A Master Transmission Plan for New York City

Final Briefing

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New York City Economic Development Corporation

June 2, 2009
Electric System Planning Working Group Meeting
Albany, New York

Today's Agenda & Schedule

Briefing for ESPWG	**10:00-11:30**

This presentation is a companion to the final report, and does not contain all of the analytic results contained within the report

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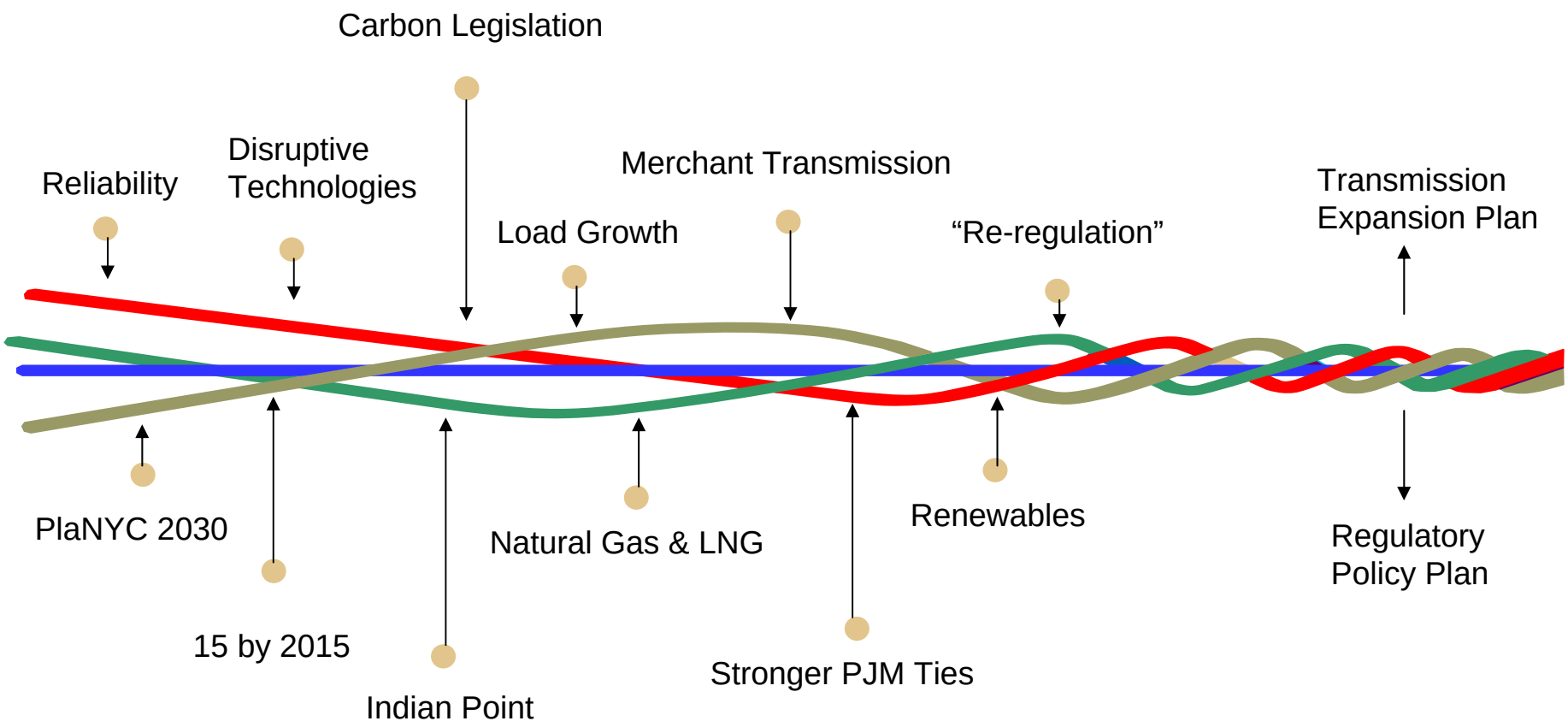
Introductions

- **Attendees**
  - **CRA**: Christopher Russo
  - **NYCEDC**: James Gallagher
  - **NYISO:**
  - **NYS DPS:**
  - **NYS PSC:**
  - **NYC:**
- **CRA Web Portal**
  - We have created a secure web portal at https://nycedc.crai.com

Project Overview & Objectives

Project drivers



There has been no integrated analysis of the impact on New York *City* from these factors; market forces can only address some of these factors

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Key Personnel and Project Stakeholders

EDC Senior VP for Energy
- James Gallagher

EDC Project Manager
- Thomas Simpson

CRA Project Manager
- Christopher Russo

CRA Vice President
- Robert Stoddard

Other Key CRA Project Staff
- Scott Niemann
- Bruce Tsuchida

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Our Goals and Deliverables

Goals

- Decrease cost of service for NYC ratepayers
- Improve the reliability of bulk power supply to New York City
- Reduce electricity production costs
- Reduce NYC's electricity "carbon footprint"
- Improve the City's diversity of fuel supply
- Ensure a fair, competitive market for electricity generation and transmission in NYC

Strategies & Action Plan

- Create an "apples-to-apples" comparison of the economic and technical impact of major transmission projects
- Identify what measures are necessary to improve the planning processes to achieve NYC's objectives
- Deliver an action plan and roadmap for optimal expansion of NYC's transmission infrastructure

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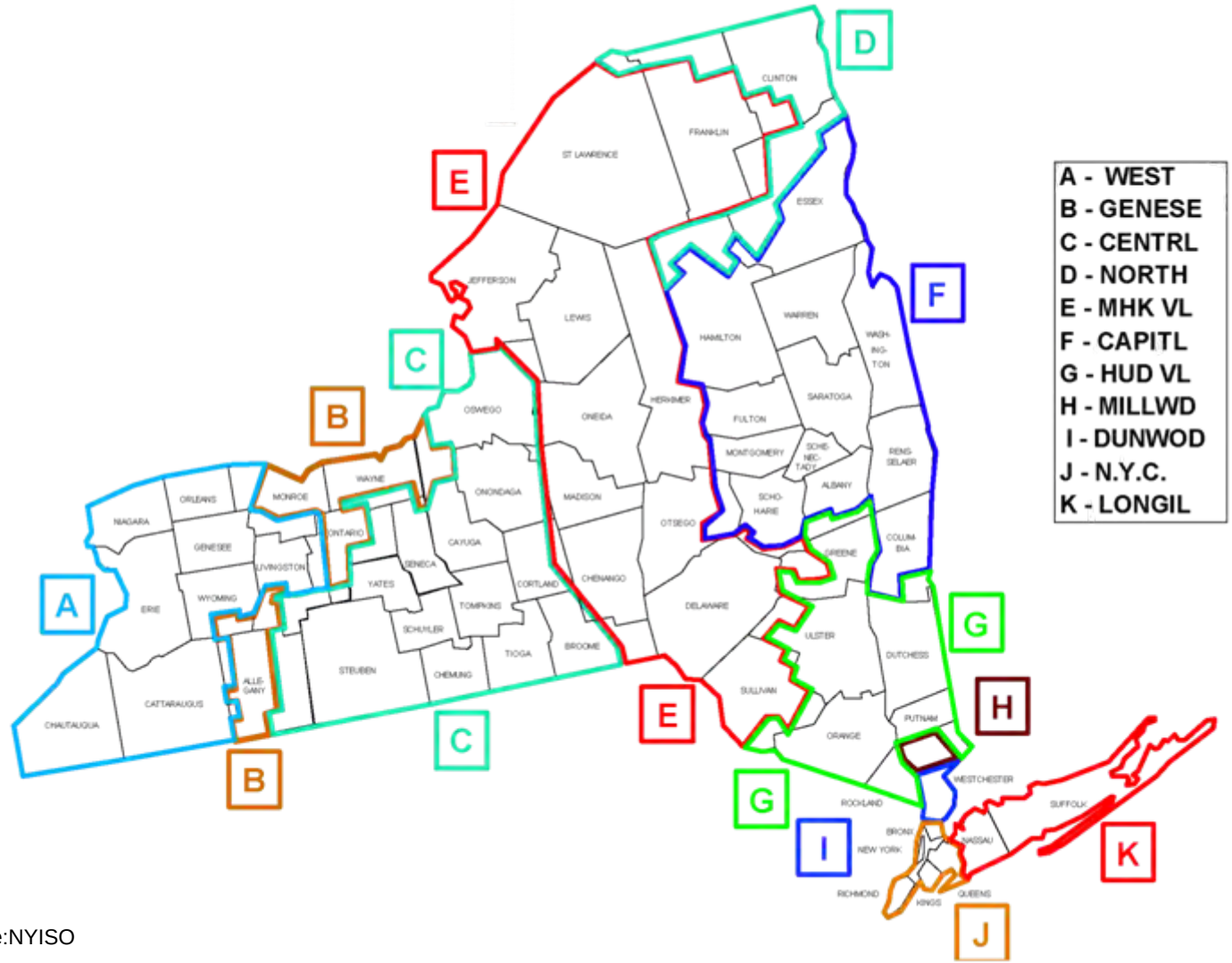
Evaluation Attributes

System reliability	Ability to meet reliability standards, including NERC and FERC measurements
Zone J ratepayer impact	Impact on cost to serve load in New York City, taking into account more than LBMP alone
Overall Production cost	Wholesale energy cost in zones I/J/K as well as the NYCA, and impact on the installed capacity markets
Carbon footprint	The amount of carbon associated with the entire system, and system components (e.g. transmission vs. source)
Supply flexibility	Does the system have the ability to utilize multiple type of fuel supplies? What about diversification by geography?
Feasibility of financing	Can the projects potentially be financed?
Encouragement of competition	Do the projects or regulatory changes help to promote a “more competitive” energy marketplace?

