

---

# *Power Conundrums: Electrical Resources in the NYC Load Pocket*

*Michael F. Bobker  
Association for Energy Affordability*

## ABSTRACT

Power system deregulation has introduced new investment market dynamics into the development of electrical resources. Under deregulation, load pockets present various special, inter-related investment decision-making problems. A variety of examples are provided. A game theoretic approach suggests that large project development is constrained by uncertainties about other projects and that, as a result, decisions are not made in the timeframe that energy system planners had become accustomed to under regulated regimes. This is consistent with observed recent behavior in the New York metropolitan area power market. The performance of power plant developers with approved Article X sites is reviewed. Delays today in project investment and construction are shown to result in predictable power shortages five to seven years in the future. An argument is presented that smaller, demand-side type investments avoid the investment-decision uncertainties of large supply-side projects and bring desirable, more economically efficient investment behaviors into the power market. The quantified potential of demand-side resources in New York City is assessed in relation to projected demand growth. It is observed that the reduced ability to control power plant investment in a deregulated market makes the mobilization of demand-side resources a more critical part of market performance.

## INTRODUCTION: CAPACITY DEVELOPMENT UNDER DE-REGULATION

In the regulated electricity regime, utilities have the obligation to serve their monopoly service area. This obligation includes planning and building the necessary capacity to assure reliable service. In exchange for this obligation, the utility receives a guaranteed return on its invested capital; the regulator sets rates as necessary to assure this. The utility establishes its load (demand) projections and a plan to meet it, subject to the regulator's review and approval. Once approved, the utility is able to go to the financial markets with a secure proposition.

Deregulation completely changes this development process. No longer is there a single organization responsible for assuring adequate supply of electricity and electrical capacity. Instead, market demand is supposed to elicit the free and timely entrance of new generators. Extensive collaborative proceedings considered and developed the workings of daily markets, creating institutions (in particular the NY Independent System Operator) and specific mechanisms, rules and procedures for market participants. Much less was established concerning the longer term investment dynamics of merchant generation and transmission.

The operation of markets is often idealized in introductory economics textbooks and in the minds of politicians. Deregulation may make market entrance possible where it was not before, but it is never "free." There are procedural rules for siting new plants, and transmission and construction permits to be obtained. A generating plant or transmission line is certainly not free—it is an expensive proposition that requires the faith and backing from investors who participate in financial markets.

### **Game Theory**

Economic textbooks simplify the process of new supply responding to demand. In the real world, it is a process of investment decisions made by market players. Each of these market players looks not only at market demand but also at other suppliers. Especially where there are only a few suppliers, their decision-making is based on evaluation of other players' moves. These kinds of situations are best analyzed in a framework known as Game Theory, sometimes called Interactive Decision Theory, a discipline that concerns the behavior of decision makers (players) whose decisions affect each other.<sup>1</sup>

Without developing the kind of mathematical analysis typical of

Game Theory, we can gain a valuable insight through understanding that market players decisions will be based on their evaluation and expectations of other market players' actions. Situations such as the classic "Prisoners' Dilemma" pose conditions in which each player's most desirable outcome is placed at risk by the other player's strategy. A less desirable choice is made to reduce risk. The total payoff for all players (society) is less than what might have been realized but is more secure and predictable. Another field of economics, Operations Research, has come to similar conclusions: that decision-making behavior often seeks a "satisfying" solution that is less than optimal but minimizes risk.

## THE NEW YORK CITY LOAD POCKET

Load pocket status is characteristic of most urban areas, consisting of a situation in which the load exceeds, at least for some of the time, the transmission capacity. It is treated as "congestion pricing" in which a market balance must be struck between remote generating resources and transmission and in-city generating resources.<sup>2</sup> The remote resources are assumed to be less expensive, justifying the payment for transmission rights when they are available.

