A Report to Mayor Michael R. Bloomberg

New York City Energy Policy:
An Electricity Resource Roadmap

Prepared by the New York City Energy Policy Task Force

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I. Executive Summary

To maintain its position as the financial, corporate and communications capital of the world, New York City must have a dependable source of electricity. Electricity makes much of the City's daily functioning possible—from the vast underground transit system and the commuter rail network to the elevators that serve our high-rise buildings. Assuring reliable, affordable, and clean electricity is essential to the continued attraction and retention of City businesses and residents.

New York City has been recognized as having the most reliable electricity distribution system in the country.[1] However, as the regional blackout of 2003 pointedly reminded us, electricity systems can also be subject to unplanned interruptions. The City has adequate energy resources for its electricity needs today, but the margins necessary for reliability are extremely thin. And the growth of demand for electricity in the City continues to be strong, even in the face of a weakened economy.

To ensure reliability, to promote economic growth, and to address environmental issues, the Task Force concludes that the City needs 2,600 megawatts of new electricity resources by 2008.[2] The best way to meet this goal will be through a combination of generation plants (both new and repowered), transmission lines, and distributed resources—including clean on-site generation and

[1]Consolidated Edison Company of New York, Inc. (Con Edison) has been named the most reliable electric utility in North America for the second year in a row by PA Consulting Group, an international consultant, which presented the company with its National Achievement Award for "sustained leadership and achievement in the area of electric reliability."

[2]A megawatt (MW) is equal to 1,000 kilowatts or 1 million watts, and is a standard measure of electric power plant generating capacity measured as the energy produced per unit of time.

- Expand the use of limited exceptions to air emission limits during wholesale market capacity and local grid emergency conditions
- Collaborate with the Partnership for New York City and the Real Estate Board of New York to expand the Summer Energy Program
- Support incentives for peak load management enabling technologies

Energy Delivery Infrastructure

- Establish a collaborative capital infrastructure planning process between relevant City and State agencies and local utilities
- Support the expansion of targeted demand-side management and clean distributed generation for grid support
- Support the passage of joint bidding legislation to facilitate infrastructure projects
- Create a special zoning or permit designation to allow utility facilities in targeted development areas
- Ensure that utilities and other energy project developers have access to public and private New York City docks

New York City—Leading by Example

- Enhance and augment the City's menu of energy efficiency programs
- Create a City energy efficiency plan
- Develop pilot energy educational programs
- Tie economic development assistance to energy efficiency
- Expand the use of steam and gas chillers and thermal energy storage systems where cost effective
- Include clean on-site generation strategies as part of a least-cost resource plan to supply the electricity needs of City agencies
- Seek direct incentives and low-cost financing for peak load management enabling technologies
- Incorporate high-performance design strategies into City-led capital projects for long-term value
- Partner with private sector New York City developers, and the building community at large, to promote the benefits of high-performance building design

II. Introduction

A. Background and Context

Deregulation of Electricity Markets

In the mid-1990s, New York State, along with a number of other jurisdictions, began restructuring the electric utility system by substituting competition for some activity that was previously regulated. Most of the large New York State utilities were directed to divest themselves of their power plants. Customers were offered the choice of purchasing their own power or letting the utility serving them purchase power on their behalf. The Federal Energy Regulatory Commission (FERC) asserted its authority over electricity transmission rates and oversaw the creation of the New York Independent System Operator (NYISO), which was charged with operating the transmission grid and the wholesale energy markets in the State.

At the direction of the New York Public Service Commission (PSC), the agency charged with overseeing and regulating utility service in the State, Con Edison divested almost all of its in-City generation plants. Con Edison retained ownership of certain generation assets to supply its Manhattan steam system, but today is largely out of the generation business and is principally an electricity, gas, and steam transmission and distribution company. The primary in-City generation owners are now KeySpan Energy, Reliant Resources, NRG Energy, and the New York Power Authority (NYPA).

Other aspects of the electricity markets have also changed under deregulation. Transmission lines, for example, can now be built by merchant developers, as in the case of TransEnergie's Cross Sound Cable connecting Connecticut and Long Island. However, the placement of new generation and transmission affects the reliability and performance of the electric grid. Unlike in the past,

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Ashok Gupta *Director, Air & Energy Program*	Natural Resources Defense Council	Natural Resources Defense Council
William Harkins	Energy Consultant	New York Building Congress
David Hepinstall *Executive Director*	Association For Energy Affordability	Association For Energy Affordability; Association of Energy Engineers—NYC
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Jay Raphaelson *President*	Energy Watch	New York Energy Buyers Forum; Building Owners and Managers Association; Owners Committee on Electric Rates
Peter Smith *Acting President*	New York State Energy Research & Development Authority	State of New York
Gail Suchman *Senior Environmental Counsel*	New York Lawyers for the Public Interest	New York Lawyers for the Public Interest; Communities United for Responsible Energy

III. Electricity Resources and Needs: 2003–2008

In 2003, New York City's forecasted peak electricity demand was 11,020 megawatts. By regulation and for reliability purposes, 8,816 MW, or 80% of that forecasted peak load, had to be supplied by capacity available in-City.[3] The available electricity supply capacity in the City exceeded the 80% requirement by only 71 MW.

