ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

NYISO Capacity Market

Evaluation of Options

ICAP Working Group – Stakeholder Presentation

February 25, 2015

Overview

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Analysis Group Assignment

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Conduct a comparative analysis of capacity market designs**
  - Evaluate the NYISO capacity spot market (SM), and compare it to Forward market (FM) structure as used in New England and PJM
  - Consider whether current market and regulatory conditions warrant a change to the capacity market structure at this time
  - Compare SM and FM structures qualitatively
  - Model market outcomes comparing SM and FM designs
  - Consider administrative costs/impacts
- **Separately consider potential impact of FM with new entry price lock in**

- **TODAY: summarize evaluation and findings**

Analysis Group Study Elements

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Evaluation reflects multiple inputs:

- **Quantitative Model developed to estimate market impacts of design elements under investigation – FM and price lock-in**
  - **Impacts on demand curve**
  - **Impacts on supply curve**
  - **Results: clearing prices/quantities, gen revenues, cost to load**
- **Analysis of market data from NYISO and other capacity markets (ISO-NE, PJM)**
- **Economic / regulatory (qualitative) assessment of design elements**
  - **Reliability**
  - **Market / economics**
- **Assessment of NYISO costs/resources**
  - **To implement, and *incremental* annual costs**
  - **Based on NE, PJM experience, and current NY costs**

Analysis Group Findings

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **A FM is not necessary to administer a resource adequacy structure in NY**
  - The Comprehensive System Planning Process (CSPP), including the ICAP market solution and regulated backstop solution processes, has operated effectively to maintain resource adequacy within the NYISO footprint
- **Decision to shift to a FM or lock-in should reflect transition costs and risks**
  - Not a "from scratch" choice of which design (SM or FM) is better
  - Rather, decision is *whether to shift to* a FM structure and, if so, how to think about key design decisions (e.g., new entry lock-in)
- **Implementation of FM is not warranted at this time**
  - Transition to a forward market structure would involve significant resources and potential risks
  - A FM offers certain benefits arising from earlier market clearing/commitment, but has some offsetting costs (e.g., reduce optionality, deficiency risks)
  - If included in design, a new entry price lock-in may support market-based entry, but has potential consequences for market efficiency
  - The need for either change – FM or lock-in – to achieve reliability objectives or improve economic outcomes is not yet demonstrated

Overview

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Current Resource Conditions

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Potential challenges for resource adequacy currently facing NYS:

- **Aging fleet includes significant MW nearing end-of-life**
  - 44 percent of NYC capacity installed prior to 1970
  - Nuclear units facing relicense or economic retirement decisions
- **Environmental regulations may require additional investment costs, creating additional financial stress on older units**
- **Capacity reserve margin diminishing – increasing importance of capacity markets to meet reliability objectives**
- **State and Federal policies reduce load growth and potentially support competing (distributed) generation resources**
  - NY REV, NY Sun, NY EEPS
  - With relatively flat load growth, need for new resources is more intermittent, with timing tied more to resource exit
- **Increasing concerns related to continued system reliability, including fuel assurance and resource performance**

Status Quo

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **NYISO Capacity Market appears to be working**
  - Market has operated with limited changes since 2003; regulatory stability is an important factor supporting market's effectiveness
  - Comprehensive System Planning Process (CSPP) supports reliability and resource adequacy objectives
  - Even if changes produce certain benefits, may not be necessary to sustain resource adequacy

- **Evaluation does not consider choice of *which* market structure is preferred, but *whether to make the change* from SM to FM**
  - Transition costs and risks (and timing) very important to such a decision

Market Elements Under Evaluation

- **Analysis Group is evaluating two elements of a capacity market**
- **Forward Market ("FM") Structure**
  - **Forward Market occurs (approximately) three years prior ("Y-3") to compliance period**
  - **Resources that clear the market assume a Capacity Supply Obligation ("CSO") for the entire one-year compliance period**
  - **Balancing auctions are run between the Forward Auction and the Commitment Period**
    - **Allows resources to trade obligation**
    - **Allows quantity of capacity procured to be adjusted (up or down) to account for adjustments to required quantity (e.g., change in load forecasts)**
- **New Entry Price Lock-In**
  - **New generation resources would have the option to lock-in their clearing price in the first auction**
  - **Lock-in of 7 years is analyzed**

Decision Context

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Whether to adopt capacity market elements under consideration is complicated question in NYS**
  - Mix of reliability and market efficiency considerations; need to consider risks and priorities
  - …against a backdrop of non-market factors that complicate the evaluation and value/impacts
  - …with a history of capacity market experience in other regions that is mixed, unique to regions, timing and circumstances, and only partly analogous
- **And there are costs**
  - Winners and losers
  - Organizational costs
  - Time for stakeholder/regulatory review, displacing other market priorities
- **Requires reasoned analysis, priorities, and judgment**
  - Not all factors can be quantified or settled with certainty
- **Considering context, priorities, alternatives, and potential impacts – is it worth making the change now?**

