BACKGROUND

NYC Energy Market Conditions

The New York City energy market is among one of the most complex in the nation. Due to tremendous in-city electricity needs, a focus on expanding generation supply to keep up with growing demand is of paramount importance. It is anticipated that NYC will require between 6,000 and 8,000 megawatts (MW) of increased generation capacity over the next 20 years in order to keep up with rising demand.[1]

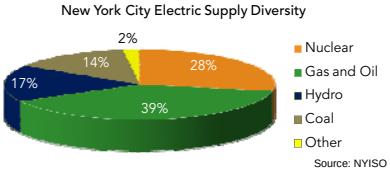


Figure 1 New York City electricity supply sources, as of 2008.

The current electricity market in New York is diverse, drawing from nuclear, gas, oil, hydroelectric, coal and other sources.[2] While most in-city generation comes from natural gas, coal and oil, there are significant nuclear and hydroelectric resources located throughout the state that contribute to New York City's base load requirements.

NYC Power Market Constraint and Supply Shortfall Forecasts

The State of New York as a whole potentially has enough capacity to meet demand on a regular basis, though the New York City area is constrained by a transmission bottleneck through Westchester County. Existing infrastructure is projected to be insufficient for estimated New York City demand growth, and politically fraught transmission construction projects are unlikely to go forward in the near- to mid-term. Given the constrained NYC power market, the New York State Reliability Council (NYSRC) has set a requirement that 80% of electricity used in New York City be derived from in-city generation.[3] This creates additional constraints on electricity supply. Indeed, in a May 20, 2008 *New York Times* article on Mayor Bloomberg, the first quote concerned a stalled generation initiative: "What's the matter with you?" he said to Councilman Peter F. Vallone Jr. "You know we need the power."[4]

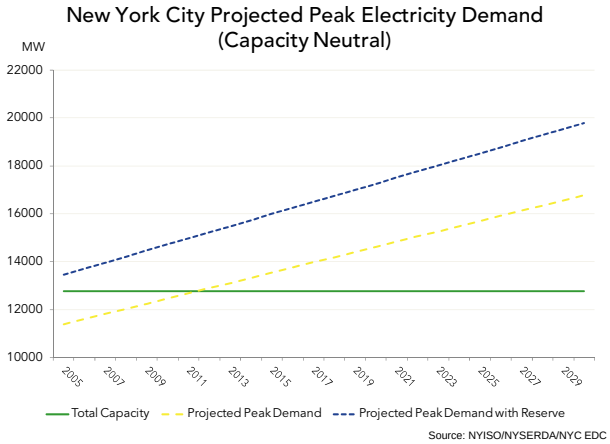


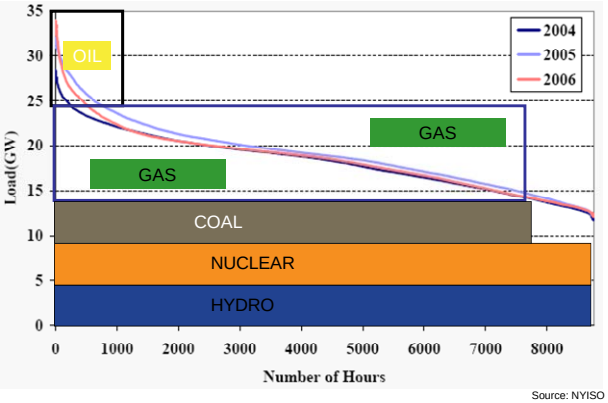
Figure 2 NYSERDA, NYISO and NYC Economic Development Corporation (EDC) projections indicate that NYC peak demand will overtake current capacity between 2011 and 2012. Total capacity includes approximately 9,000 MW of installed capacity in NYC and another 4,000 MW of imported capacity (maximum imported capacity is 5,000 MW, but this has traditionally been impossible due to transmission constraints). In addition, NYISO calls for 18% reserve capacity above demand, which is not currently being met.

NYISO & Merit Order Bid Stack Pricing

The New York Independent System Operator (NYISO) was created in the post-deregulation environment to manage the supply and demand of electricity throughout the entire state. In essence, it acts as the New York electric commodity market maker, aligning the demand of power buyers with the supply of power generators and setting prices for their transactions.