In other words, New York City has adequate electricity resources today, but only by a slim margin. A projected increase of approximately 1.5% annually in electricity demand in the next five years will necessitate new generation and transmission facilities and expanded distributed resources measures. Additional resources will be required to assure market price stability, and old power plants will need to be retired and/or replaced with cleaner, more efficient facilities by 2008. This report stresses near-term decisions in the context of a long-term energy strategy for the City.

A. Electricity Requirements

In total, the Task Force estimates that New York City will need about 3,780 MW of new electricity resources by 2008, for the following purposes:

- 665 MW to accommodate load growth;
- 1,000 MW to reduce energy and capacity prices;

[3]Reliability concerns require that 80% of the City's peak load be met with in-City resources under a mandate from the New York State Reliability Council and the New York Independent System Operator.

plants, the City will enjoy the concurrent environmental benefits of reduced air emissions.

Unless new electric generation is constructed or investment in energy efficiency is undertaken to replace some of the City's aging units, the amount of generation that is more than 45 years old will total 3,730 MW, or approximately 42% of existing total capacity, by 2010. For purposes of this report, the Task Force assumes that one third of the 45-year old plants will be retired in the next five years. This gives rise to an additional need of 1,240 megawatts.

In addition to the above, an agreement announced by Governor Pataki in 2002 to allow construction by NYPA of a new 500 MW plant at the Poletti site in Queens requires that the existing 875 MW Poletti plant be retired no later than January 1, 2010, and as early as 2008 if there is sufficient capacity in-City to permit it. Accordingly, this 875 MW must be included in the retirement and replacement need for the period through 2008, bringing the total to 2,115 MW of additional resources needed to replace aging energy capacity.

B. Addressing the Need

At present, there are two principal means to address the needs described above.

Power Plants Currently Under Construction —875 MW

Three power plants are now under construction in the City: KeySpan's Ravenswood addition (250 MW), Con Edison's East River Project (125 MW net addition for peak periods after the retirement of the company's Waterside plant), and NYPA's new Poletti combined-cycle plant (500 MW), for a total of 875 MW. All of these plants are expected to be completed and serving load in the period 2004–2005.

In addition, two projects with a total of 1,563 MW (Reliant Resources and Astoria Energy–SCS) have been certified by the state under Article X and are currently seeking financing commitments.

Distributed Resources —300 MW

It is difficult to estimate the amount of peak load management, energy efficiency, and clean on-site generation resources that will be in place in the City by 2008. For planning purposes, the Task Force estimates a business as usual case of 300 MW, or on average some 60 megawatts annually over the next five years. Policy changes and new commitments of resources would make additional distributed resources possible. (See the extended discussion of Distributed Resources in Section V of this Report).

IV. Energy Supply

A. Overview of Energy Supply Infrastructure

The following sections describe four aspects of the energy supply infrastructure serving New York City: electricity transmission, generation, natural gas pipelines, and the Manhattan district steam system.

Electricity Transmission into New York City

In electrical terms, New York City is a *load pocket.*[6] This means that transmission lines cannot carry enough energy into the City to meet its *peak load,* defined as the year's highest point of electricity demand. To meet the City's peak load, 80% of the forecasted demand must be supplied by capacity located inside the load pocket.[7] For the balance, including reserve requirements imported over transmission lines, New York City is connected to upstate New York, to the electrical grid system in northern New Jersey, and to Long Island.

- In the north, Con Edison's overhead transmission lines connect substations in Westchester and run south to the City, connecting to the underground

[6]The only exception is the Rockaway peninsula, which is in the City but in the Long Island Power Authority's service territory, and hence part of the Long Island load pocket.

[7]The fact that an area is a load pocket is not necessarily a problem; even areas with much generation capacity that are usually power exporters may be load pockets. Technically, New York State itself is a load pocket, since in-state load is greater than the transmission import capacity and in-state generation plants must run to meet load.

Several areas within New York City are also load sub-pockets, which require local generation plants to meet their own peak loads. (Those sub-pockets are defined as much by transmission voltage as by geography. They include the entire 138-kilovolt (kV) transmission system and the 69kV system around the East River plant.) This report deals primarily with the capabilities of the transmission system connecting New York City to other geographic areas.

The maximum power that can be imported into the in-City load pocket from the three transmission corridors is approximately 5,000 MW. However, the actual amount that is imported during peak load conditions is generally lower due to conditions such as transmission constraints and local reliability rules. A simplified map of the bulk power transmission system appears on the opposite page.

Transmission capacity to the City has not been increased since the 1980s. The last significant upgrade to the system in New York State was the Marcy-South project running from the Utica area into downstate that was completed in 1988. Marcy-South allowed importation of more power into the City.

Currently, NYISO is considering transmission plans and expansions in conjunction with FERC and the PSC. Meanwhile, merchant developers are proposing two transmission projects connecting New York City to New Jersey and upstate New York. If built, these lines might allow access to power at prices lower than those now available in the City.

Electricity Generation Sources

The City load pocket currently has approximately 8,760 MW of generation. The following five parties own or control almost all of the in-City generation:

- Reliant Resources, NRG Energy, and KeySpan Energy own the electric plants and gas turbines divested by Con Edison.
- NYPA owns the Poletti plant and a fleet of new gas-fired combustion turbines at six locations throughout the City, and holds a long-term contract for the output of the cogenerator at the Kennedy International Airport.[9]
- Con Edison owns a few generators for steam production and a few small combustion turbines, and has long-term power contracts from Cogen Technologies (currently owned by Goldman Sachs), York Warbasse, and BNY Cogen Partners.