Overview

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Capacity Market Model

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Quantitative model developed to evaluate market outcomes, including prices, quantities, and costs to load**

- **Model reflects the current structure of the NYISO ICAP Market**
  - Nested zonal structure
  - Administratively determined demand curves
  - Market clearing rules

- **Model reflects current and potential resources**
  - Resources within NYISO footprint, based on CARIS II GE MAPS production simulation data
  - Imports and DR from CARIS II
  - New entry – planned and potential, based on 2014 RNA Study

- **Analysis performed for single year (2020)**
  - Forecast loads (2014 Gold Book load forecast)
  - Some new entry (per CARIS)
  - Supplemental analysis performed to consider a subset of multi-year, dynamic issues

Potential Effect of Forward Commitment on Bids
Existing Resources, Imports, SCR, UDR

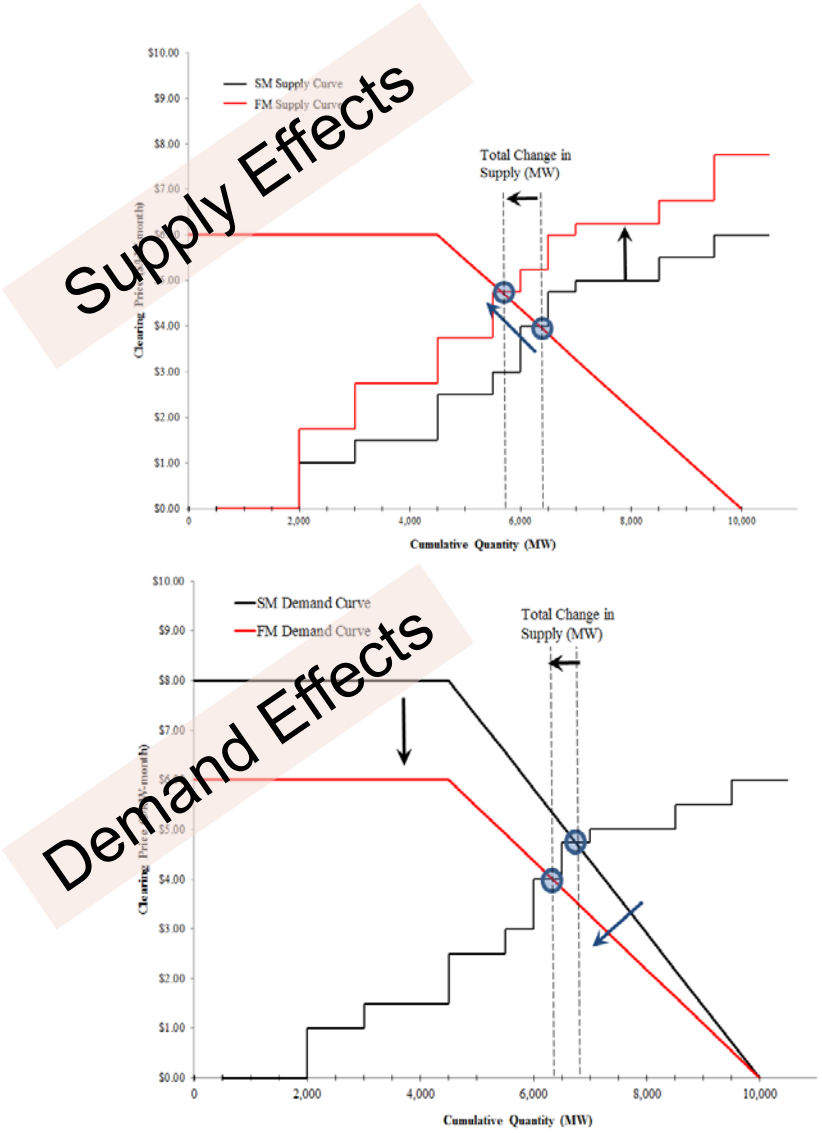
Cost Factor	Effect
Price Lock-In (Financial Commitment)	Lowers Bid • Reduces price uncertainty, cash flow volatility
Physical Commitment	Raises Bid • Reduces optionality – forward commitment reduces option to retire, mothball or supply to another market. Option is more valuable when uncertainty is high: ▪ Regulatory risk (environmental) ▪ Varies by fuel type (gas v. coal v. nuclear v. DR) ▪ Reliance on revenues from capacity market v. E&AS markets
Risk of Significant Decrease in Capacity	Raises Bid Risk of incurring deficiency payments if supply obligation cannot be fulfilled – depends on multiple factors: • Risk of loss of capacity (e.g., plant accident) • Cost of replacing capacity obligation (e.g., in reconfiguration auction) or penalties