Key Findings, Recommendations & Implications

New York's Power Market Zones



Source:NYISO

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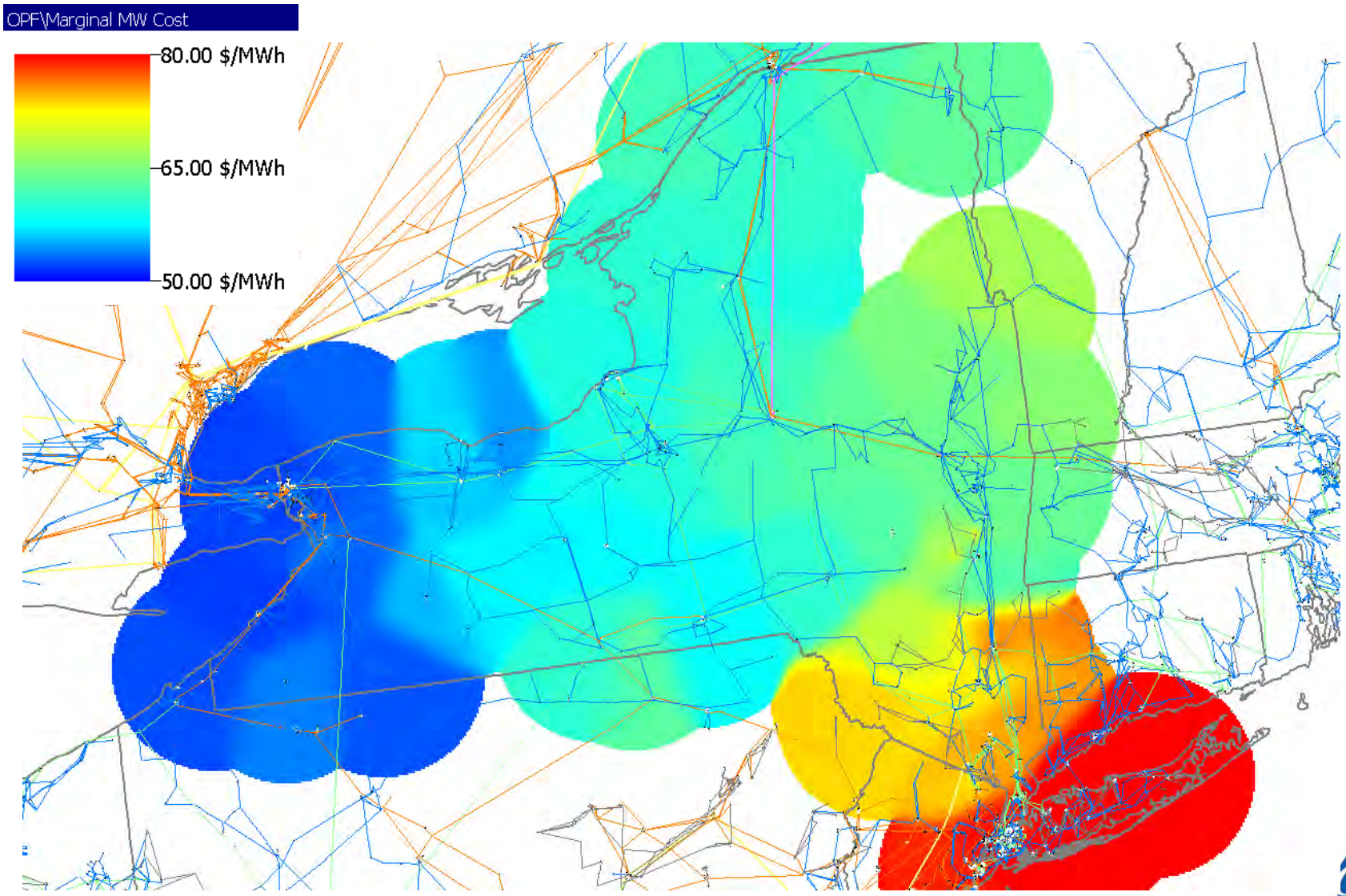
New York's Typical Energy Price Patterns



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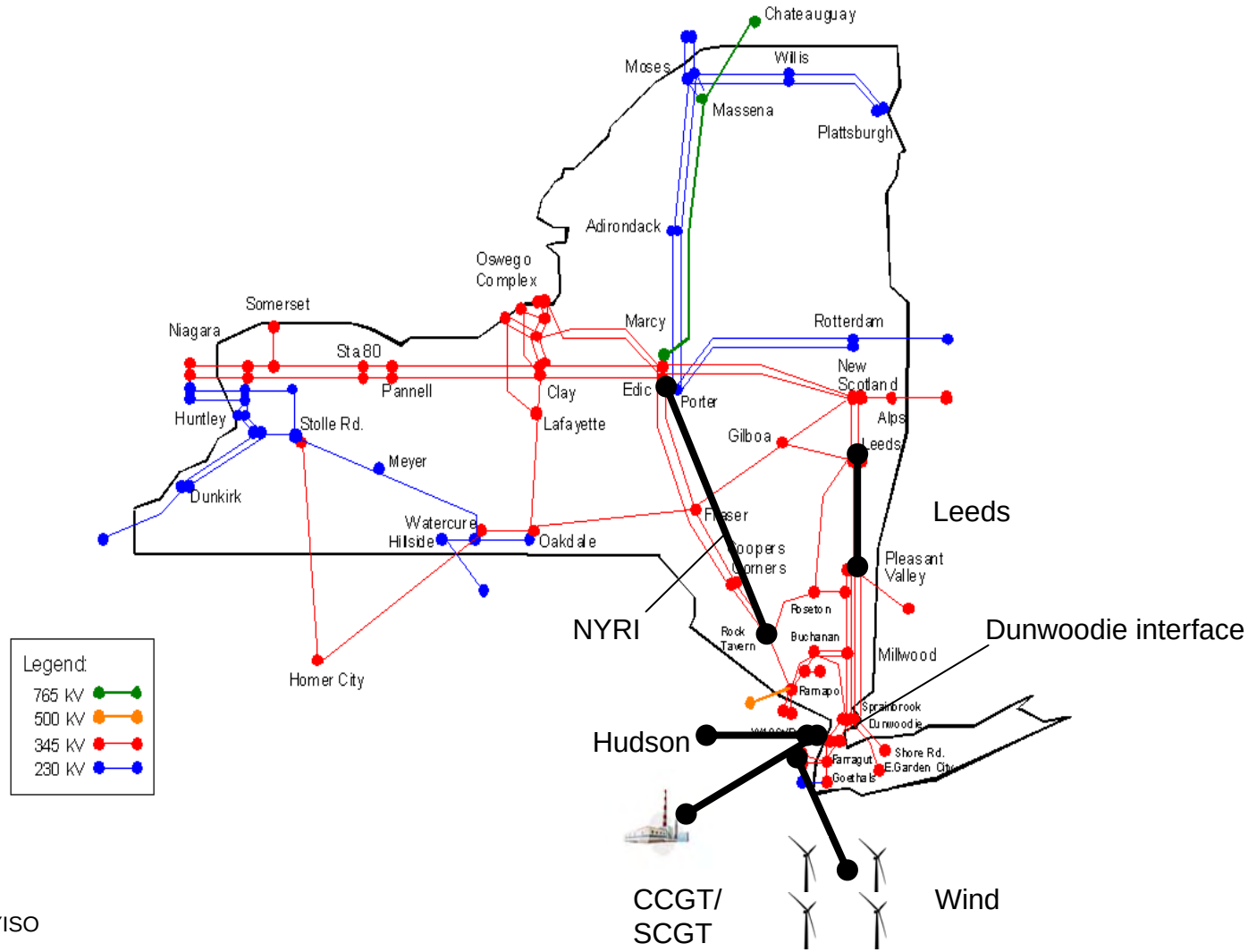
New York's High Voltage Transmission System



Source:NYISO

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Key Findings

- **None of the transmission projects we evaluated show substantial net statewide economic benefits for NYC or NYS ratepayers**
  - There is neither a critical economic nor reliability need for new transmission or new generation in NYC in the near future; new generation would not be needed until 2019. High load growth, high fuel prices, and low carbon prices have only proportional differences on these benefits
- **The most economically beneficial options for NYC ratepayers are new in-City generation or the Leeds – Pleasant Valley project**
  - Most benefits from each project derive from the energy market; NYC has a surplus of supply in the installed capacity market
  - New in-City generation or transmission would create economic activity and lower energy prices for consumers in NYC
  - The projects we evaluated are largely mutually exclusive in terms of benefits
  - Only one transmission project we evaluated would be beneficial if evaluated solely under the production-cost metric
- **No project evaluated would significantly affect the reliability of energy supply in NYC**
- **With the exception of the Leeds and NYRI projects, overall Statewide air emissions changes are relatively small – less than 1% in most cases**
  - The Hudson cable raises emissions in PJM, but the impact is less than 1% overall
- **The benefits from the Hudson cable are highly dependent on the difference in prices between NYC and NJ; this difference may not be the same in the future as it is now, but there is good reason to believe there may be long-term benefits**
  - We are conducting additional analysis on the project as a supplement to this study
- **Offshore wind looks good from many perspectives, but has cost and schedule uncertainties**

Three ways of measuring benefits

NYC Consumers

- The change in the LBMP paid by NYC consumers times the City load, less
- The value of bilateral contracts and TCCs held by NYC LSEs
- The margin earned by the generator (or cable) that is returned to City ratepayers, plus
- The change in the ICAP price times the NYC capacity procured, plus
- The difference between the project cost and the corresponding amount of capacity of market-purchased capacity
- *The most direct impact on NYC consumer rates*

NYS Consumers

- The change in the market-clearing LBMP paid by all consumers times the State load, plus
- The margin earned by the generator (or cable) that is returned to State ratepayers in both the energy and capacity markets
- *A commonly used measure of statewide consumer impact in regulatory proceedings. It does not take into account the impact on generators*

NYS Production Cost

- The change in the production cost of all generators in NYS, plus
- Imports into NYS priced at the LBMP of the delivery zone
- *The NYISO and FERC's preferred metric, and the most economically "pure" measure. It does take into account the impact on generators*

There is no single "right" way to evaluate project benefits

Three Rounds of Analysis

Round 1 – Single Year Analysis (2013)