Most generation in the City can utilize either natural gas or residual fuel oil, but some plants are limited to one fuel type. Natural gas is the cleanest fuel available for fuel-burning power plants, producing almost no sulfur and generally low emissions of nitrogen oxides. While particulate emissions from the combustion of natural gas are significantly less than for distillate oils, there is still concern with respect to the emission of fine particulate matter, especially in neighborhoods that have been shown to be at or above federal ambient standards.

[9]In addition, NYPA installed ten gas turbine generators in the City in early 2001. These plants added a total of 408 MW of in-City generation.

Natural Gas Supply

The gas supplies delivered to New York City originate in the gas fields of Texas, Louisiana, the Gulf of Mexico and Western Canada, and are transported by interstate pipelines to the region. New York City is served directly by three interstate pipeline companies and five interconnections. One other pipeline and three interconnections can supply gas at points outside the City limits.

New York City and the three New York counties in the region (Westchester, Nassau and Suffolk) are served through gas facilities operated by Con Edison, KeySpan Delivery of New York, and KeySpan Delivery of Long Island. The three local distribution companies (LDCs) receive gas from five interstate pipeline companies through numerous interconnections. Con Edison and KeySpan each has its own internal distribution system which carries gas from delivery points in the City and to interconnections between the local distribution companies.

As reported in the 2003 New York Gas Report prepared by the Northeast Gas Association, the three local utilities experienced peak day delivered volumes totaling 3,132,000 dekatherms[11] and annual delivered volumes of 698,715,000 dekatherms to all customers including power generators.

The interstate pipelines that serve this area are as follows:

- Transcontinental Gas Pipe Line, Texas Eastern Transmission (and its Algonquin Pipeline affiliate), and Tennessee Gas Pipeline carry gas from the Gulf Coast region to in-City delivery points of one of the gas LDCs.[12]
- Iroquois Gas Transmission brings western Canadian gas from the Trans-Canada pipeline in Ontario through upstate New York and Connecticut, across the Sound to Long Island, and into an out of City delivery point. By early 2004, Iroquois will be delivering directly into a new in-City delivery point of one of the gas LDCs.

The same pipelines connect New York City to underground gas storage facilities in Pennsylvania and western New York State. Gas from the supply areas is injected into those storage facilities in the summer, when customer demand is relatively low, and delivered to the distribution companies in the

[11]A dekatherm is equivalent to 1,000,000 BTUs. A BTU, or British thermal unit, is a unit of heat—the quantity required to raise one pound of water one degree Fahrenheit.

[12]Since these pipelines connect to Midwestern pipelines that carry gas from the Southwest and from western Canada, the actual gas delivered to New York City may have come from almost anywhere in North America. In addition, these pipelines interconnect with other pipelines in the region that deliver gas from remote sources of gas supply and storage facilities.

B. Energy Supply Resource Options

Over the past year, the pace of construction of new electric resources has lagged. Financing of new electric resource projects has been highly uncertain, particularly in the aftermath of September 11 and the collapse of several energy firms, but there are signs the tide may be turning. Beyond the power plants now being built, there are a number of options for New York City to achieve its electricity needs by 2008.

Power Plants

Power Plants Certified for Construction—1,562 MW

Article X projects that have been certified by the State but are not yet in construction are tracked by the Public Service Commission.[13] Astoria Energy LLC (SCS) was recently awarded a 500 MW contract by Con Edison for a 10-year period commencing in 2006, and is expected to construct a large power plant in Queens. Article X plants currently certified in New York City are as follows:

- Astoria Energy LLC (SCS)..... 1,000 MW
- Reliant Energy Astoria Repowering..... 562 MW (net)

Power Plants in the Certification Process—1,620 MW

Two additional in-City power plants are still in various stages of the Article X approval process. The following plant proposals are currently under review by the New York State Siting Board:

- Sunset Energy Fleet, LLC .....520 MW
- TransGas Energy .....1,100 MW [14]

There are also a number of projects proposed for New York City that have a capacity lower than the 80 MW threshold for Article X, and therefore will be subject only to approval under the State Environmental Quality Review Act.

[13]Article X of the New York State Public Service Law addresses the siting of power plant projects, and grants authority to a State Siting Board to certify applications for approval. The current law expired on January 1, 2003 (see discussion on page 24).

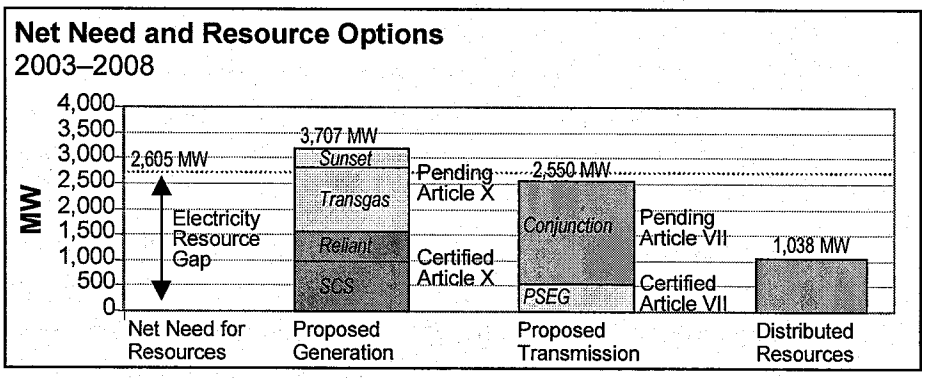
[14]As a matter of public record, the City of New York opposes the proposed location of the TransGas power plant in Brooklyn on the grounds that it conflicts with the City's Greenpoint-Williamsburg rezoning and redevelopment plan. The City has offered an alternate site. For further details, please refer to PSC Case 01-F-1276–TransGas Energy Systems, LLC.

in 2004. Conjunction has obtained initial equity financing and estimates that the transmission line could be operational as early as 2006.