Effect of Forward Commitment on Bid Costs

- **All FM Modeling Scenarios assume:**
  - **Physical Commitment Risk equal to 10% of offer costs ("Commitment Risk")**
  - **Risk of Significant Decrease in Capacity ("Deficiency Risk"):**
    - **Based on Historical Gold Book data and Forced Outage Retirements**
      - 4% for Coal, Oil/Gas Steam Units
      - 2.5% for Simple Cycle Units
      - 1% for all other units
    - **Risk of Significant Decrease costs modeled as:**
      - Increase to Offer Cost = Outage Probability * GFC * 150% deficiency penalty
      - Assumes each unit is the marginal unit when bidding costs
- **The values assumed in our analysis are order-of-magnitude approximations of the potential costs associated with a FM – actual costs would reflect actual design details**

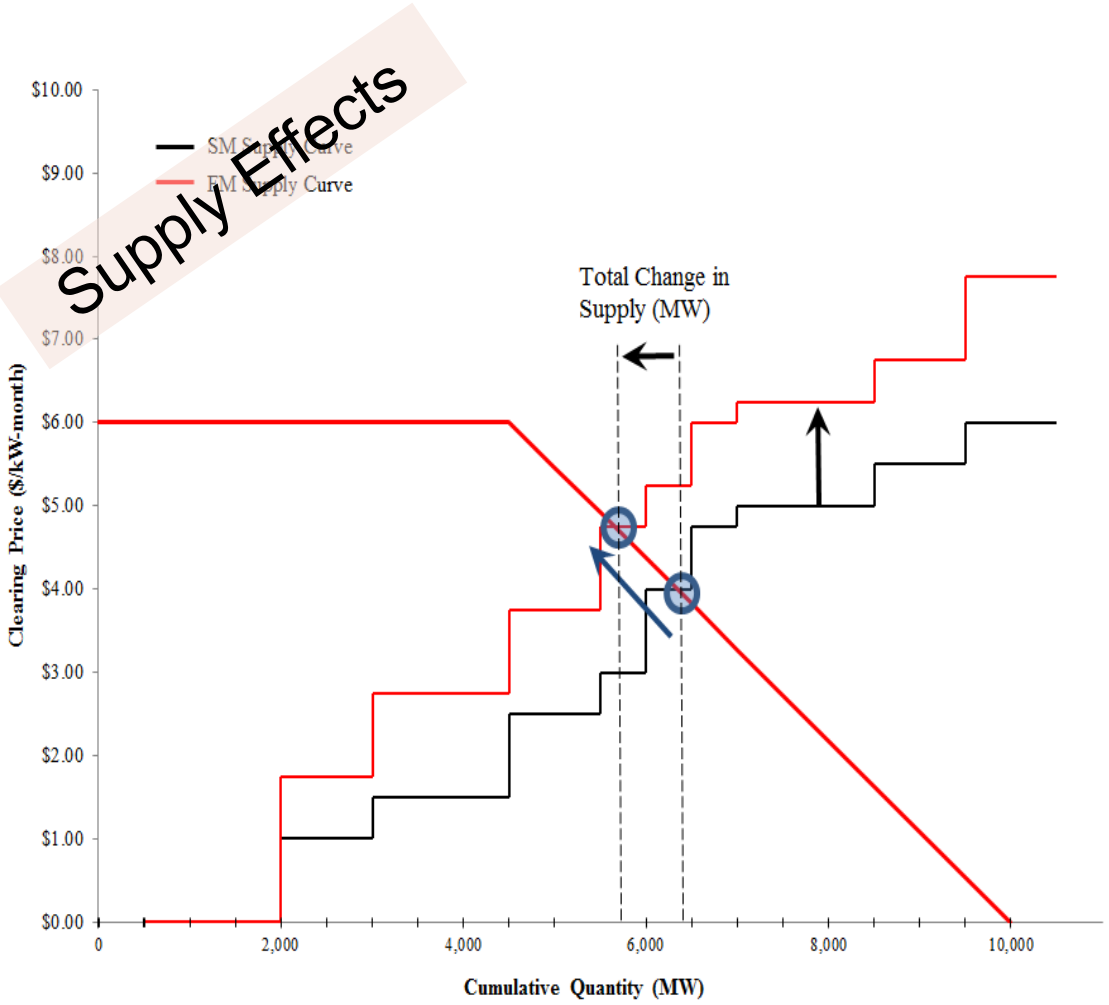