- 500 MW combined cycle gas turbine on Staten Island connected to Gowanus (CCGT)
- Increased export capacity from NYC to Long Island (CE-LIPA)
- NYRI 1,200 MW HVDC line from Utica to Orange County
- 660 MW HVDC cable from New Jersey to NYC (Hudson)
- 500 MW peaker on Staten Island connected to Gowanus (SCGT)
- Leeds-Pleasant Valley 1,200 MW line (Leeds-PV)
- Upgrades to the Dunwoodie (Yonkers) interface into NYC combined with Leeds & NYRI

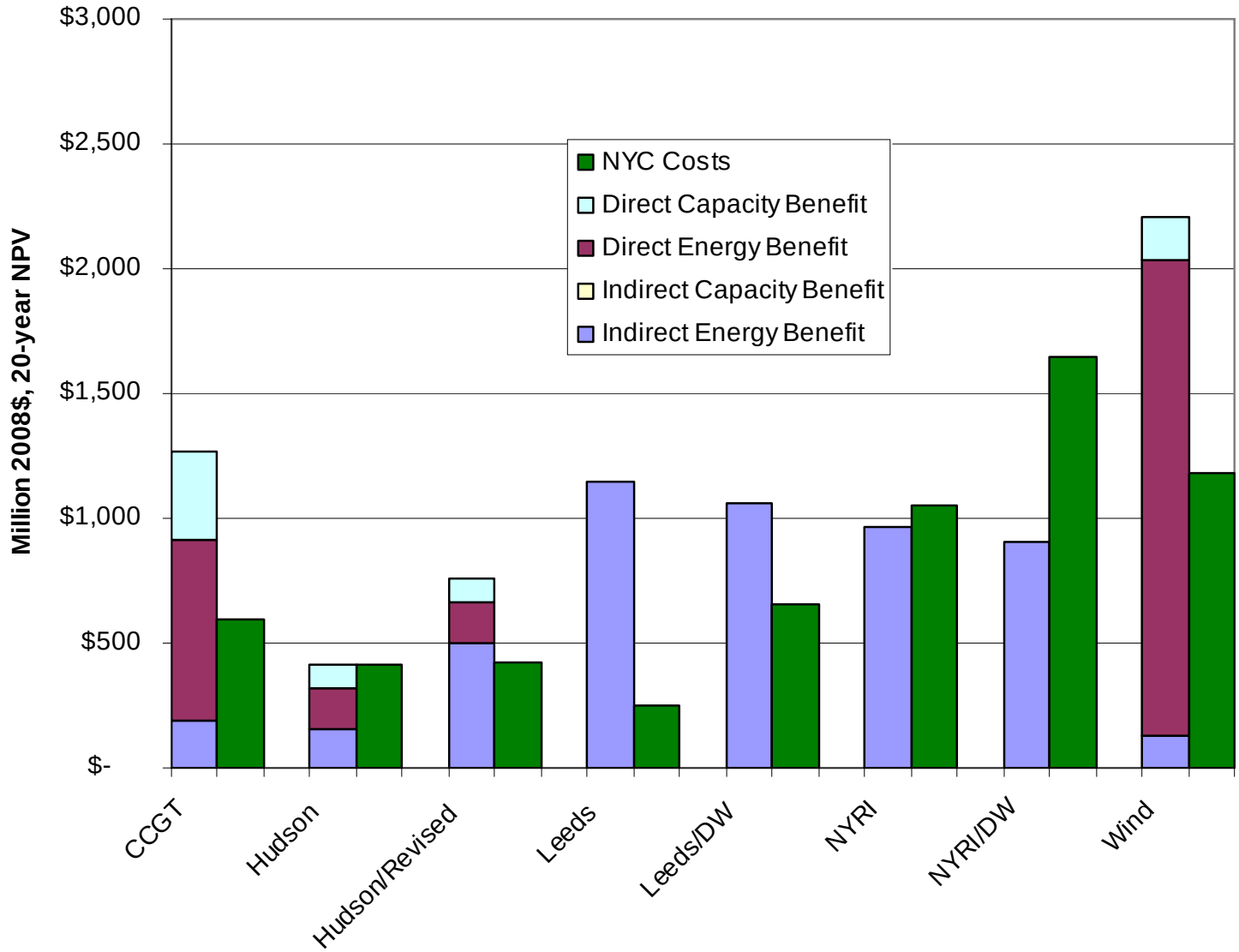
Round 2 – 20 Year NPV Analysis

- 500 MW combined cycle gas turbine on Staten Island connected to Gowanus (CCGT)
- NYRI 1,200 MW HVDC line from Utica to Orange County
- 660 MW HVDC cable from New Jersey to NYC (Hudson)
- Leeds-Pleasant Valley 1,200 MW line (Leeds-PV)
- Upgrades to the Dunwoodie (Yonkers) interface into NYC combined with Leeds & NYRI

Round 3 –Three Sensitivities

- 660 MW HVDC cable from New Jersey to NYC (Hudson)
- Leeds-Pleasant Valley 1,200 MW line (Leeds-PV)
- Compared against
  - High load growth case
  - High gas price case
  - Low carbon price case

NYC Consumer Economic Costs and Benefits



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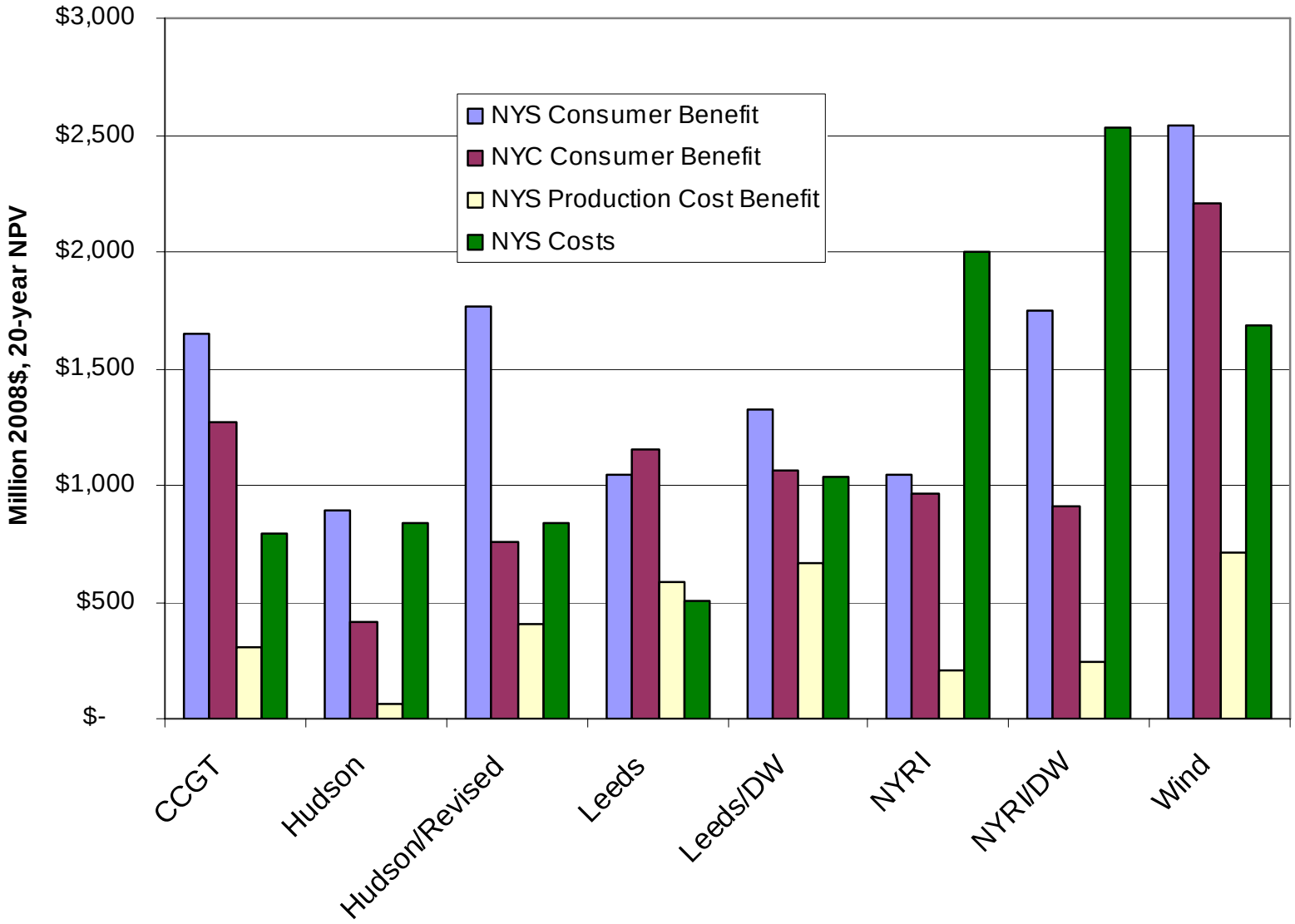
Statewide Economic Costs and Benefits