The market is divided into thirteen (13) NYISO zones, with Con Edison territory (New York City and southern Westchester County) comprising Zone J. Relying on historic demand data and daily load projections, the NYISO estimates day-ahead demand for each zone in the market. Generators bid in prices for their capacity based on their marginal costs (e.g. fuel), and the NYISO accepts bids to fill its projected demand requirements in each zone. This is called the Locational-based Marginal Pricing (LBMP) Day Ahead Market (DAM). In an effort to arrive at the most efficient market price, lowest bids are considered highest merit and those generators are dispatched first (i.e. base loaded); highest bids are considered lowest merit. This is called

[1] New York Building Congress <www.buildingcongresss.com/code/research-2006-overview.htm>.
[2] New York Independent System Operator (NYISO) <http://www.nyiso.com/public/company/about_us/index.jsp>.
[3] *Locational Minimum Installed Capacity Requirements Study*. 2/28/2008. NYSRC <http://www.nyiso.com/public/webdocs/services/planning/resource_adequacy/LCR_report_2_28_08.pdf>.
[4] "As Term Wanes, Bloomberg's Temper Boils Up," *New York Times*, 5/20/2008. <http://www.nytimes.com/2008/05/20/nyregion/20bloomberg.html>.



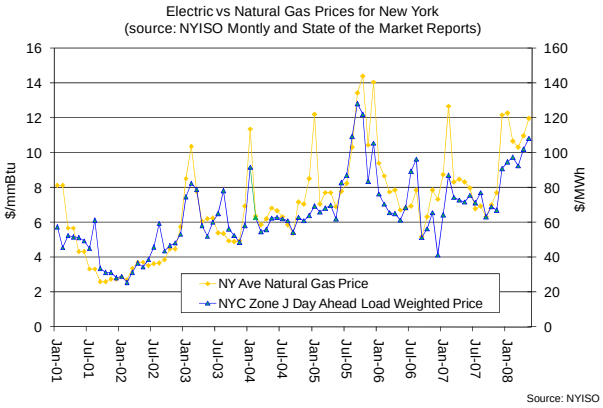
Source: NYISO

Figure 3 The load duration curve for NYC (NYISO Zone J), with an overlay of the "merit order bid stack" for dispatched generation. As demand increases, more expensive and less efficient (i.e. "lower merit") generation sources are necessary. For instance, hydroelectric and nuclear power are base loaded (lowest marginal costs, lowest bid price, highest merit first) while gas and oil are used to supply power in periods of peak demand (highest marginal costs, highest bid price, lowest merit last). These are the generators setting the commodity price for virtually all on-peak power in NYC; however, utility-scale gas generators have the same spark spread as the CHP system proposed for 888 Seventh but, without waste heat recovery, they generally use the fuel only about half as efficiently and therefore half as cost-effectively.

the merit order bid stack. Nuclear and hydroelectric generators tend to bid the lowest due to their low marginal costs (low relative fuel costs), while fossil fuel-based generators generally bid higher (depending largely on variable fuel costs). As a result, nuclear and hydroelectric generators are typically tapped first for base loads while additional demand is satisfied through fossil fuel-fired generation. Figure 3 illustrates the merit order bid stack for NYISO Zone J, showing generation dispatch by type according to the Zone's annual load duration curve. As expected, nuclear and hydro are highest merit, supplying base load all 8,760 hours in the year; coal and natural gas are next highest merit, dispatched more than 7,500 hours (including all peak demand hours) and oil is lowest merit, dispatched only about 1,200 hours during highest peak demand periods in the year.

Time-Differentiated Electric Commodity Pricing

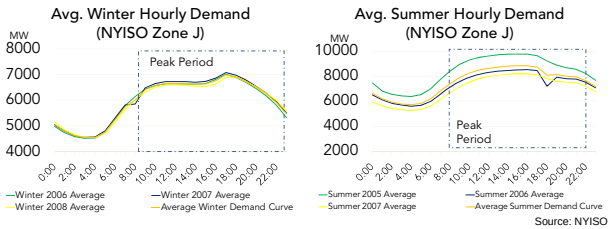
The price of electricity for any given bid period (every 15 minutes) in the NYISO DAM is set by the highest bid needed to meet demand in a given Zone for that period. Due to increasing demand in New York City (and Zone J, generally), coupled with the aforementioned 80% in-city generation requirement, electric commodity pricing for most of the on-peak hours is set largely by natural gas-fired generators and to a lesser extent by oil generators. Of the roughly 4,000 hours of highest on-peak demand in Zone J, Figure 3 shows that oil sets the electric commodity price for about 1,200 and natural gas for the remaining 2,800 or so. Thus, there is a historic link between the average price of natural gas in New York and on-peak Zone J electric commodity price, as seen in Figure ? (below).



Source: NYISO

Figure 4 Average natural gas prices and Day Ahead Market electricity pricing in Zone J (Con Edison territory) have historically risen and fallen in lock-step, as expected based on gas-fired generation representing the market-clearing LBMP bid during most on-peak hours in Zone J.