Illustrative Model effects

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS



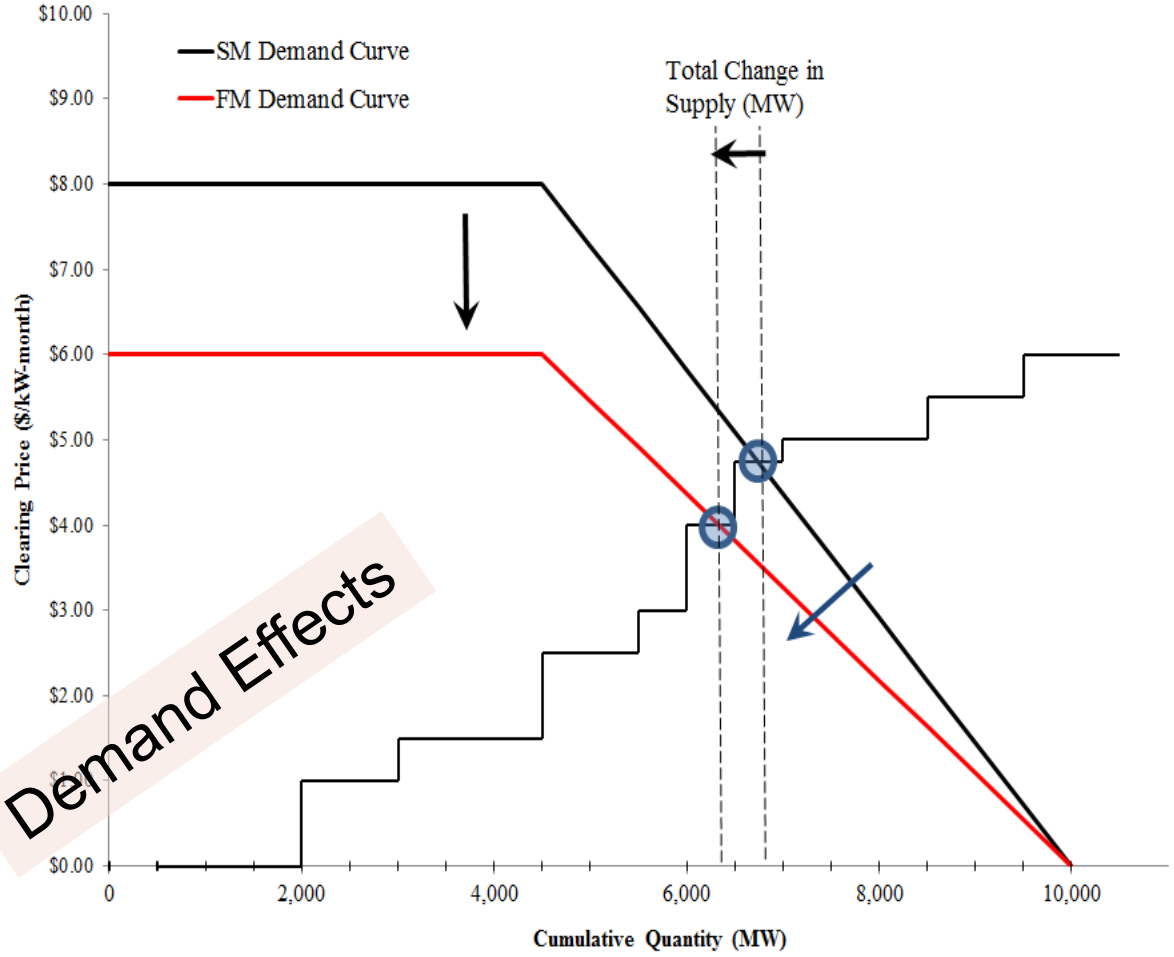
- **Static Model of a forward year (2020)**
- **Purpose: Identify direction, potential order-of-magnitude impact of certain differences between SM and FM on capacity market outcomes**
  - **Clearing prices**
  - **Quantities**
  - **Revenues to generators/cost to load**
- **Not a forecast; assumptions, inputs consistent with NYISO planning assumptions**

Illustrative Supply Curve Shift



- **Increased uncertainty for existing resources**
  - Risk premiums
    - **Commitment Risk**
    - **Deficiency Risk**
  - Varies by technology and size
- **New resources offers**
  - Assume new entry always offers at net CONE
  - Net CONE varies with assumptions for new entry price lock-in