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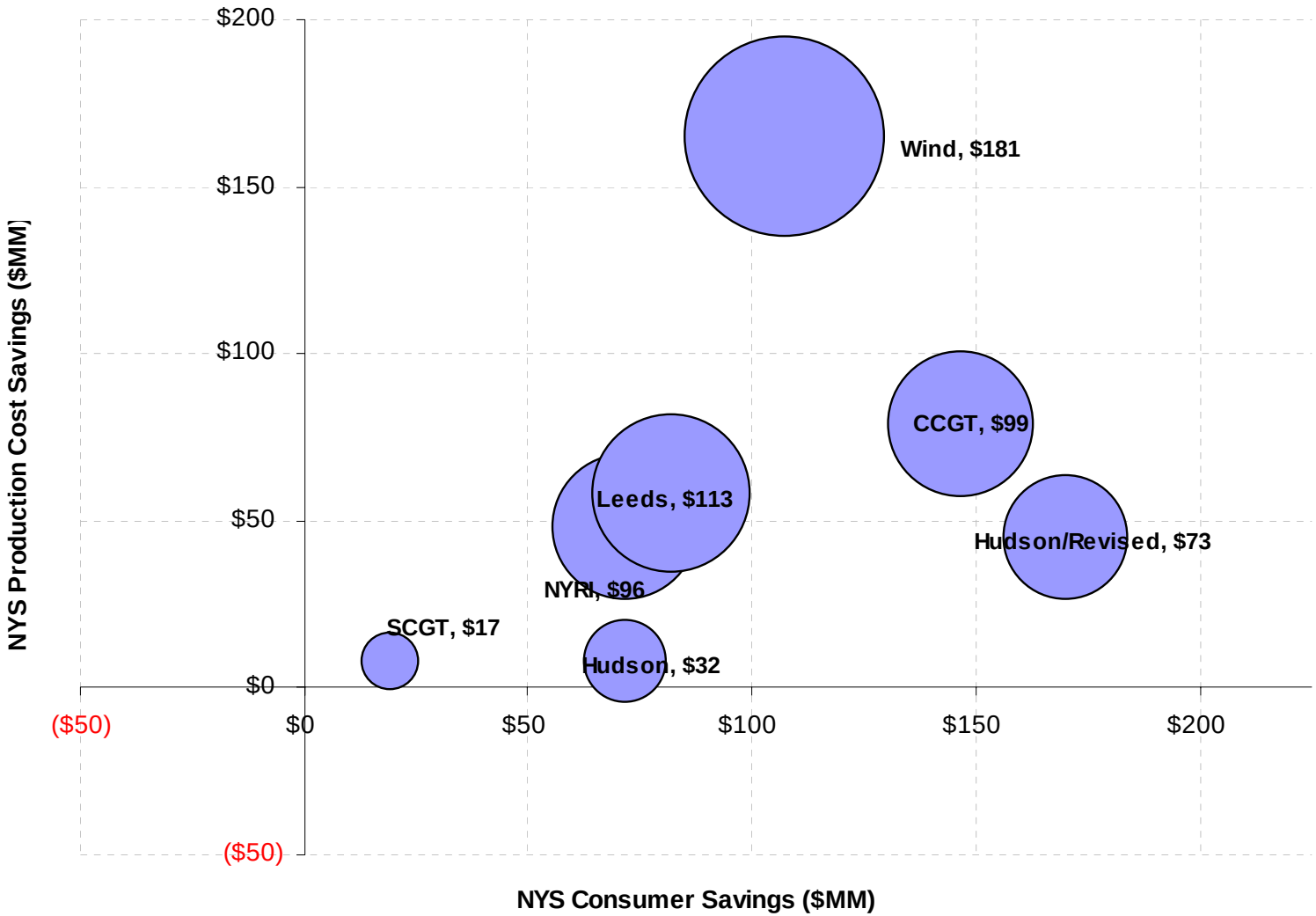
Statewide and NYC Costs and Benefits for 2013



The bubble's size and label indicate NYC consumer benefit

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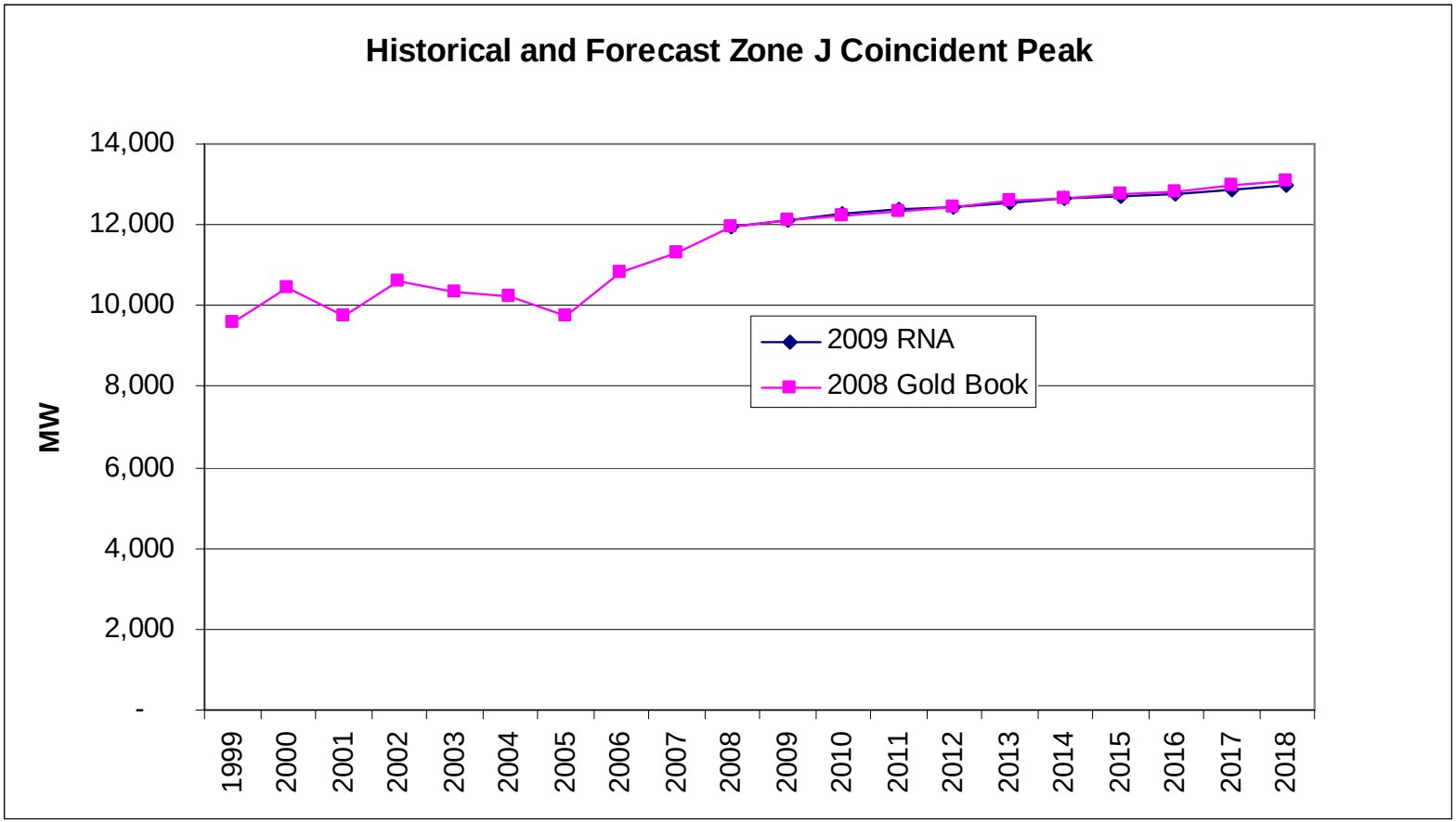
Multiple Forecasts Show Growth Slowing Considerably



1999-2007 Compound Growth = 2.8% : 2008-2018 Compound Growth = 0.8%

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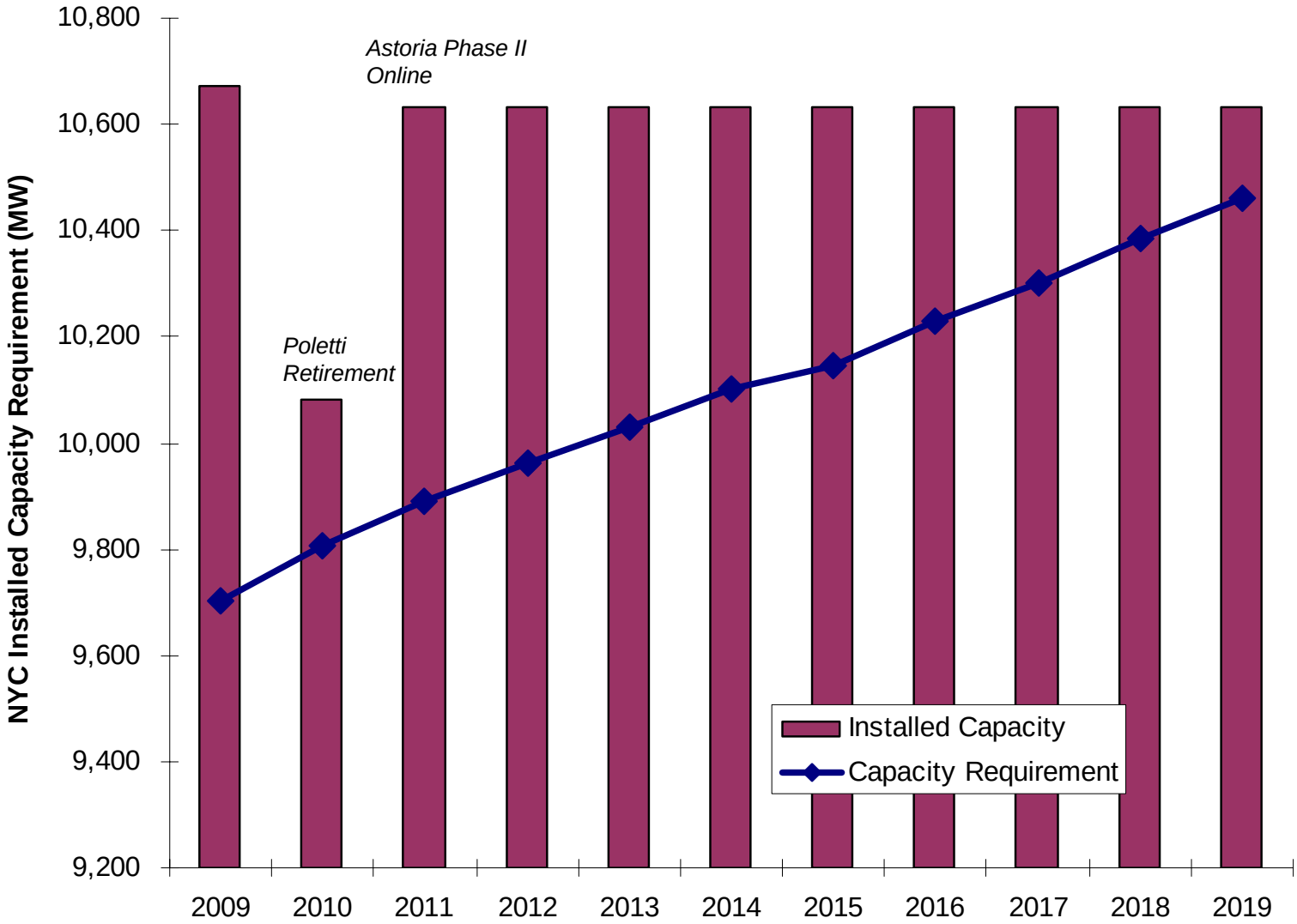
New Capacity Will Not Be Needed In NYC Until 2019