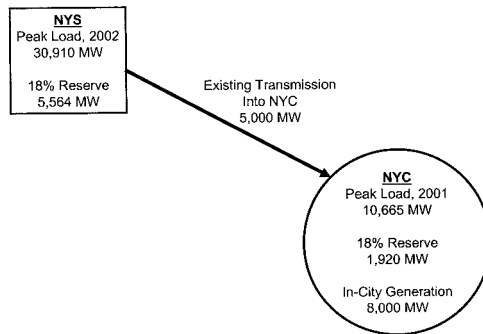
This situation, shown in Figure 1, for the relation between New York City and New York State, is characterized by

- Constrained transmission into the city, less than the city's peak requirement, creating a "load pocket." The city's base load of 7,000 MW also exceeds the transmission capacity.

This is the basis of the installed capacity market mandated by the ISO, requiring that all retailers purchase contracts for in-city installed capacity equal to 80% of their purchased capacity.

- Summer peak demand approaching the margin of present supply capacity

Because electricity prices are a function of real-time electricity availability, especially under deregulation, this situation is most significant for a city that already faces among the highest electricity prices in the nation, well above national, regional and state averages. The NY Independent



**Figure 1. NYC Load Pocket: Peak Load and Capacities**

System Operator (ISO) suggests potential price increases of 15-20% by 2005 unless capacity is significantly increased. The attractiveness of the city for businesses, the competitiveness of businesses already located here, and the associated tax base are all impacted.

Even more impacted are the city's working and low-income populations, who are burdened with energy costs as a higher percentage of their budgets and have no way to pass along these costs. With energy prices made in a unitary wholesale market and cross-class subsidies out of favor, price spikes at system peak from a concentrated commercial sector are spread across the prices everyone pays.

Beyond price spikes, marginal capacity has a physical aspect, affecting the system's voltage stability. NYC's key banking and financial industry has a digitized infrastructure with mission-critical power reliability and quality requirements.

What is not shown by the diagram of load pocket structure is what has characterized the market experience and policy considerations of the past two years:

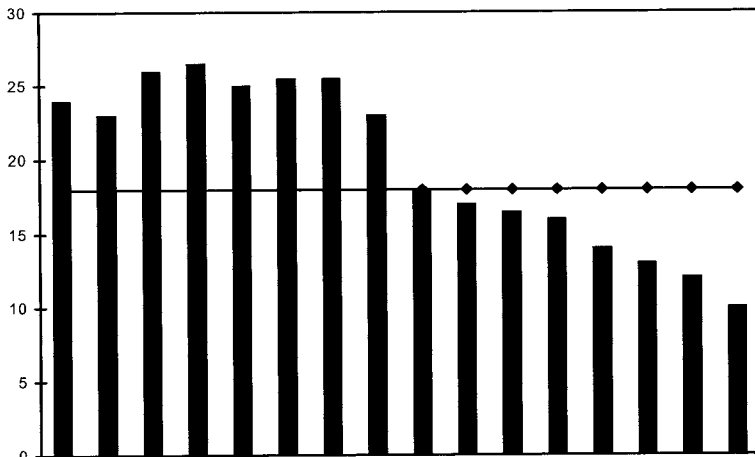
- Uncertainties in siting, investment and timing of new generation and transmission projects

This situation requires a long-term perspective because of the "lumpiness" of power sector investments on the supply and transmission side. "Lumpiness" describes both time and investment.

Siting infrastructure is a delicate and highly charged political issue in metropolitan areas. The regulatory review process and political debate drags on for years, even with procedural protocols established by NYS

law, Article X for plant siting and Article VII for transmission line siting, established with the intent of providing for public participation while keeping decisions out of the court system.

While demand grows fairly steadily in small increments, in response to economic growth, population, and increasing affluence, supply does not. At least not when considered from the traditional electric system planning perspective. Figure 2 shows the effect of incrementally increasing demand when supply is constant with respect to the system's reserve margin.



Source: NY ISO Power Alert, March 2001

**Figure 2. NY's Declining In-State Capacity Reserve Margin Base Case—No New Generation**

The reserve margin, considered desirable at 18% of peak load, protects the system's reliability, but also protects against the exercise of market power on prices, which proved so devastating in California. In a worst-case scenario of no capacity additions, the ISO projected reserve margin shortfall starting in 2003. A system can move from what seems like robust capacity surplus to marginal shortage in a matter of a few years. Because this is also the timeframe for the development and construction of large plants, delays in the flow of projects can fairly quickly drive a system to criticality.