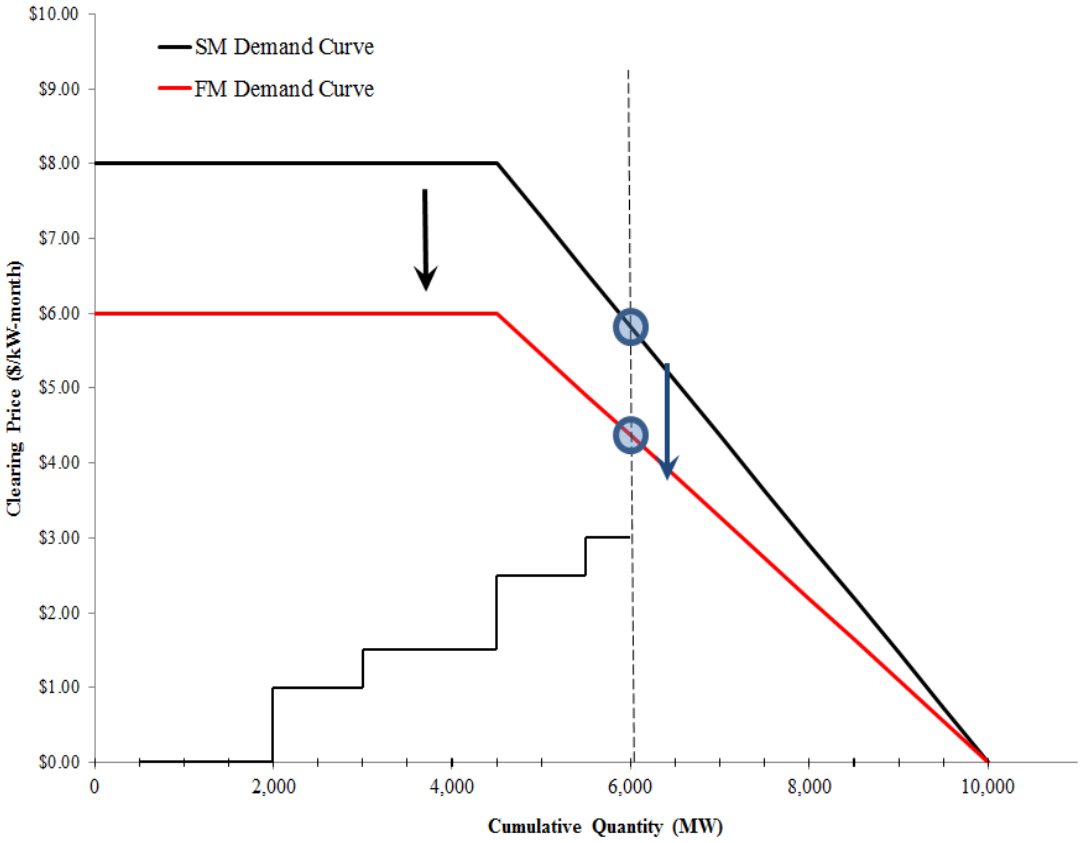
Illustrative Demand Curve Shift



Demand Curve shifts only in Scenarios with Lock-in:

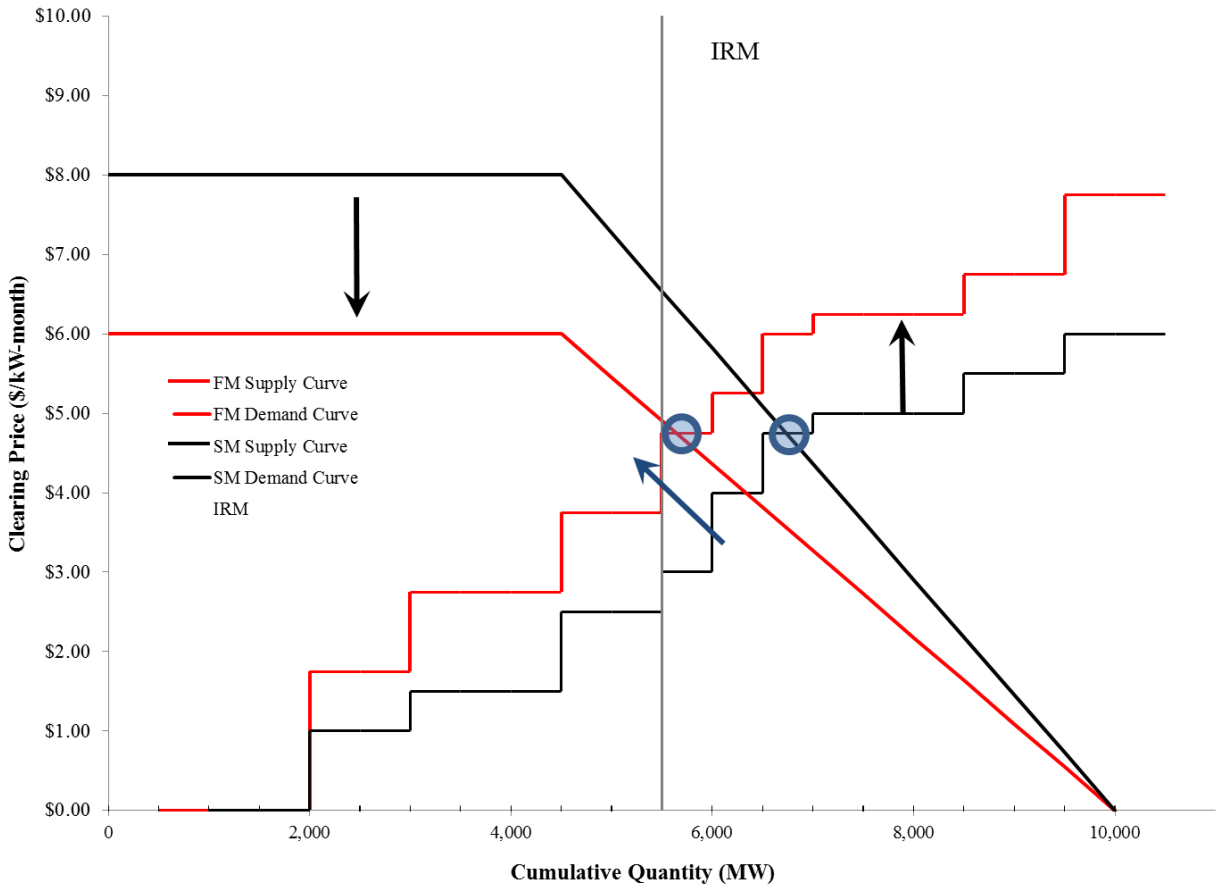
- Assumed 7 year lock-in reduces new resource WACC
- Reduces net CONE for the demand curve reference unit