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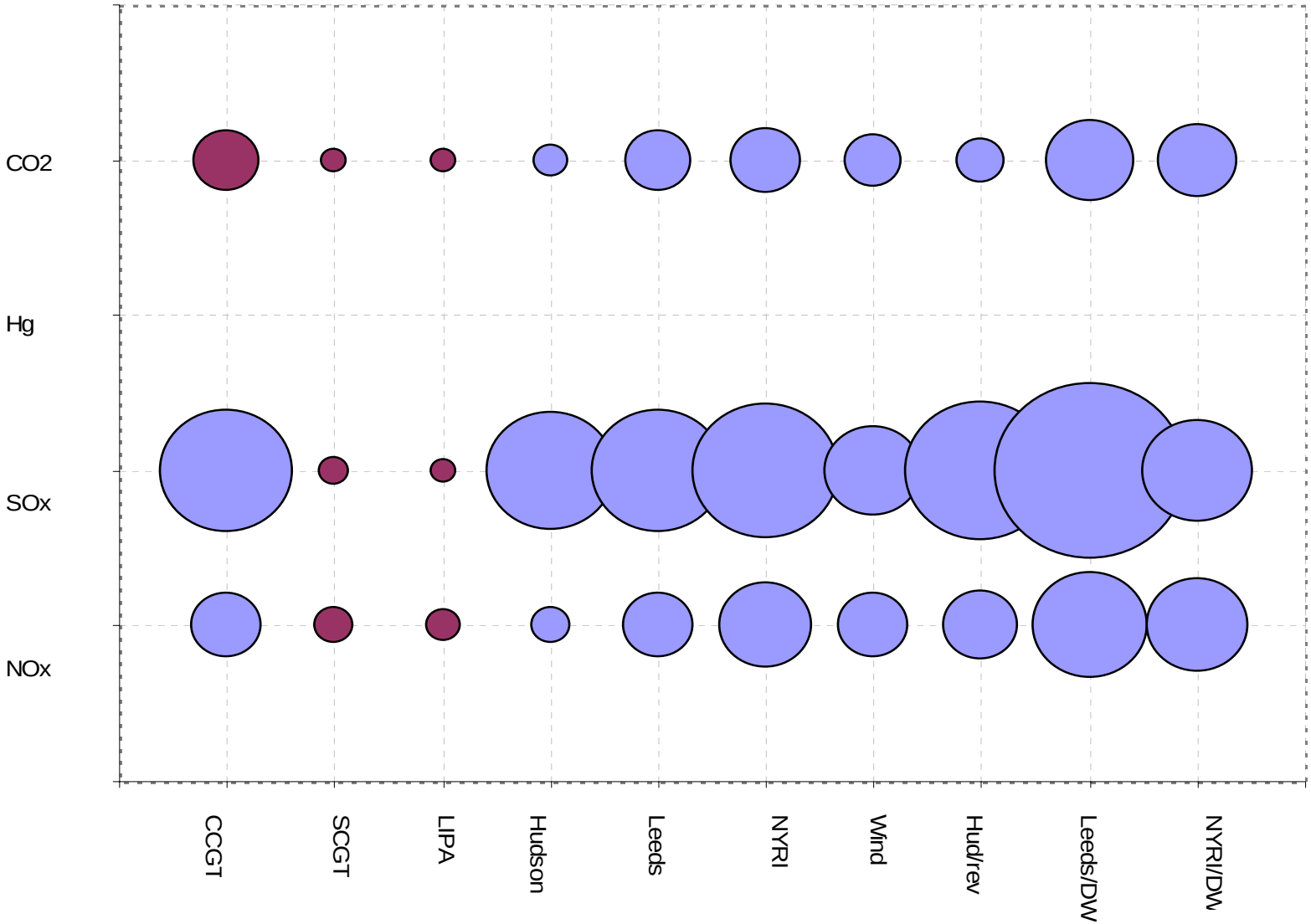
Policy Implications Of Building Capacity Before Need

- **The "economically optimal" solution is for capacity to be added when it is needed to fulfill reliability criteria**
  - This is not expected to be the case until 2019, or potentially later given events of the last few months
  - The New York City market has not always been driven solely by economic factors
- **Building new generation or the Hudson cable before that point, would result in market prices being suppressed**
  - This is a policy decision with short-run consumer benefits at the cost of NYC generators
  - There are longer-term implications for the ability of NYC energy markets to attract private investment
- **The implicit assumption is that the market would not build before need, but governmental entities could; a step back towards a regulated supply system**
- **Generators (at least NYC ones) will argue that this is an harmful exercise of market power by buyers to suppress prices**
- **Current FERC and NYISO methodology is to use system-wide production-cost benefits to determine eligibility for rate-basing of transmission projects**
  - There is no clear answer yet on what "the system" is
  - There have been no precedent projects (officially) evaluated or approved under this test in New York
  - There are not many potential projects that could pass this test
  - Other RTOs (e.g. PJM) have provisions in their market rules that permit rate-basing of projects for public policy (not purely economic) reasons

New York City Emission Changes



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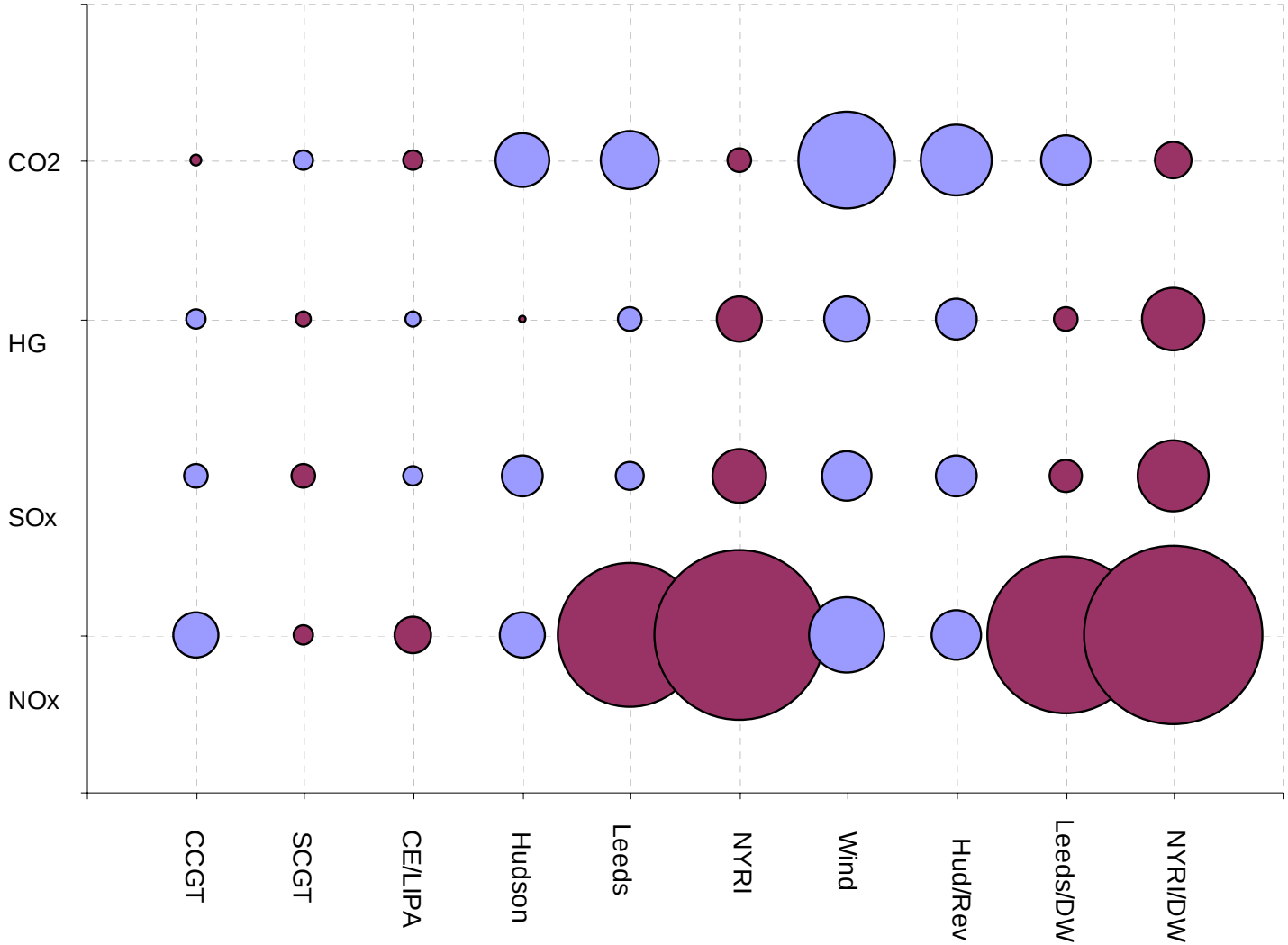
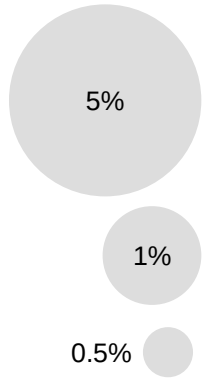
Statewide Air Emission Changes





Emissions increases for the NYRI and Leeds projects result from increased generation from higher-emitting units upstate