### Projecting Capacity Requirements

Understanding this, the NY Independent System Operator (ISO) has indicated, starting in 2001, the need by 2005 for 7,000 to 8,000 MW of

added capacity statewide, 3,000 of which should be within NYC.<sup>3</sup> To put this in perspective, a MW of new, standard utility plant capacity costs +/- \$1 million, so we are talking about, respectively, \$8 billion and \$3 billion in capital funding.

The ISO, however, has no authority to actually implement a plan to accomplish this; it only suggests what the market needs to accomplish. At the Governor's direction in 2002-2003, the state-owned New York Power Authority did take action, as an emergency measure, installing eleven turbine systems, each just under 80 MW (thereby exempt from the Article X process), thus providing a safety margin until several re-powering projects are on-line (Keyspan-Ravenswood, Con Ed-East River, and NYPA-Poletti).

More recently, starting in 2003, the City of New York itself realized that it faces a critical infrastructure issue and organized a task force to address it. Their findings are consistent with those of the ISO, finding a need for just under 3000 MW by 2008, as calculated in Table 1. Table 2 goes further, showing the specific resources in the approval pipeline, and Table 3 tallies up what the task force report refers to as "distributed resources," which include efficiency, cogeneration and demand-response.

## GAME THEORY CONUNDRUMS

Investment in the NY power capacity market has not been forthcoming as smoothly as was once expected. Projects across the state approved under Article X have not gone forward into design and construction. The late 1990s were a troubled time for investment generally, with the Internet-bubble collapse leading a broad stock market decline. Investors are especially wary of the energy sector following the Enron scandal and a continuing wave of difficulties for merchant power producers.

In fact, while the constrained NYC load pocket focuses on peak capacity shortage as its driving consideration, the merchant power industry in general appears to have over-built, causing a poor financing picture for new plants for some years to come.<sup>4</sup> This suggests that out-of-city electricity would be significantly less expensive than in-city supply if sufficient transmission were available. This is even independent of the fuel considerations that work in the same direction.<sup>5</sup>

As New York State deregulated, it was argued that new entrants would bring cleaner, more efficient technologies into the market to

**Table 1. NYC Electric Resource Net Need, 2003 to 2008**

	MW
<i>Projected Demand</i>	
1. Need to Meet Demand Growth	665
2. Need to Assure Market Stability	1,000
3. Need to Replace Aging Power Plants	2,115
Total Capacity Need	3,780
Less	
<i>Projected Supply and Distributed Resources</i>	
4. Power Plants Under Construction	(875)
5. Distributed Resources (base case)	(300)
<b>Net Capacity Need Through 2008</b>	<b>2,605</b>

Source: NYC Mayor's Energy Task Force.

**Table 2. Resources in Approval Process**

	MW
<b>Power Plants Certified for Construction</b>	
Astoria Energy	1,000
Reliant Astoria Re-powering (net)	562
<b>Power Plants in Certification Process</b>	
Sunset Energy	520
TransGas	1,100
<b>Transmission Certified for Construction</b>	
PSEG Cross Hudson (Bergen)	550
<b>Transmission in Certification Process</b>	
Conjunction LLC Empire Connection	2,000
<b>Total</b>	<b>5,732</b>

Source: NYC Mayor's Energy Task Force.

compete with and eventually drive out and replace older, less efficient plants. Despite a spate of combined-cycle gas plants, older coal and heavy-oil-fired plants have remained in the market, increasing their operating hours and seeking to increase their capacities; this is what the political

**Table 3. Distributed Resources, Low and High Estimates**

	Low Estimate MW	High Estimate MW
Peak Load Management	127	127
Energy Efficiency	300	868
Clean On-Site Generation	142	343
<b>Totals</b>	<b>569</b>	<b>1,338</b>