Illustrative Demand Curve Shift



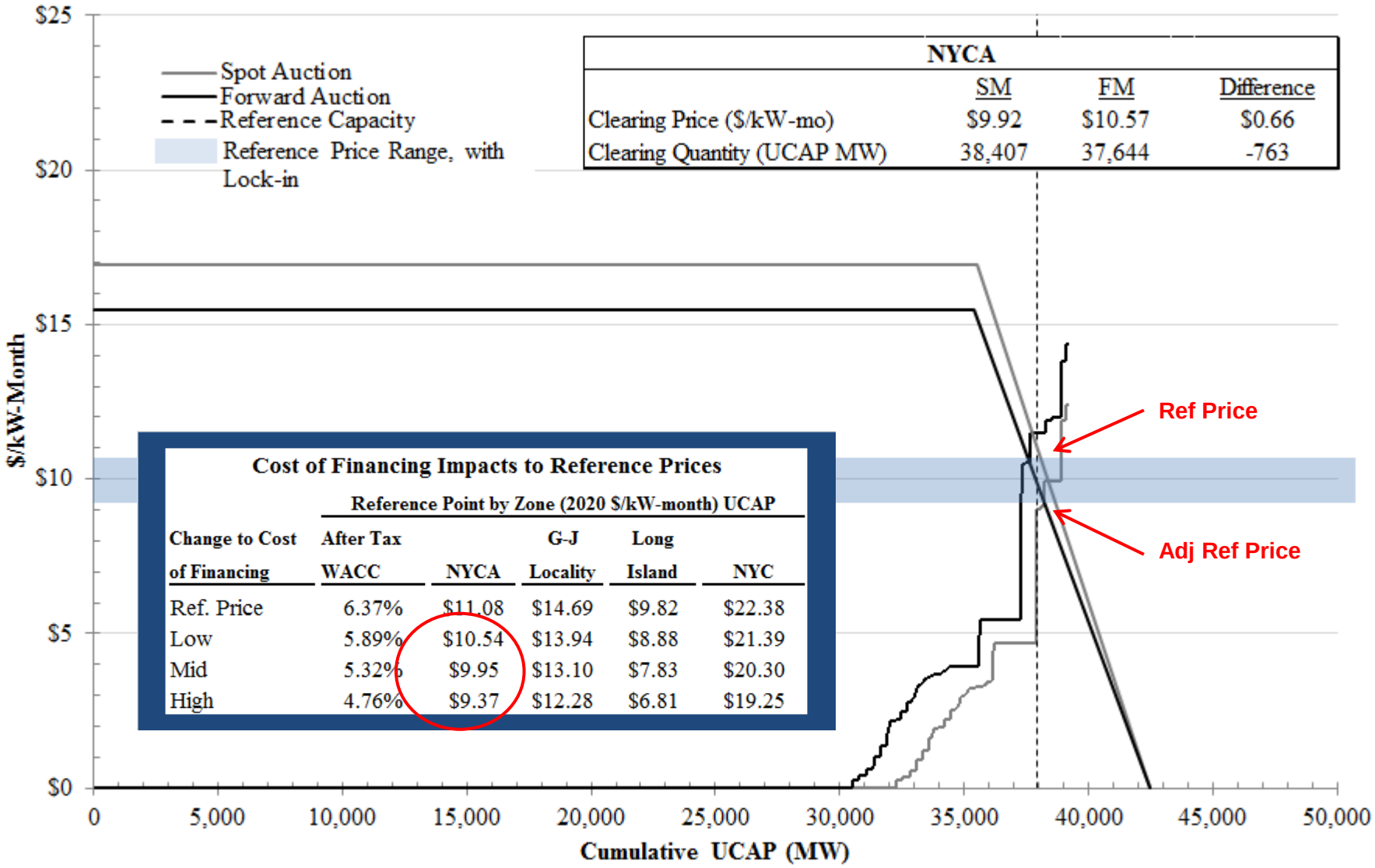
- **Where Supply and Demand do not intersect (Capacity Zones NYC and G-J):**
  - **Total Quantity is unchanged between FM and SM**
  - **Price impacts reflect changes in net CONE**

Illustrative Combined Effect



- **Combined effect drives differences between SM and FM – differences in:**
  - **Quantity procured**
  - **Clearing price**
  - **Revenues to resources**
  - **Costs to load**
- **Representative curves and results presented for each zone, each scenario**