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Key Recommendations

- **Seek ways to encourage clean, efficient, in-City generation resources**
- **Conduct additional analysis on the Hudson project**
  - This is already in progress as a supplement to this effort
- **Develop strategies to capture wind resources**
  - There are technical as well as economic aspects hurdles to be passed
  - These strategies require time to evaluate and develop
- **Pursue policies that reduce energy consumption**
  - Many of these efforts (e.g. “15 by 2015”) are already underway
  - Market solutions (e.g. RTP and demand response) may accompany energy efficiency efforts
- **Pursue joint planning studies**
  - Technical coordination is already quite good, but economic planning is largely compartmentalized
- **Continue to evaluate options as circumstances change**
  - The past several months have seen unprecedented volatility in financial and energy markets; it is prudent to continue to update these analyses as conditions change

The City has the advantage of having time to select the best alternative – we are not in “crisis mode”

Potential Advantages of in-City Generation

- **There are suitable sites on Western Staten Island or NJ that would not require new over-land transmission**
  - Underwater cables could connect the plant to where the energy is needed; conventional wisdom regarding these cables' costs may be outdated
  - These sites can re-use existing industrial "brownfield" sites
- **New generation would have ancillary benefits for the City**
  - We did not explicitly evaluate these effects, but generation creates jobs and economic activity during construction and on an ongoing basis
- **City-owned generation would return substantial monies to ratepayers**
  - The margin (or profit) from the plant grows over time
- **Consumers outside of NYC would not be penalized**
  - Developing ratepayer-owned generation before need penalizes some generators, however
- **Wind generation, while expensive to construct, could be economically beneficial in terms of energy prices and economic activity**
  - Evaluated purely on economic bases, it may not be competitive

Offshore Wind: Appealing, But With Uncertainties

- **Nearly-free power, injected directly into NYC, is a highly attractive prospect**
- **There are still technical challenges associated with both construction and wind integration to be solved**
  - Meeting reliability criteria would require additional non-renewable resources
- **Offshore wind of this scale has not been attempted in the United States yet, and not in urban waters**
  - Our cost estimates still contain a great degree of uncertainty
  - The schedule for plant development is uncertain as well
- **An offshore wind plant would be unlikely to be able to survive as a merchant plant; public funding and subsidies are critical to its success**
  - We have included in our analysis the assumption that offshore wind would be able to offset its development costs with incentive tax credits

Upstate Transmission Options and Their Effects

- **The two projects evaluated, the Leeds and NYRI project (now withdrawn) did not show substantial net statewide benefits**
  - The NYRI project suffered from extremely high costs
  - The Leeds-Pleasant Valley project is relatively inexpensive but has similar benefits
- **With bulk transmission projects, there is always allocation of benefits from some consumers and producers to others**
  - NYC consumers would benefit, and NYC producers would lose - the converse is true upstate
- **The production-cost test focuses on overall system (i.e. producer and consumer) economic benefit**
  - Few projects might meet it – we found that more projects would meet a consumer benefits test
- **Recent FERC rulings have given ConEd effective veto power on any bulk transmission projects**

Hudson Cable – More Analysis To Be Done

- **The Hudson cable is the furthest along in terms of its development process – construction could begin shortly**
- **The benefits from the cable are highly sensitive to the price difference between NJ and NYC**
  - Anything that raises prices in NJ or lowers prices in NY would hurt the project's performance
- **The cable would be entering the market during a period of overcapacity, suppressing prices for consumers at the cost of some consumers**
- **There are unresolved questions regarding the cost of potential upgrades in PJM**
  - The debate centers on who should pay for some upgrades that are necessary to support the Hudson cable but could likely be constructed anyway for other purposes
- **The Hudson cable would increase competitiveness in the NYC energy market**
  - Its marginal production cost would be set by the PJM market, not an individual generator, potentially reducing generator market power
- **Its effect on New Jersey is mild**
  - Wholesale price increases in northern New Jersey are on the order of 1%
  - Emissions increases are on the order of 1% for all pollutants; transmission constraints limit the impact on coal-fired units farther west in PJM. Most of the increase is in gas-fired generation
- **We are currently conducting additional analysis on the cable**
  - We will be considering the impact of new transmission upgrades, potentially in service by 2013, which could increase the economic benefits of Hudson

Detailed Discussion of Results

Essentially, all models are wrong, but some are useful.

-George Box (1987). Empirical Model-Building and Response Surfaces.

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Key analysis assumptions and their impact

- **Load forecasts**
  - We used the 2009 RNA (released November 2008) and the 2008 PJM forecast (released March 2008) for all projects
  - We performed a one-off analysis of the Hudson project using the 2009 PJM (released January 2009) load forecast
  - The 2009 Gold Book has just been released and shows lower load than the 2009 RNA
- **National mandatory carbon policy goes into effect in 2015**
  - Prices start at $30/ton. We also analyzed a $10/ton carbon scenario
- **Assume that NYC ratepayer benefit is muted by LSE-held bilateral and TCCs**
  - Neither bilaterals nor TCCs expire. As a rough number, these contracts and hedges offset approximately half of the LBMP change impact in NYC; this is a “conservative” assumption
- **We used a new power flow case from the NYISO and NERC (2009 ERAG series)**
  - This power flow case shows reduced congestion in NYC
  - It includes a subset of PJM RTEP changes
- **We assume that all projects would go into service in the same year**
  - This allows apples-to-apples comparison of projects
- **A new 500 MW combined cycle is built in NYC in 2019**
  - Approximately 200 MW would be needed to satisfy reserve margin
  - The construction of a 500 MW CC attenuates benefits for generation and DC cable projects more quickly than if only enough was built to satisfy the reserve margin
  - The choice of a CC over a CT also tends to diminish benefits more quickly

Three ways of measuring benefits

NYC Consumers

- The change in the market-clearing LBMP paid by all consumers times the City load, less
- The value of bilateral contracts and TCCs held by NYC LSEs
- The margin earned by the generator (or cable) that is returned to City ratepayers, plus
- The change in the ICAP market-clearing price times the NYC capacity procured, plus
- The difference between the project cost and the corresponding amount of capacity NYC consumers would had to have procured

NYS Consumers

- The change in the market-clearing LBMP paid by all consumers times the State load, plus
- The margin earned by the generator (or cable) that is returned to State ratepayers in both the energy and capacity markets

NYS Production Cost

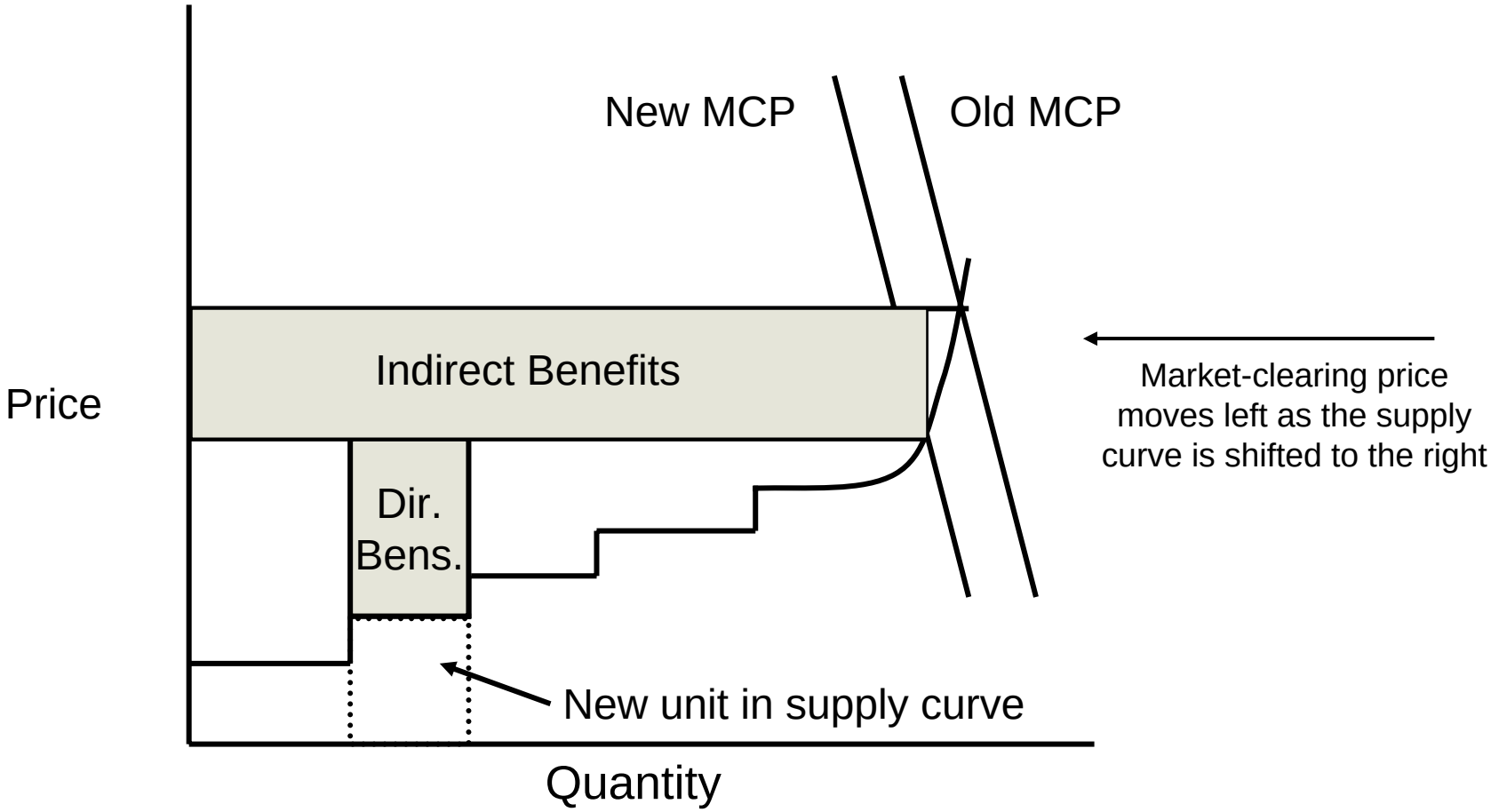
- The change in the production cost of all generators in NYS, plus
- Imports into NYS priced at the LBMP of the delivery zone