Source: NYC Mayor's Energy Task Force.

fight over New Source Review rules is about.<sup>6</sup> This is also the projection for the coal and heavy-oil-fired generators along the Hudson River Valley that are well positioned to supply the NYC market.<sup>7</sup>

Notice that even within the NYC load pocket, the supply projects in the queue (see Table 2) are more than double the projected resource need. If all the listed projects were constructed in the 2008 timeframe, there would be a large capacity surplus and prices would collapse, making all the projects uneconomic. This scenario does not even consider the distributed resource (see Table 3), which is conservatively assessed.<sup>8</sup> Looked at in this way; it may become more understandable why investors are hesitant to move ahead on any given project.

Electric sector deregulation has brought forth a new and still largely untested market mechanism for raising capital. The interactive decision-making framework of Game Theory helps us understand the detailed conundrums faced by independent but interacting market participants. Some examples:

- An in-city power plant investment cannot price and value its revenue stream without knowing what new transmission lines may be brought into the city
- A transmission investment cannot price and value its revenue stream without knowing what power supply will be available within the city
- An out-of-city plant investment cannot evaluate its access to the NYC market without knowing transmission logistics
- An in-city power plant investment must be able to assure and price its natural gas supply from pipelines
- Natural gas pipeline investment, while presently tied up in right-of-way disputes with local communities, cannot be fully evaluated independent of electric transmission plans.

The risk-minimizing decision for the investor in these unresolved interactive situations is to do nothing. Under the regulatory system, such issues were resolved by planning. Eventually they will be resolved under the new market arrangements. But here enters the interplay of investment and construction lumpiness: with a 3-5 year construction timeframe, investment delays now spell out electric capacity shortages in the second half of the decade. Looking only at supply and transmission resources, this scenario looks more and more inescapable. Risk-minimizing individual delays flirt with disaster for society as a whole.

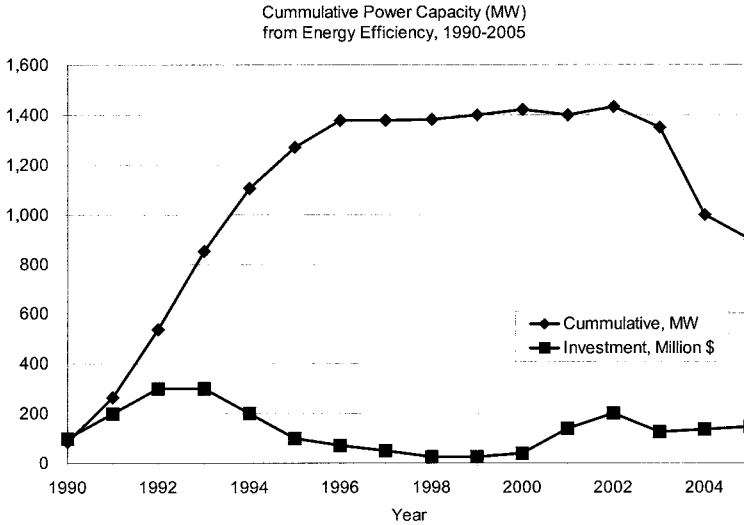
### **Players on the Demand Side**

Projects that reduce demand or slow its growth have essentially the same system impact as new capacity, but are individually much smaller and incremental in character. Richard Goldstein of the Natural Resources Defense Council (NRDC) recently points out that “energy efficiency standards for appliances (are) saving as much energy every year as the entire output of the US nuclear energy program.”<sup>9</sup> In so far as many energy efficiency measures are less expensive than new construction of plant capacity and have lower on-going operating costs, they actually improve the economic performance of the system.

The simultaneous beauty and difficulty of efficiency resources lies precisely in the institutional structure of efficiency investments, of involving private sector funds at the property level. The power sector effectively gains new sources of funding, leveraging private facility investment and operating budgets. Because each such project investment is only a small enhancement of overall property revenue and can act as hedge against future energy price increases, they are not subject to the full weight of interactive conundrums facing major infrastructure merchant investors.