Due to the commercial nature of New York City, with many large office buildings ramping up power demand around 8-10 AM and ratcheting down demand by about 8-10 PM, daily electricity demand is concentrated during a roughly 12-14 hour peak plateau. The on-peak electricity demand profiles reach their highest during the winter heating and summer cooling seasons (see Figure ?), but the daily load profile is essentially the same shape throughout the year.



Source: NYISO

Figure 5 Average hourly demand profiles for NYISO Zone J, based on sample winter and summer days from 2005, 2006 and 2007.

Historically, average on-peak demand is approximately 35% greater than average off-peak demand. Given constrained supply, growing concentrated demand and the reliance on primarily natural gas for on-peak electricity in

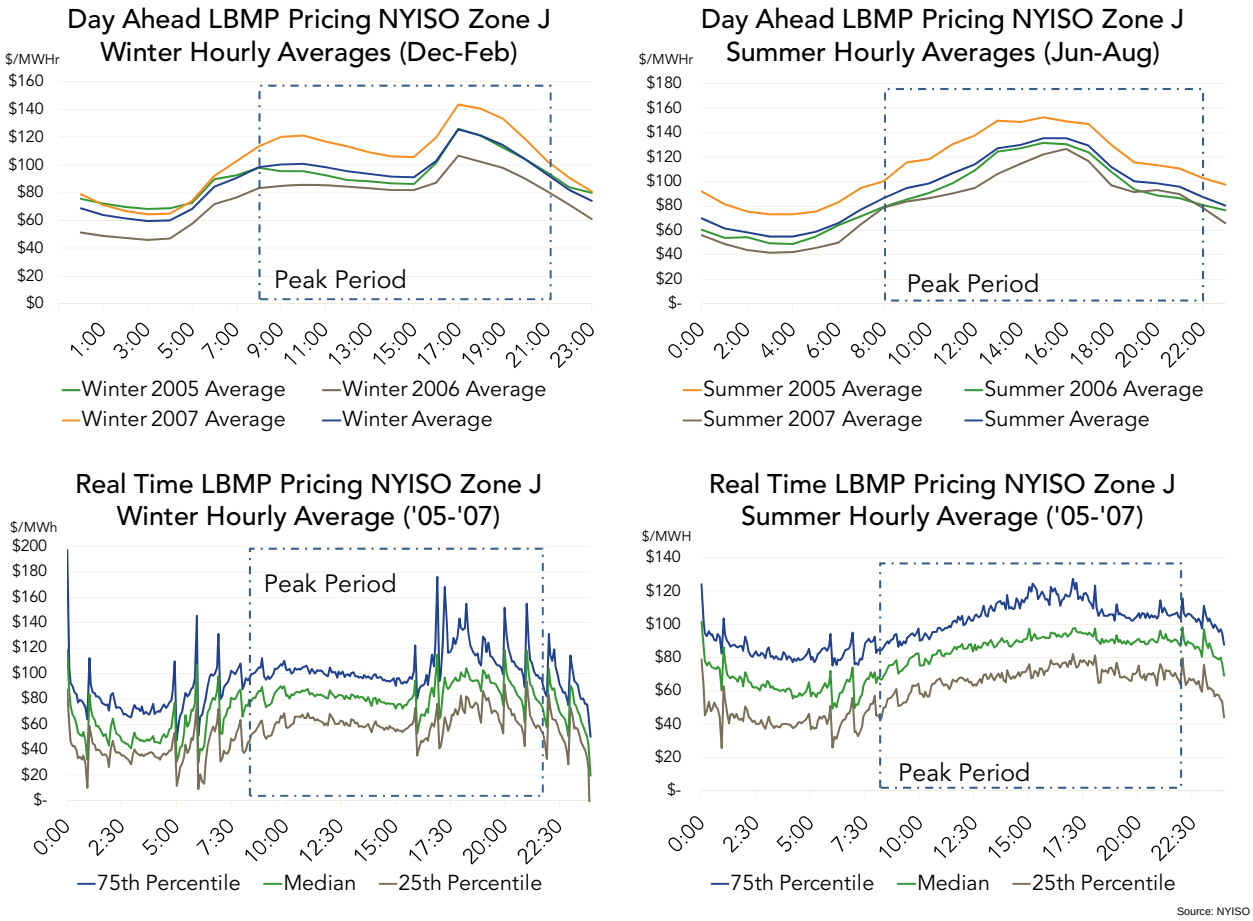


Figure 6 Actual NYISO Zone J (Con Edison territory) Day Ahead and Real Time LBMP pricing data, averaged for winter and summer 2005-2007, show that electric commodity prices have a similar peak plateau profile to the load profile of the typical NYC office building. In on-peak hours, when supply is constrained and demand high, Zone J electricity prices are generally significantly higher than in off-peak hours, largely due to the fact that the market-clearing price is typically being set by utility-scale in-city natural gas generators. These are the hours and the prices for which efficient CHP offset of electricity, along with recovered thermal energy, make most sense from the standpoint of effective demand reduction and maximized financial returns.