There is no single "right" way to evaluate project benefits

Defining Benefit Types

Direct Energy	Indirect Energy
• Profits from the ratepayer-owned generator are returned to the owners, putatively NYC consumers • For the Hudson cable, this is the difference between the price in PJM and the price in NYC	• The amount that the market-clearing price for energy is suppressed by adding a new source of energy to the system
Direct Capacity	**Indirect Capacity**
• The difference in how much less capacity ratepayer-owners would need to purchase in the marketplace because they now own more of their own capacity • For the Hudson cable, this is the difference between capacity presumed to be purchased at the market price in PJM and what the price would be for capacity in NYC	• The amount that the market-clearing price for capacity is suppressed by adding a new source of capacity to the system • There will be an administrative floor in the market by 2013 when these projects go into service , limiting this effect

Comparing Indirect and Direct Benefits



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Comparing Benefits for Generation and Transmission

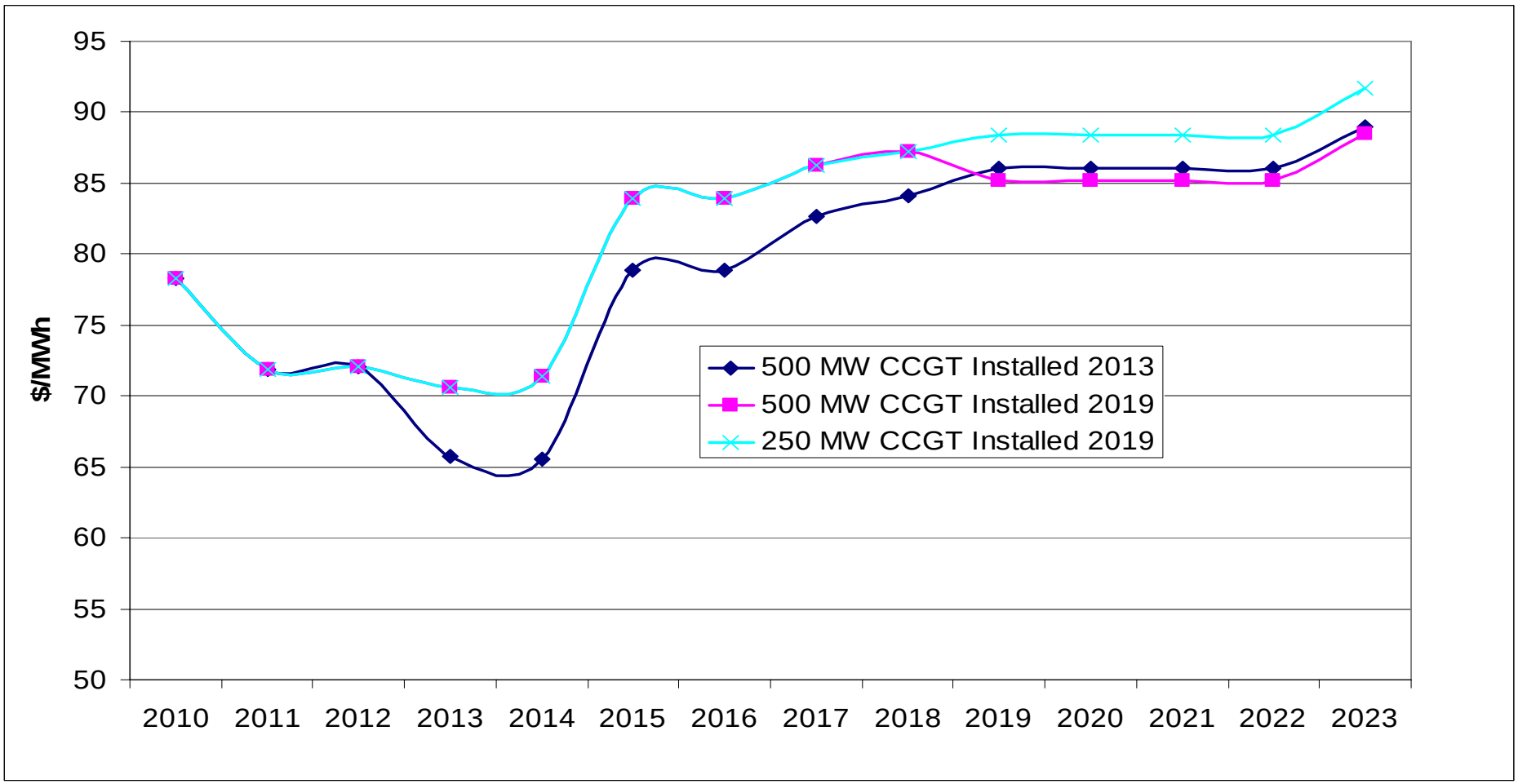
Generation

- Likely to be built anyway for reliability reasons
- What type and size of generation will be built in NYC is the subject of debate
  - Do we build only enough to satisfy demand margin, or a commercially common size?
  - Merchants and governmental entities might build different units
- The calculation is different depending on who gets the benefits
  - Is the criterion overall societal benefit, or do we favor producers or consumers?

Transmission

- The bulk transmission projects we evaluated were economic ones
  - They were unlikely to be built as reliability backstops
  - Large transmission projects are extremely difficult to build on a merchant basis
- Benefits from transmission projects can potentially persist significantly longer than for generation projects.
  - Changes in consumption and generation patterns can take decades to be realized

Comparing future NYC Capacity Additions



Adding a 500 MW CCGT in 2019 tends to cut off benefits sooner and represents a conservative assumption

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Economic Costs and Benefits – 20 Year NPV (million 2008$)

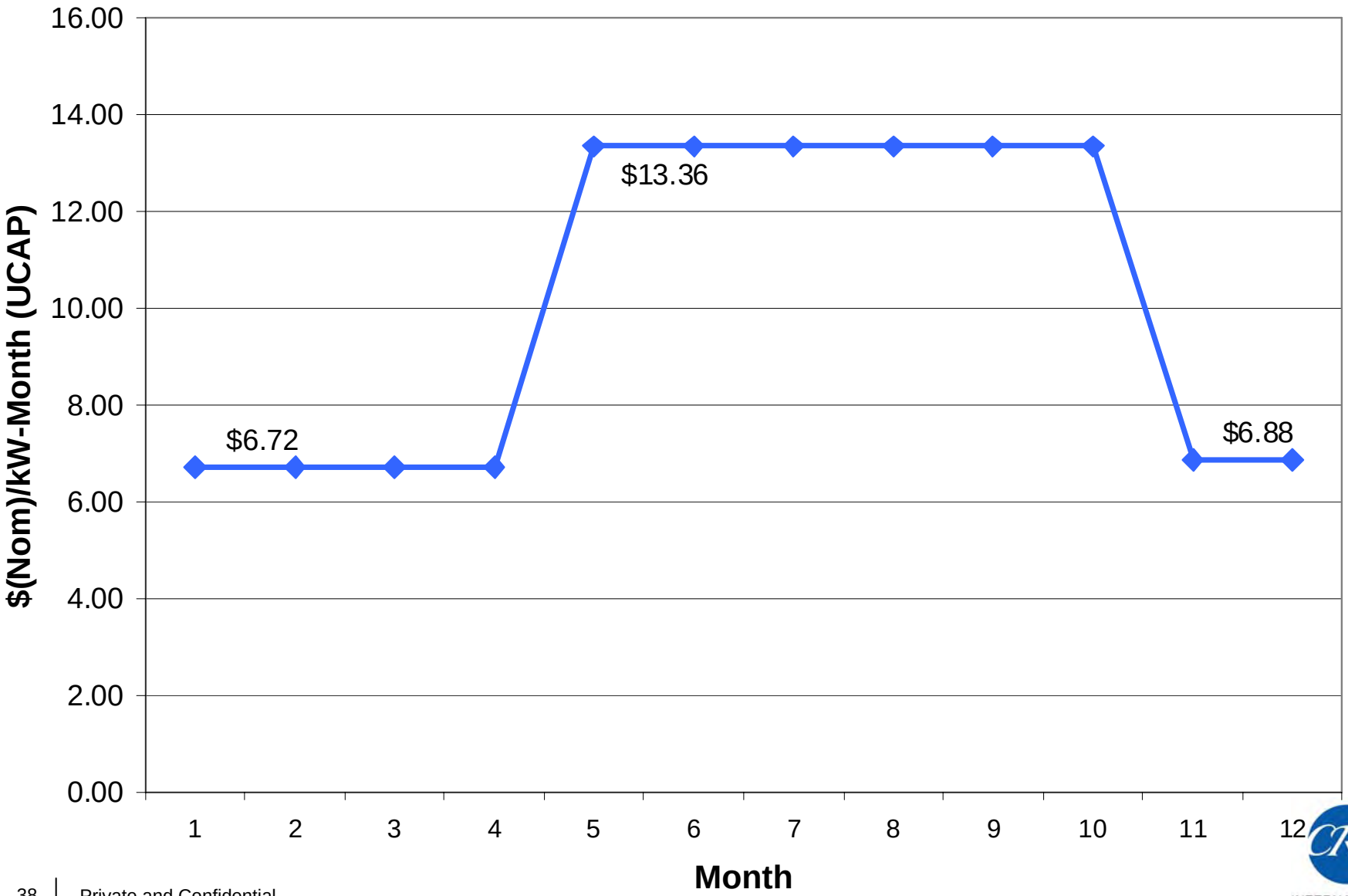
	NYS Consumer	NYC Consumer	NYS Production Cost	NYS Costs	NYC Cost Allocation	NYC Costs
CCGT	$1,647	$1,266	$309	$795	74%	$592
Hudson	$892	$412	$67	$836	49%	$411
Hudson/ revised	$1,768	$756	$401	$836	51%	$427
Leeds	$1,047	$1,149	$582	$505	50%	$250
Leeds/DW	$1,324	$1,063	$665	$1,035	63%	$653
NYRI	$1,046	$962	$208	$2,002	53%	$1,053
NYRI/DW	$1,745	$907	$244	$2,532	65%	$1,646
Wind	$2,537	$2,208	$709	$1,683	70%	$1,179

Project Cost Estimates and Notes (million 2008$)