NYCA, No New Entry Scenario

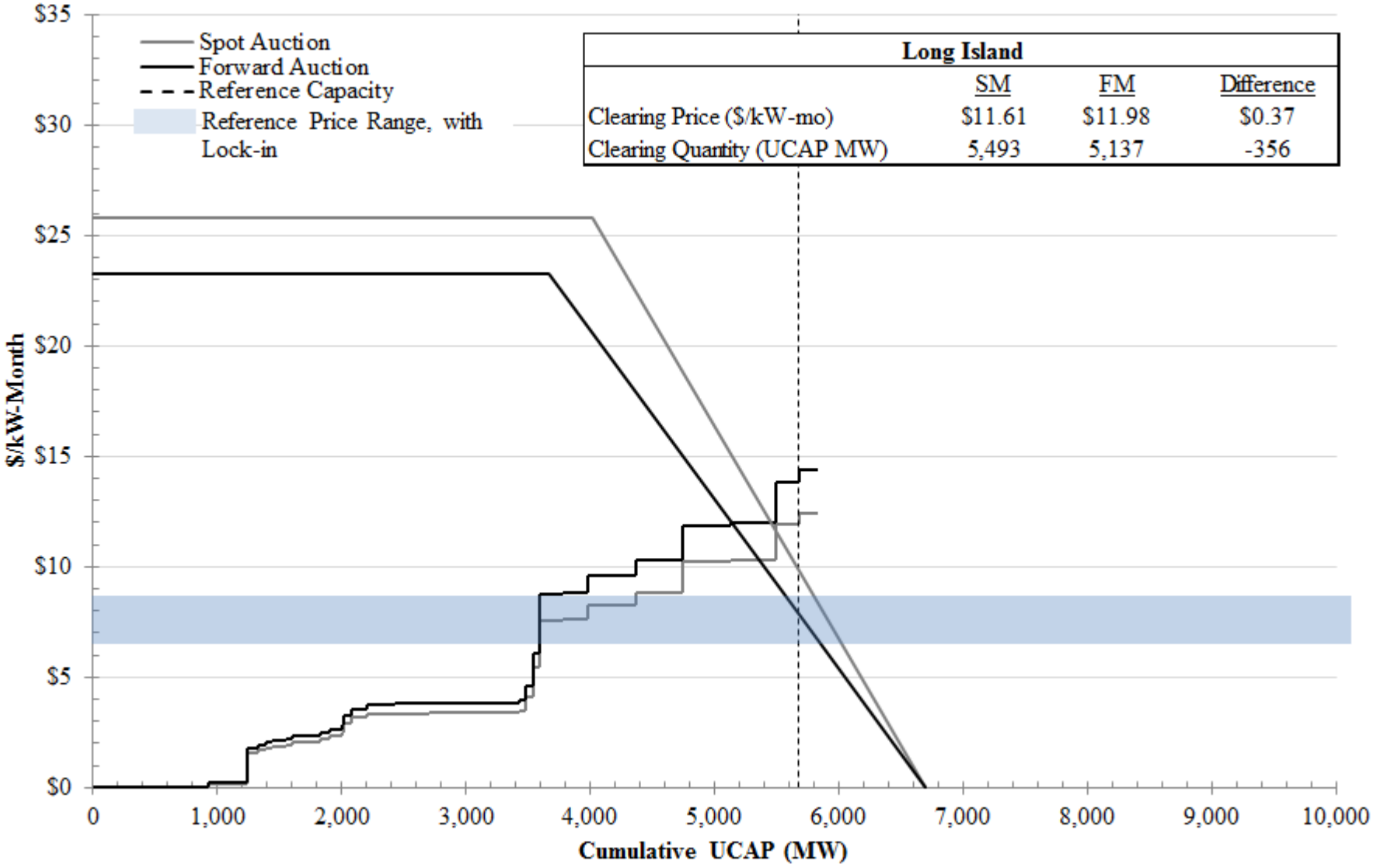


NYCA	SM	FM	Difference
Clearing Price ($/kW-mo)	$9.92	$10.57	$0.66
Clearing Quantity (UCAP MW)	38,407	37,644	-763