Zone J, market prices for on-peak power are higher than for off-peak power and generally vary with natural gas costs. Figures 6 illustrate the time-differentiated nature of NYISO's electric commodity pricing in both the LBMP DAM and the real-time market. This creates opportunities
for economic savings through on-peak energy demand reduction and more efficient use of natural gas, such as CHP.

Initiatives Encouraging NYC Distributed Generation

With potential capacity shortfalls forecasted for the near- and mid-term, a number of initiatives have been announced to aid in mitigating the situation. In 2003, New York Mayor Michael Bloomberg commissioned an Energy Policy Task Force (EPTF) which issued a report in January 2004 proposing 28 recommendations, of which nine dealt directly with the development of distributed resources throughout the city. These recommendations included directives to:

- Determine the types and necessary levels of direct incentives to overcome the initial cost barrier of installing steam and gas chillers and thermal energy storage systems.
- Support the use of clean on-site generation systems.
- Adopt a standardized and streamlined interconnection review and approval process for clean on-site generation systems.
- Support incentives for peak load management enabling technologies.[5]

[5] New York City Energy Policy Task Force <www.nyc.gov/html/om/pdf/energy_task_force.pdf>.

In 2006 Con-Edison set a three-year target of 675 MW of distributed resources including on-site generation.[6] Finally, in 2007 Mayor Bloomberg's office released PlaNYC, "a comprehensive sustainability plan for the City's future." Among PlaNYC's energy goals are:

- By 2030 increase the amount of Clean Distributed Generation resources by 800 MW.
- By 2015 increase the total amount of generation capacity in New York City by between 2,000 MW and 3,000 MW.
- Promote Peak Load Management programs.
- Reduce global warming emissions by more than 30%.[7]

One common form of Clean Distributed Generation is Combined Heat and Power (CHP). CHP systems have several advantages over traditional utility generation. In the process of generating electricity at a utility-scale plant, a tremendous amount of heat is created which generally goes unused. This heat loss combined with electricity lost over transmission lines en route to the end-consumer means that the typical coal, oil or gas-fired utility can only operate at approximately 33% efficiency (as measured by dividing the potential energy contained within a fuel—i.e., MMBTU's—into the actual end-product electricity--MWH). Because CHP systems capture waste-heat and can utilize it productively (in the form of steam-generation for heating and air conditioning as well as domestic hot water production) on-site, along with the lack of long-distance transmission loss, these systems will typically operate at efficiencies above 60%. At the same time, today's new gas-fired generators produce less emissions than their older utility counterparts and can reduce a building's carbon footprint (the impact emissions containing carbon—greenhouse gases—have on the environment) significantly. This reduction in carbon footprint can also increase a building's ENERGY STAR® and LEED ratings, contributing positively to a building's reputation and economic bottom line.

A CHP system displaces much of its on-peak electricity expenses with fuel expense (natural gas) that feed the generator. In New York City, where the price of peak electricity is significantly higher than the price of off-peak electricity, economic benefits can be gained by operating the system during peak load hours. This arrangement is called Peak Coincident Distributed Generation (PCDG). Because the cost of operating the generator during peak hours (inclusive of fuel and maintenance charges) is significantly less than the cost of purchasing the equivalent electricity directly from the utility, a building owner can realize maximum economic savings by operating the CHP system only during peak load demand hours. In addition to the electricity produced, many buildings in the New York City market utilize steam-based heating and air conditioning systems. Steam purchased from Con Edison complies with the same peak/off-peak pricing scheme as electricity. Thus the same economic savings can be realized by utilizing the CHP system to produce steam during peak hours.

The New York State Energy Research and Development Authority (NYSERDA) has issued Program Opportunity Notice (PON) 1197 seeking service providers to complete feasibility studies on possible CHP projects in the New York City metropolitan area. Pursuant to PON 1197's requirements, the proposed system described in this study meets the following requirements:

- Facility where proposed system is installed must utilize 75% or more of the potential output of the system.
- Energy efficiency must be greater than or equal to 60%.
- Sum of all usable thermal energy must constitute at least 20% of the technology's total usable output.
- System must produce between 100kW and 5MW of electricity.

[6] NYC EPTF 2006 Status Report <www.nyedc.com/NR/rdonlyres/B418F914-9905-4DDE-BA07-30C521B1EB2E9/0/2006StatusReportFinal061406.pdf>.
[7] PlaNYC 2030 <www.nyc.gov/html/planyc2030/html/plan/energy.shtml>.