Electricity Resource Options

In summary, New York City's electricity needs can be met through several options, including 2,550 MW of proposed transmission lines and approximately 3,700 MW of new and repowered generation projects. In addition, distributed resources can reduce or reshape electric system load and thereby mitigate the need for increased generation and/or transmission resources. Distributed resources are discussed in Section V.

The chart below compares the net need for resources, calculated in Section III, to the resource options outlined in this section. Any combination of generation, transmission, or distributed resources can be used to meet the net need of 2,605 MW in 2008.



Natural Gas Pipelines

Pipelines Approved by FERC and New York State and Under Construction

Iroquois Eastchester Extension, owned by Iroquois Gas Transmission System, will connect a Canada–New England pipeline with the Con Edison system in the Bronx, bringing 230,000 dekatherms of natural gas per day to the City by early 2004.

Pipelines Approved Only by FERC

Millennium Pipeline, co-owned by Columbia Gas Corporation, TransCanada Gas Pipeline, Duke Pipeline and DTE Energy, would bring 350,000 dekatherms per day of natural gas supplies from Canada and the Midwest and increase market area storage access to a new interconnection to the Con Edison gas system at the Bronx–Westchester border for direct deliveries into the City market. The State of New York is currently reviewing this project.

restructuring in New York has required that the utilities reduce their role in energy supply to consumers and transfer generation risks to developers. Unless consumers are required to purchase through the utility, long-term purchase contracts can shift risks to the utility or its remaining customers.

Market prices for generation services, which determine the value of power plants, have been very volatile. The structure of the electric markets—including energy, capacity, operating reserves, and ancillary services, plus market power mitigation rules—is much more complex than that for natural gas sales. Regulation of the wholesale electric markets is more complicated and less predictable than for gas, further increasing developers' risks. The NYISO and FERC have continued to adjust certain aspects of the markets' operation, as illustrated by the recent imposition of the demand curve for capacity prices in New York State.[17]

Cost recovery for merchant transmission is particularly problematic. The capacity increase due to addition of normal alternating current (AC) facilities to existing systems depends on complex electrical interactions of the existing and new equipment; no jurisdiction has yet worked out a fully satisfactory mechanism for assigning AC capacity to merchant facilities. High Voltage Direct Current (HVDC) lines require expensive conversion facilities at both ends, but allow control and measurement of power flow due to individual lines. Even so, the investment return on a HVDC line depends on the price differentials between the ends of the line, which are exposed to the usual price risks, as well as the effect of the line itself on those differences. In addition, the ability of such large HVDC terminals to work effectively in parallel with an underground cable system is still unproven.

Financial markets have also created problems for developers of electric generation facilities since the bankruptcies of Enron, Mirant, PG&E's National Energy Group, and NRG, as well as the financial distress of still more merchant developers and marketers. While a number of developers remain active and financially sound (including subsidiaries of PSEG and KeySpan) and creditworthy affiliates of such financial firms as Goldman Sachs and Kohlberg Kravitz Roberts & Co. are taking equity positions in new projects, it may be some time before the confidence of lenders returns to the sector.

[17]The New York ISO uses a "demand curve" that is an administrative estimate of the incremental value of generation capacity in the market; as less capacity is made available, its relative price rises.

participants. "Power Alert III: New York's Energy Future" (NYISO, May 2003) recommended addressing this issue.

All interstate gas transmission facilities require FERC approval, although FERC's standards for gas pipelines are more clearly defined than for electric transmission. In-City development of gas supplies and power plants are closely interrelated. Power plants cannot be developed without adequate supplies of natural gas, and gas pipelines cannot be developed without adequate demand from power plants. Maintaining some dual fuel capability in existing and new units may be necessary for both gas and electric system reliability.

D. Energy Supply Recommendations

Support innovative means to finance appropriate electricity projects

- Support the targeted use of long-term power purchase agreements or other financial commitments from creditworthy entities, including the City of New York, as a vehicle for reducing project and financial risk.
- Facilitate financing for power plants and transmission lines. The City, Task Force members, and others should convene a series of meetings with developers and financial institutions involved in recent financing of energy projects.
- Encourage the targeted use of tax-exempt financing vehicles for energy supply infrastructure projects in New York City.
- Pursue long-term policies to establish a competitive energy market that will encourage developers to invest in energy projects in the City.

Advocate in Albany for the immediate passage of the Article X Power Plant Siting Law

Article X of the New York Public Service Law should be reenacted with the following measures:

- Increase coordination between the Siting Board and Department of Environmental Conservation (DEC) reviews to reduce lead time and uncertainty of developers' planning processes.
- Include analysis of the cumulative effect on the immediate community of air emissions from a proposed facility, in addition to emissions from other existing or planned sources in the area. Consideration should be given to a

state pipeline interconnections into the City and independent supply sources to enhance reliability, increase diversity, and reduce price volatility.