	EPC Cost	Land Cost	Adjustments	Interest During Const.	Public Cost Estimates	Total Cost
CCGT	$696	$50		$49		$794
Hudson	$501		$300	$35	$660	$836
Leeds	$192	$105	$200	$8		$504
NYRI	$1,202			$109	$2,002	$2,002
Dunwoodie upgrades	$486			$44		$530
Wind	$2,097		-$629	$215		$1,683

Project cost estimates were supplemented with public data, and do not include financing costs

2013 Base Case UCAP Price Forecast for Zone J



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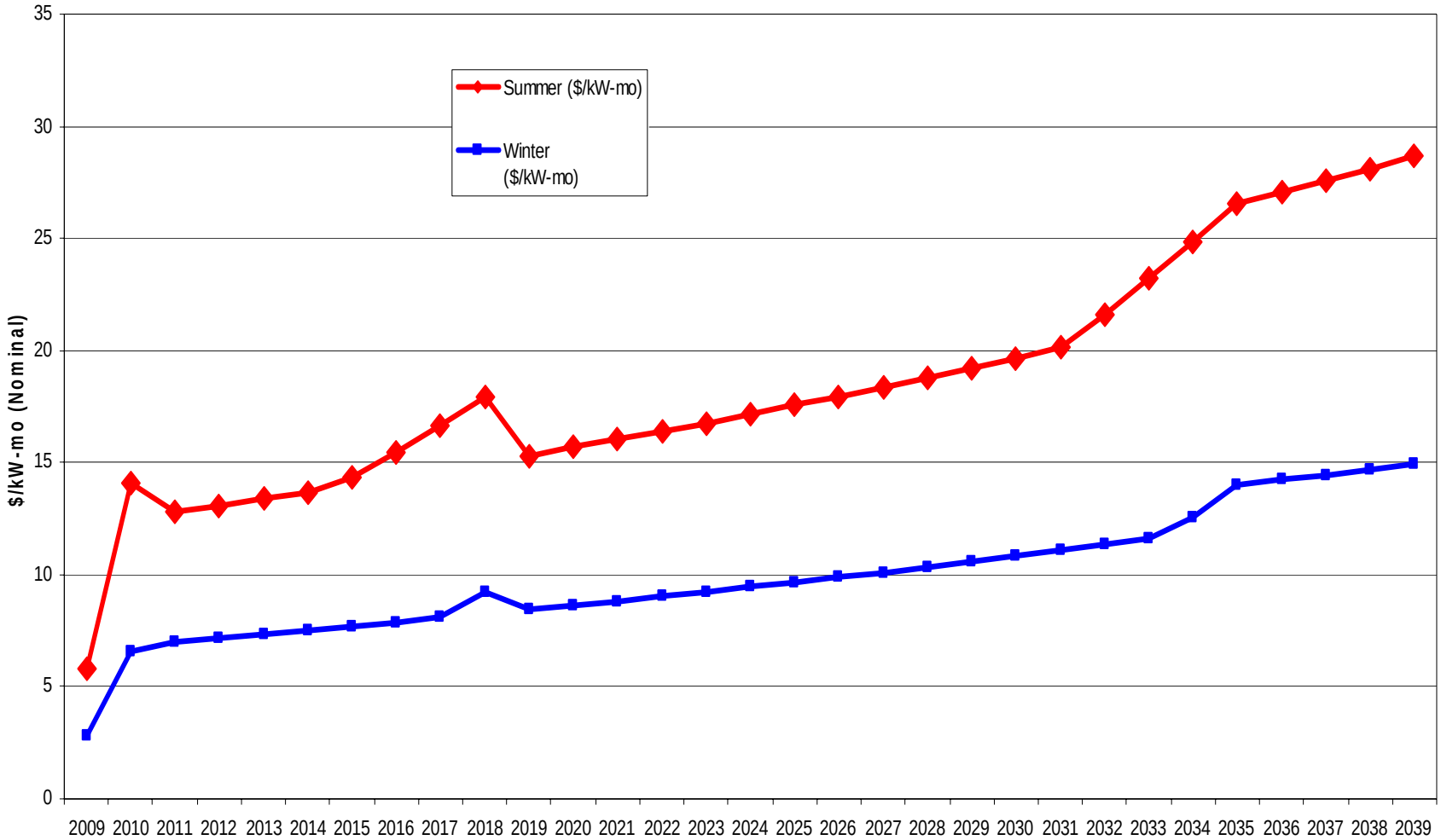
NYC Capacity Market Prices



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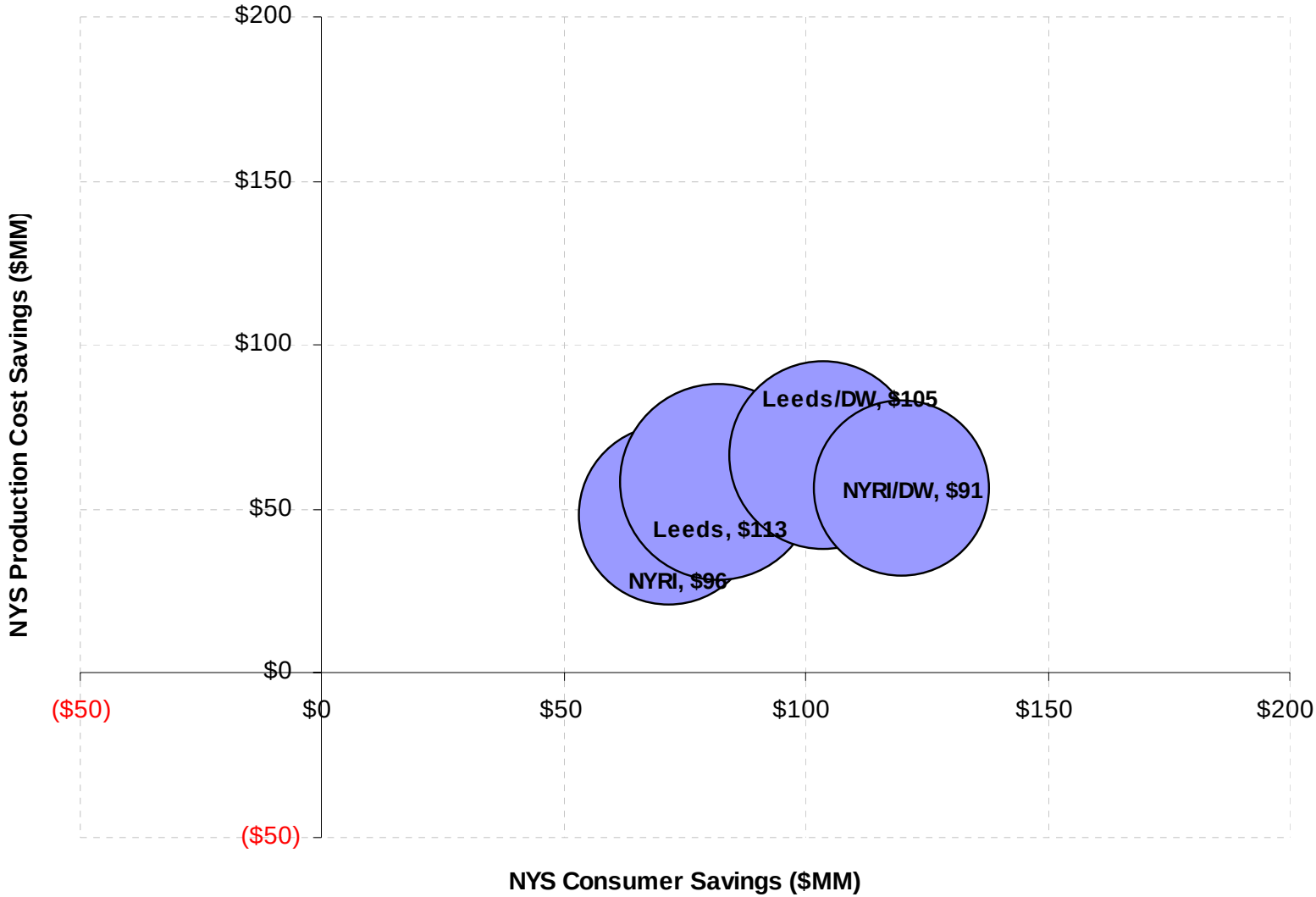
Dunwoodie Upgrades Impact



The Dunwoodie upgrades have relatively small impacts, and no impact on NYC consumers principally because of TCCs held by NYC LSEs

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Change in 2013 Annual Zonal LBMPs by Project ($/MWh)

	A	B	C	D	E	F	G	H	I	J	K	PSEG
Base	54.72	58.22	61.44	64.24	64.16	66.63	77.56	80.19	80.70	84.92	86.78	81.38
CCGT	0.23	0.13	0.10	0.01	0.06	0.06	(0.89)	(1.17)	(1.25)	(2.03)	(0.83)	
LIPA	0.17	0.11	0.09	0.02	0.06	0.02	0.14	0.15	0.10	0.16	(0.36)	
NYRI	0.72	1.46	1.77	1.80	2.12	2.28	(2.33)	(3.39)	(3.48)	(1.62)	(1.12)	
HTP	(0.01)	(0.01)	0.02	(0.13)	(0.05)	(0.12)	(0.43)	(0.50)	(0.52)	(0.55)	(0.88)	0.65
SCGT	(0.01)	0.00	0.02	0.04	0.04	0.05	(0.08)	(0.13)	(0.13)	(0.33)	(0.01)	
Wind	(0.09)	(0.09)	(0.10)	(0.02)	(0.09)	(0.10)	(0.62)	(0.76)	(0.72)	(1.29)	(0.52)	
Leeds-PV	0.65	1.43	1.73	1.93	2.10	3.15	(2.77)	(4.77)	(4.95)	(1.69)	(0.98)	
Leeds/DW	0.86	1.64	2.08	2.18	2.44	3.47	(2.14)	(4.05)	(4.28)	(2.58)	(1.04)	
NYRI/DW	0.72	1.43	1.84	1.76	2.13	2.13	(1.88)	(2.74)	(2.88)	(2.53)	(1.36)	

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