At the same time, the real estate sector’s decision-making is unwieldy, alien, and unreliable from the utility planner’s perspective. Producing power, or “negawatt power” is not the real estate owner’s line of business -- can they be relied upon to make timely decisions and then do what is necessary to sustain load avoidance for the next 10 or 20 years? Examining the New York State experience in the early 1990s, illustrated in Figure 3, is instructive.<sup>10</sup>

Under regulatory rules and incentives known as Integrated Resource Planning (IRP),<sup>11</sup> the NYS Public Service Commission (NYS PSC) mandated efficiency programs by utilities. Con Edison became for a time the largest



**Figure 3. NYS Utility Energy Efficiency, 1990-2005.**

procurer of energy efficiency projects in the region, providing aggressive incentives for many end-user installed technologies. Between 1990 and 1995, more than 1,300 MW of capacity (“megawatts”) were obtained statewide.<sup>12</sup> Since deregulation, the need for incentives to mobilize the real estate industry for this kind of investment is addressed by System Benefit Fund programs administered by the NYS Energy Research and Development Authority (NYSERDA) on behalf of the NYS PSC.<sup>13</sup>

## CONCLUSION

Applying the game theoretic perspective of interactive decisions provides a better understanding of investments in the power sector. Delays are not just a function of “the investment climate” but are based in structural relationships between resources on the supply side—generation and transmission.

Demand-side resource decisions are made through a distinct network. While they can provide a significant contribution to the same physical system, they are largely independent of the interactive decisions on the supply side. Therefore they have the potential to provide critical capacity while understanding of new market-based relationships evolves on the supply side.

---

**Endnotes**

- 1 The New Palgrave Dictionary of Economics.
- 2 See Steven Stoft. *Power System Economics*, 2002. esp pp 390-394 for a locational marginal pricing (LMP) and congestion pricing framework.
- 3 NY ISO "Power Alert" 2001 and "Power Alert" 2002.
- 4 J.Fisher. "Working Off a Surplus," *Hart's Energy Markets* v.8 no.12. December 2003.
- 5 Air emission rules prohibit coal-burning within NYC and both residual and diesel oils are restricted.
- 6 See B. Barcott "Changing All the Rules" *NY Times Sunday Magazine*, April 4, 2004 for a summary account of this issue.
- 7 Pace Law Energy Project "A Clean Energy Strategy for the Hudson River Valley." Presentation of research findings, May 2004 at the Hudson River Foundation, NYC.
- 8 The demand-response estimate is limited in the high-case to the presently existing participation in the ISO's demand-response programs. The high-end efficiency estimate is little more than 10% of NYC base load, when energy audits of individual facilities typically find 25-40% electrical reductions cost-effectively available. The on-site power estimate is limited substantially below the 3,000 MW of cogeneration opportunity found technically feasible in NYC by a NYSEDA study in 2002.
- 9 NRDC journal *On Earth*, December 2002.
- 10 The source of Figure 3 is the New York Energy Research and Development Authority, New York State Energy Plan 2002.
- 11 For a full account of the development of IRP and utility efficiency programs nationally and their demise under deregulation see Richard Hirsh, *Power Loss*, 2001.
- 12 Hopefully many of the projects reaching their 10-year life are not actually being retired (and therefore showing up as capacity reductions in the data that account for the curve's downturn after 2002) but instead are being maintained and sustained by private sector (facility) funding so that the picture may not be quite what this graph suggests.
- 13 SBC-NYSEDA investment at \$150 million per year is just more than one half of what utility efficiency investment had been at its 1992-1993 peak.

---

**ABOUT THE AUTHOR**

**Michael Bobker** is a Certified Energy Manager and holds a Master of Science in energy management from New York Institute of Technology as well as graduate degrees in sociology and anthropology from Oberlin College and Business Management from New York University. He has worked in the NYC buildings sector for over twenty-five years in various capacities revolving around energy efficiency technology implementation, policy, and training. He can be contacted at *Mbobker@aol.com* or *Mbobker@aenyc.org*.