- Foster close coordination between the regulatory review processes for new generation and the gas transmission facilities required to support it.
- Encourage fuel flexibility in power plants in New York City, consistent with environmental and local community impact considerations, and support a properly designed statewide renewable portfolio standard to improve reliability and reduce price volatility.
- Coordinate with federal, state, and local environmental officials to promote appropriate fuel diversity for in-City generation, and to include limited utilization of low-sulfur oil as a dual-fuel alternative to natural gas.

V. Distributed Resources

A. Overview of Distributed Resources in New York City

The term *"Distributed Resources"* refers to:

- *Energy Efficiency*—targets *permanent* demand and energy usage reductions by the design, application and installation of energy efficient building materials and equipment such as high-efficiency building envelopes (including green roofs), lighting, appliances, office equipment, electric motors, building controls and air conditioning systems. Energy efficiency also includes better practices such as "commissioning," a process that ensures building systems operate efficiently and in accordance with their original design intent.
- *Fuel Switching Applications*—refers to the use of steam and gas chillers in lieu of electrically driven chillers for air conditioning systems in large buildings. The primary goal is to reduce on-peak electric demand *permanently* by using non-electric cooling equipment.
- *Thermal Energy Storage*—encourages off-peak production and integration of chilled water storage, low temperature fluid storage, and ice storage into air conditioning distribution systems. Shifting this cooling energy usage to off-peak hours can considerably reduce on-peak electricity demand.
- *Clean On-Site Generation*—includes cogeneration (also known as combined heat and power or "CHP") and clean distributed generation ("clean DG"), such as microturbines and fuel cells. Both are defined as electric generation connected to the distribution level of the grid usually located at or near the intended place of use. Cogeneration or CHP systems generate

C. Distributed Resources Potential in New York City through 2008

Unlike central station generation and transmission, a distributed resource will generally provide benefits directly to the end customer (i.e., reduced energy consumption) in addition to its benefits to the rest of New York City (i.e., reduced requirements for distribution investments, reduced market prices for energy and capacity). The discussion in this section recognizes both groups of benefits to New York City and treats as cost-effective any resource that provides total benefits to *anyone* in New York City that are greater than the total costs to *everyone* in New York City.

Energy Efficiency

In a recent study of energy efficiency, the New York State Energy Research and Development Authority (NYSERDA) estimated the economic potential for reducing New York City summer peak demand by 2008 to be approximately 1,250 MW.[19] For 2012, the report estimates an economic potential of about 2,710 MW in peak demand reduction, of which 1,826 MW, or 67%, would be economically achievable. Applying the same ratio for 2008, 868 MW in summer peak reduction would be economically achievable. However, this entire economic potential is unlikely to be achieved, since it has not taken into account other factors such as future market acceptance rate, technology adoption cycle, design and operational constraints and the full administrative costs of implementing energy efficiency programs. Therefore, for planning and policy development purposes, the Task Force estimates the actual potential for energy efficiency in the next five years to be within a base case of 300 megawatts and a high case of 868 megawatts in peak electric demand reductions.[20]

Clean On-Site Generation

Another recent NYSERDA study found that 3,276 MW of combined heat and power (CHP) technical potential exists in the Con Edison service area over the next ten years.[21] Most of this CHP will comprise units smaller than 5 MW in size and will be in commercial and institutional facilities: hospitals, hotels, commercial office buildings, and large residential complexes. While this

[19]Energy Efficiency and Renewable Energy Resource Development Potential in New York State—Final Report, August 2003. The 2008 value is interpolated from the report's estimates for 2007 and 2012.

[20]The base case is derived as follows: 125 MW from NYSERDA's energy-efficiency and clean on-site generation programs plus 125 MW from Con Edison's DSM RFP plus 50 MW from NYPA's efficiency programs. This equals 300 total MW in peak demand reductions.

[21]Combined Heat and Power Market Potential for New York State Final Report 02-12. October 2002

D. Challenges & Opportunities

Energy Efficiency Programs

Energy efficient mechanical and electrical equipment and other building systems are typically more expensive than standard equipment on an initial-cost basis. Even though these systems can be more financially advantageous from a life-cycle cost perspective, split incentives, budget constraints, and/or an inability to compete effectively with alternative capital investments have meant that energy efficient investments remain far below their technical and economic potential. The rebates and other forms of assistance available today from entities like NYSERDA sometimes do not provide sufficient economic incentive to achieve the efficiency potential in the City.

Fuel Switching Applications and Thermal Energy Storage

The principal alternatives to the use of electricity for such critical purposes as summer cooling are steam and gas-fired chillers, both of which have higher upfront costs. The higher initial cost of purchasing and installing such systems stands as a serious impediment to their wider application. Also, steam chillers, gas chillers, and thermal energy storage systems generally have larger space requirements relative to standard electric chillers.

Clean On-Site Generation

Fault current limitations at several points on the distribution level of the grid directly affect the ability of synchronous generation devices such as natural gas engine-generator sets (which currently constitute the vast majority of such resources) to connect to the City's local electrical distribution system.[25] A number of Con Edison's distribution system circuits are currently operating at or near full capacity and large capital investments will be required just to maintain and support reliability. Additional investments will be required to allow interconnection of synchronous clean on-site generation systems. While more technologically advanced and cleaner devices such as fuel cells and solar cells are not subject to the same limitations, their current market share and penetration relative to engine-based systems still remains relatively small.

