrated and shared as well as the degree of interactivity of users within the system.

Payback Period

Varies by application.

HeyGov!, the City of San Francisco's interactive 311 system rendered on a map enables users to view the intensity of 311 activity over a period of time. (photo)

NYC BigApps2.0—There are more than 50 applications showing how city agency data can be used to deliver personalized and intelligent information for residents and visitors.

Real-time access to 311 data such as the Open 311 approach enables new web-based applications that use real-time data empowering citizens to track the status of repairs or improvements, while also allowing them to make new requests for services.

Summary: The Way Forward

Technologies available today can create smarter and more sustainable neighborhoods throughout all of New York City. These proven solutions are already in use in the Tri-State Area and throughout neighborhoods across the United States.

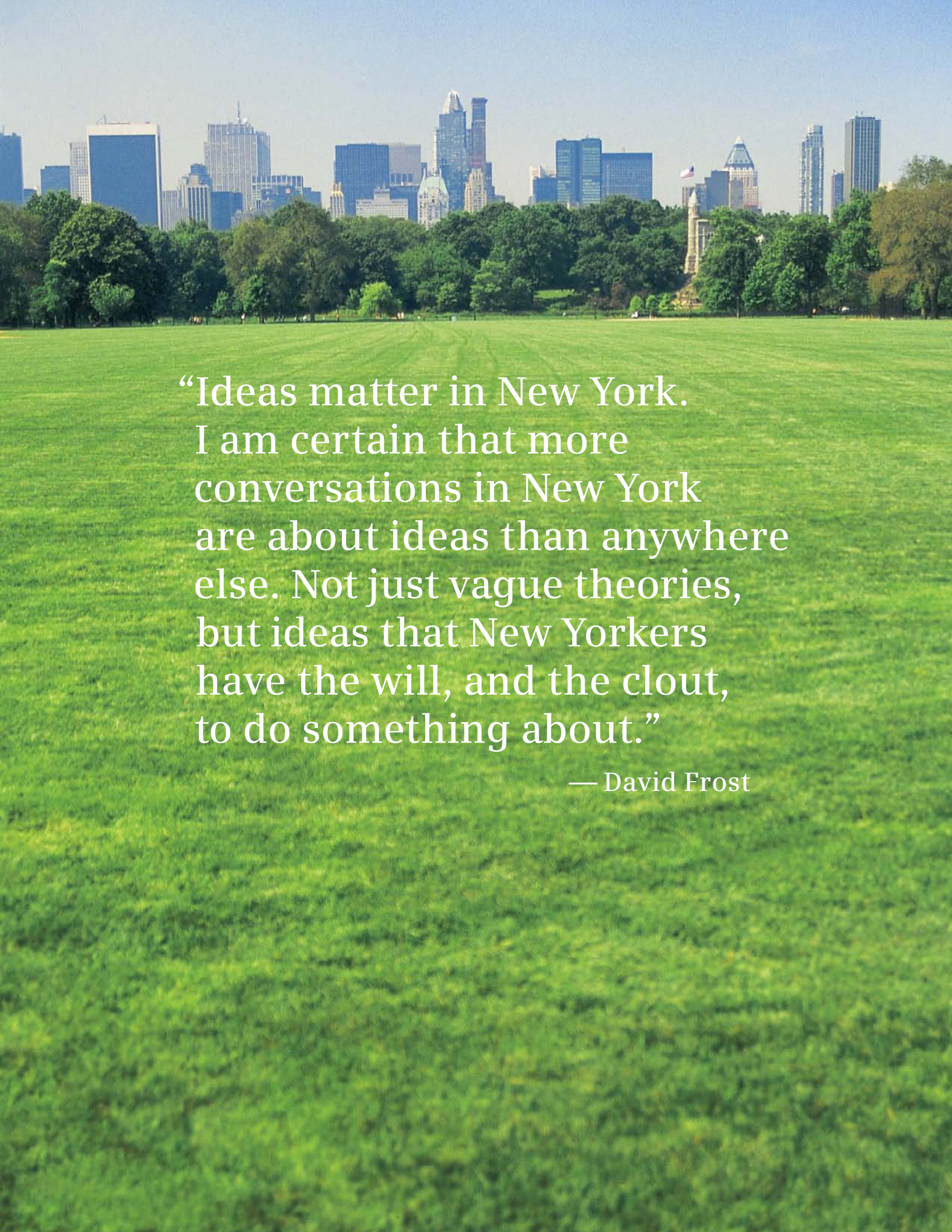
To support New York in its planning decisions, the Regional Plan Association and Siemens can convene experts from other cities, organizations and companies to explore in depth how the diverse neighborhoods that make up all five boroughs can help New York City become more sustainable—*today*.

In weighing all the options, performance contracting is one of the best ways of accelerating sustainability improvements while minimizing capital outlays. While not a new concept, this cost saving method is currently under utilized in New York City. Overcoming this barrier can lead to job creation as well as improve the City's quality of life.

New York can best maximize the social, economic and environmental impact these sustainability changes can provide by using a phased implementation. Deploy technologies with the shortest economic payback first and then move towards solutions with longer-term returns. Action taken today can reap benefits tomorrow and in years to come for the millions of residents who call New York City home.

Solutions for a More Sustainable New York City





“Ideas matter in New York.
I am certain that more
conversations in New York
are about ideas than anywhere
else. Not just vague theories,
but ideas that New Yorkers
have the will, and the clout,
to do something about.”

— David Frost