Moreover, a complicated and lengthy interconnection review and approval process adds significant upfront cost and uncertainty to potential projects. This is often further compounded by the customer's desire to ensure that the utility grid backs up their on-site generation. The interconnection of clean on-site generation facilities to the electric distribution system requires a series of

[25]Fault current is the momentary power that flows throughout an electrical system during a short-circuit disturbance.

- Support policies that promote investment in energy efficiency to enhance overall electric system reliability, lower consumer costs, and enhance the protection of the environment.
- Support the increased use of cost-effective energy efficiency, fuel switching, and clean distributed generation as a least-cost strategy for providing distribution load relief services.
- Assist Con Edison in obtaining cost recovery from the Public Service Commission for reasonable expenses necessary to defer distribution reinforcement projects.
- Determine the optimal target level of distributed resources for New York City in the next five years.
- Recommend appropriate levels and allocations of SBC program investments for distributed resources in New York City.
- Work with NYSERDA to prioritize and align existing and upcoming incentive programs according to New York City's distributed resources needs.
- Collaborate with NYSERDA to optimize the marketing and delivery of their incentive programs and associated technical support services in New York City.
- Encourage the targeted use of tax-exempt financing vehicles for distributed resources projects in New York City.

Support legislation and regulatory rule-making to set and/or enhance appliance standards and targeted incentives at the state and federal levels

- Support regular reviews and strengthening of the New York State Energy Code.
- Form coalitions and participate in regulatory and legislative proceedings at the federal and state levels to support stricter energy efficiency appliance standards.

Fuel Switching and Thermal Energy Storage

Determine the necessary types and levels of direct incentives required to overcome the initial cost barrier of installing steam and gas chiller and thermal storage systems

- Support regulatory policies that will provide Con Edison and KeySpan Delivery the ability and flexibility to offer individually negotiated rates for non-electric chillers and thermal energy storage systems.

Collaborate with the Partnership For New York City and the Real Estate Board of New York to expand the Summer Energy Program

- Share best practices and expand the Summer Energy Program to other large customer groups in New York City including, but not limited to, the Building Owners and Managers Association of New York, New York Energy Buyers Forum, Consumer Power Advocates, International Facilities Managers Association (NYC Chapter) and Greater New York Hospital Association.
- Seek technical and financial support from NYSERDA, NYISO, local utilities and other private sector sources to streamline and automate the existing Summer Energy Program implementation and to create a workable measurement and verification protocol.

Support incentives for peak load management enabling technologies

- Support the expansion of targeted incentives from NYSERDA for smart metering, sub-metering and building control systems.
- Continue to implement targeted and pilot real time pricing programs to transform the market and to spur technology development in energy information and building controls.

VI. Energy Delivery Infrastructure

A. Overview of the Energy Distribution System

The City energy supply addressed in Section IV of this report is of little value if electricity cannot reach those who need it on a reliable basis. The ultimate availability of electricity depends on an effective transmission and distribution system.

Electric demand was up this past summer, in large part due to burgeoning residential requirements, and the August 2003 blackout vividly reminded New Yorkers of the critical role energy transmission plays in their lives. In order for the City to remain an international center of commerce and culture, public and private decision makers must be sure that New York has a reliable and resilient energy delivery infrastructure.

Con Edison Electric Distribution System

The Con Edison distribution system covers 604 square miles and contains an approximate population of 8,786,300, which includes the Bronx-Westchester region, Brooklyn-Queens region, Manhattan region, and Staten Island region. The electric distribution system consists of 54 area substations supplying 75 secondary networks and non-network load.[27] As of January 1, 2003, Con Edison served 3,126,174 electric customers: 2,291,421 network and 834,753 non-network. Approximately 86% of its 23,945-MVA[28] distribution transformer capacity is underground and 14% is overhead.

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[27]A secondary network has the ability to supply load via multiple paths, whereas a non-network secondary system does not have this ability.

[28]MVA—Megavolt Ampere, a transformer capacity rating

B. Economic Development and the Energy Distribution System

Each year, the City's projected rate of economic growth is factored into each utility's demand forecast. A current trend of increasing demand, despite the economic downturn, has contributed to the need for some 2,600 megawatts of additional resources by 2008. New York City has a highly reliable distribution system, with numerous separate and distinct power grids, but constant investments must be made to ensure its continued resilience.

One of the Bloomberg Administration's hallmark initiatives is to expand the City's economy by capitalizing on the strengths of the outer boroughs. Numerous areas are being rezoned, and comprehensive plans are under review for the development of commercial and residential projects throughout the City. To make Hudson Yards, Long Island City, and Downtown Brooklyn attractive alternative business districts, companies locating there must be assured a reliable power supply. Similarly, educational facilities on Governor's Island (which has its own distribution network), and new development projects in Lower Manhattan, Morrisania, and East Harlem will all need a strong distribution network to serve new customers.

In many cases, the new commercial or residential development will occur on land that is currently underutilized. For example, the City's plans for the far west side of Midtown Manhattan (Hudson Yards) involve rezoning land from its current manufacturing designation to one that would allow the development of large commercial and residential buildings. Examining the distribution network in these areas is critically important. In the case of Hudson Yards, the distribution network might include district steam service for heating and cooling, provided that the extension of Con Edison's steam distribution system would be economically attractive.

The current situation in Chelsea illustrates the importance of comprehensive economic development planning. In 1995, the City rezoned large portions of Sixth Avenue in Chelsea to allow for the development of large residential complexes on land that had been previously reserved for manufacturing use. In the period since the rezoning, nearly 1,500 residential units have been built on Sixth Avenue between 24th and 31st Streets alone. As galleries, restaurants, and other businesses have opened, real estate values throughout Chelsea have increased and additional residential development has occurred. Chelsea's electricity demand has recently grown at an annual rate of 3.3%, and Con

districts. These critical utility facilities can be developed "as-of-right" in manufacturing zones, but not in residential and commercial zones. While the rezoning is intended to spur economic growth, it also restricts the energy infrastructure needed to support that growth. For example, the Hudson Yards Development Plan proposes rezoning that would change much of a manufacturing area to commercial and residential. As a result, Con Edison may not have an opportunity to build new substations as-of-right, and may face significant obstacles and substantial costs in securing the required variances or other approvals required to serve the economic growth. Ultimately, such costs are passed on to consumers.

Difficulties of Managing an Underground Infrastructure

While New York City's underground infrastructure facilities greatly enhance delivery reliability, maintenance and repair work on these facilities is difficult and expensive. Inaccessibility is an issue, not only because of the subterranean location, but also due to traffic disruption concerns and the sheer complexity of the underground network that includes telephone and cable lines, storm and sanitary sewer lines, subways, and water mains.

In a highly concentrated urban environment, a certain amount of disruption is inevitable in any substantial building or repair project. In the case of infrastructure work that almost inevitably involves opening streets for extended periods of time, it is particularly important to avoid unnecessary, costly, and inefficient projects on the same or overlapping sites.

D. Energy Delivery Infrastructure Recommendations

The primary responsibility for the City's energy infrastructure rests with the utilities that have the obligation to maintain and improve it. As noted above, they spend very large sums each year on infrastructure improvements and, to the extent that they are regulated, remain subject to Public Service Commission oversight in doing so. However, the City needs to play a role in facilitating necessary maintenance and upgrades of its energy infrastructure to the maximum extent possible.

Establish a collaborative capital infrastructure planning process between relevant city and state agencies and local utilities

- Establish a formal planning process to coordinate the major infrastructure projects for the City and State with local utilities.

with the movement of large trucks and equipment. Access is also integral to the supply of building materials, utility components, and for the development activities associated with maintaining the energy infrastructure.

VII. New York City—Leading By Example

A. Overview of City Buildings and Facilities

The City of New York owns more than 2,500 major building assets, containing over 200 million square feet, and leases an additional 22 million square feet of space.[31] These facilities are utilized by twenty different City agencies and range from brand new schools to the landmarked City Hall, courts, police precincts, correctional facilities, homeless shelters, hospitals, and recreation centers in parks. The New York City Housing Authority (NYCHA) is managed independently of the City and is the largest public housing agency in the nation. Its 181,000 dwelling units in 346 developments are located in 2,724 residential buildings. In all, New York City, excluding NYCHA, holds more than 5,000 electricity accounts. A summary of the annual electricity use at City facilities appears in the table on the following page.

Together, the City of New York and NYCHA use more than 10% of the total energy consumed in the entire City. By expanding and improving their efforts to deploy distributed resources, City agencies can

- significantly reduce electric demand and energy usage in the City;
- reduce the burden on taxpayers;
- have a distinct, if indirect, influence over practices in the private community in such areas as design, construction, operation, and energy policy choices.

[31] "Major building assets" are defined as buildings with replacement cost of more than $10 million and at least ten years remaining life.

pay for the cost of the project. Through ENCORE, NYPA offers turn-key services and low-cost financing to the City. Between January 1997 and September 2003, ENCORE completed 164 projects at a cost of $153 million, generating annual energy savings of $14 million, annual electrical energy savings of 55,000 MWh, and 8.7 MW in baseline energy demand reduction. Examples of major ENCORE projects demonstrate impressive savings:

- New high-efficiency lighting systems in more than 150 City public schools, installed at a cost of $42 million, save $7,000,000 annually in electricity expenses;
- Energy efficient chillers installed at the Brooklyn Municipal Building save $153,000 per year;

Similarly, City agencies have undertaken major energy efficiency initiatives of their own. The Department of Transportation has an initiative underway that will reduce energy use by nearly 20% per year by installing street lights and pedestrian crossing indicators that use significantly less wattage. At the Wards Island treatment plant, DEP has established an energy exchange with the New York State Department of Health. DEP sends digester gas to the Manhattan State Psychiatric Hospital; boilers at the hospital then use the digester gas to produce steam, which is then shared by the hospital and the treatment plant. Most of the steam is used for plant heating, but some is used by DEP to power chillers for air conditioning, thus reducing peak load on the electrical grid.

Clean On-Site Generation

Fuel cells generate "clean and green" electricity on-site at various City facilities including DEP water pollution control plants. In some cases, the fuel cells generate electricity from anaerobic digester gas, a by-product of the wastewater treatment process that would otherwise be flared to the atmosphere. The City now has eleven fuel cell installations; six are operational and five more are expected to be operational in April 2004.

In addition, certain New York City government buildings, including NYCHA, may be able to house equipment that can produce clean on-site electricity and heat using natural gas through the application of clean distributed generation (DG) or combined heat and power (CHP) systems. As discussed in Section VI, DG and CHP represent the potential to use current forms of energy more efficiently, and to thereby make a substantial net contribution to existing capacity. [32]

[32]See NYSERDA Final Report 02-12, Combined Heat and Power Market Potential for New York State (2002).

that was reduced at One Centre Street on a peak day during the summer of 2003.

High-Performance Building Design

High-performance buildings are generally those that are highly energy efficient, have low life-cycle costs, and minimize adverse environmental effects for their occupants and the community at large. The added initial cost for some of these high-performance features must be justified by the reduction in future costs and an improved working environment over the term of the building's operation.[33]

The City's Department of Design and Construction's (DDC) Office of Sustainable Design has incorporated high-performance building design elements in two completed pilot projects—the new South Jamaica Branch Library in Queens, and the new Children's Center in Manhattan, a central intake and training facility for the Administration for Children's Services. Four more pilots are under construction and ten are in design, including three projects being designed to achieve LEED certification from the U.S. Green Buildings Council.[34] These latter projects will be analyzed to assess the costs, benefits, and limitations of using LEED as a design tool in the ongoing effort to improve the performance of City buildings. Two of the projects incorporate photovoltaics into roof and exterior wall materials. Based on technical projections of energy performance, average savings on all the pilot projects should be approximately 20% above those mandated in the current New York State Energy Conservation Code. Actual savings on the completed projects are being monitored to ensure that such projected savings are in fact realized.

In order to further support these guidelines, the City recently joined with the federal Environmental Protection Agency and others in sponsoring a design competition for green buildings design in New York City. The competition will seek ideas on how to utilize clean on-site power generation, solar and wind energy, brownfield developments, and water and energy efficiency in new building designs. Winning designs will be displayed in all of the five boroughs. They will contribute to the City's understanding of green buildings and will benefit all City agencies and the public at large.

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[33]See High Performance Building Guidelines, New York City Department of Design and Construction, April 1999. This report was developed with the Design Trust for Public Space.

[34]Leadership in Energy and Environmental Design (LEED) is a consensus-based national design standard for developing highly efficient and sustainable buildings.

In addition, facilities that might have sufficient load-shedding capabilities are not currently equipped with the right meter type, building controls system, and rate structure, or have very limited functional flexibility to curtail load.

High-Performance Building Design

Initial costs of projects often overshadow life-cycle costs. High-performance building design and green buildings use materials and equipment with reduced impacts on global, local, and internal environments during their design, construction, operation, demolition, and reuse. While there are numerous life-cycle benefits from green buildings, many decisions made in the public and private sectors are still based on, or constrained by, the real or perceived additional cost of designing and constructing green buildings. Also, at this early stage in the technology adoption cycle, the benefits of high-performance building design are still challenging to quantify and justify to most decision makers.

D. New York City—Leading by Example Recommendations

Energy Efficiency

Enhance and augment the City's menu of energy efficiency programs

- Increase the use of energy performance contracting such as the City's Energy Cost Reduction (ENCORE) Program. Research thoroughly and consider alternative ways and methods of project delivery and financing.
- Develop a pilot web-based energy information management system to track and report on energy usage and the cost to operate select City facilities.
- Organize formal energy efficiency training programs for agency representatives, including facility managers and building engineers.
- Introduce a pilot commissioning program for new and existing facilities.[35]
- Consider incentives to encourage agencies and City employees to reduce energy and operating costs. For example: (1) assign dedicated resources to fund cost-effective incremental energy efficiency components in capital projects; (2) develop a high-profile awards program to recognize City employees for exemplary energy efficiency achievements.

[35] Commissioning is a process that ensures that building systems operate efficiently and according to their original design intent.

Clean On-Site Generation

Include clean on-site generation strategies as part of a least-cost resource plan to supply the electricity needs of City agencies

- Conduct a survey of City facilities to screen for potential application of clean on-site generation projects over the next six to twelve months.
- Forge partnerships with NYPA, NYSERDA, KeySpan, and Con Edison to develop and facilitate projects for various clean on-site generation applications including natural gas packaged co-generation, micro-turbines, fuel cells and solar photovoltaic systems.

Peak Load Management

Seek direct incentives and low-cost financing for peak load management enabling technologies

- Collaborate with NYPA, Con Edison, KeySpan, NYSERDA and NYISO. Request assistance for peak load management enabling technologies such as smart metering, sub-metering, and the upgrading or re-commissioning of building control systems.

High-Performance Building Design

Incorporate cost-effective high-performance design strategies into City-led projects for long-term value

- Review high-performance building strategies with client agencies and consider them in the context of an overall project plan prior to commencement of design and construction.
- Explore making LEED a requirement for all New York City new construction building projects.
- Seek public and private resources to support technical design assistance. Review energy-related building materials and equipment to determine their appropriateness for New York City capital projects.

Partner with private sector New York City developers and the building community at large to promote the benefits of high-performance building design

- Highlight innovative green and sustainable development projects, both in the public and private sectors, to illustrate the ability to incorporate extremely high standards even in very large buildings in New York City.
- Use the City's building code (currently under revision) and permitting process to foster innovative design and construction strategies. Work with the Department of City Planning to see if the same can be done with regards to zoning.

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The specific recommendations of this report reflect a consensus position of the organizations involved. In some instances, certain organizations may be precluded from actively endorsing specific recommendations if such recommendations are outside of the direct charter or mission of the organization.

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