Cost of Financing Impacts to Reference Prices

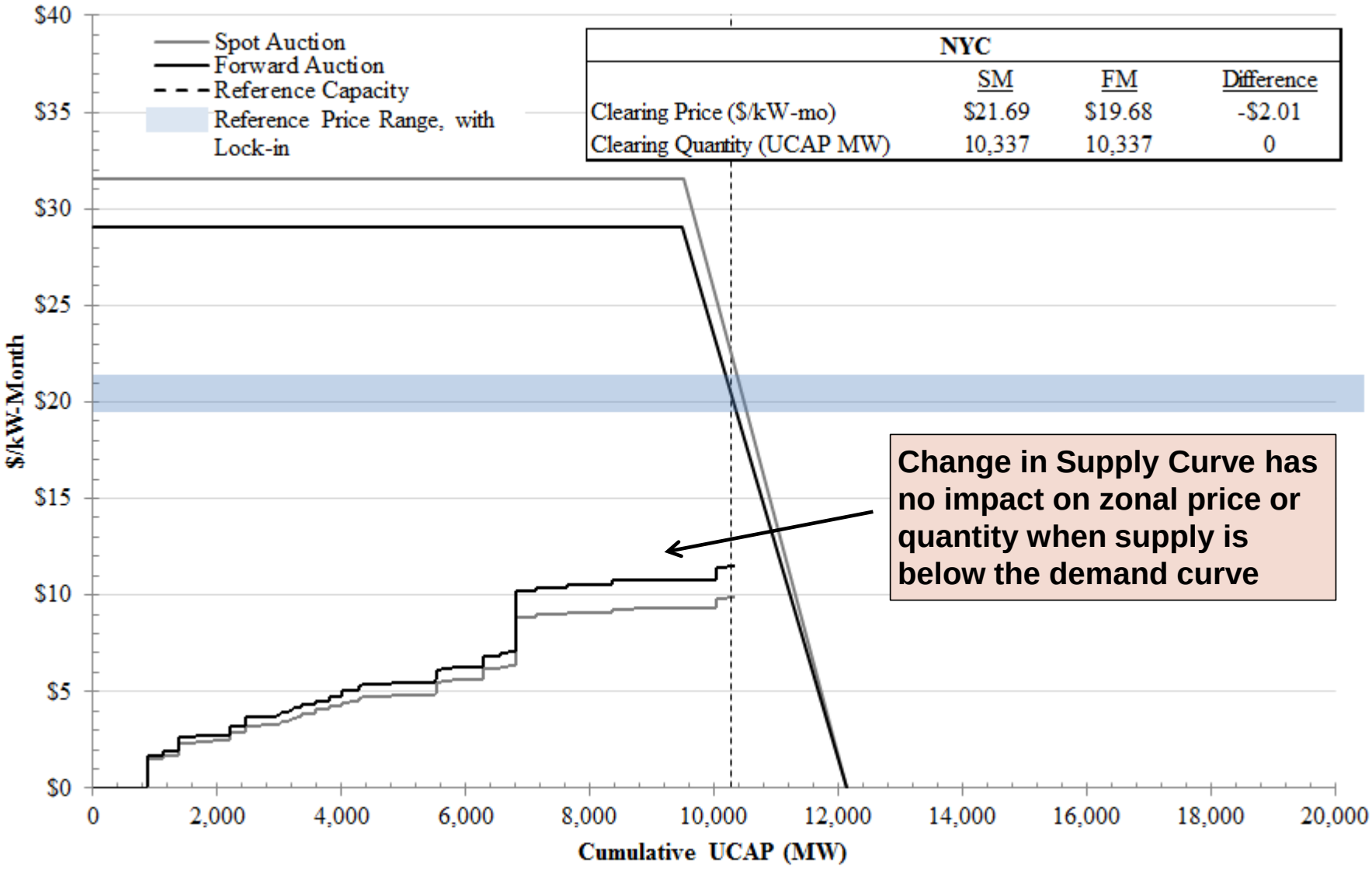
	Reference Point by Zone (2020 $/kW-month) UCAP				
Change to Cost of Financing	After Tax WACC	NYCA	G-J Locality	Long Island	NYC
Ref. Price	6.37%	$11.08	$14.69	$9.82	$22.38
Low	5.89%	$10.54	$13.94	$8.88	$21.39
Mid	5.32%	$9.95	$13.10	$7.83	$20.30
High	4.76%	$9.37	$12.28	$6.81	$19.25

Long Island, No New Entry



Long Island	SM	FM	Difference
Clearing Price ($/kW-mo)	$11.61	$11.98	$0.37
Clearing Quantity (UCAP MW)	5,493	5,137	-356

NYC, No New Entry



NYC	SM	FM	Difference
Clearing Price ($/kW-mo)	$21.69	$19.68	-$2.01
Clearing Quantity (UCAP MW)	10,337	10,337	0

Change in Supply Curve has no impact on zonal price or quantity when supply is below the demand curve

Model Scenarios Considered

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Scenario	Key Assumption
1. No New Entry	• No New Resources in Spot or Forward Market • Differences in Prices, Quantities, and Cost to Load driven by changes in supply curve and demand curve (in cases with a price lock-in)

2. New Entry at net CONE	• New Entry assumed in SM and FM
	  • Spot Market: offers at $0/kW-mo, until clearing price equals net CONE
	  • Forward Market: offers at net CONE, clearing quantity determined by auction
	• New Entry quantities vary with price lock-in

3. All Coal Retires with New Entry in FM, No SM New Entry	• Spot Market: All Coal Retires, no new entry • Forward Market: All Coal Retires, NYCA new entry at net CONE
4. All Coal Retires, with Planned New Entry in FM, RSSAs in SM	• Spot Market: All Coal Retires, 50% retained on RSSA • Forward Market: All Coal Retires, NYCA new entry at net CONE
5. Higher than Expected Load Growth	• Load obligations in the delivery year are 5% higher than forecast at Y-3 • Incremental FM capacity procured through rebalancing auction • Spot and Forward ultimately procure the same target of capacity
6. Lower than Expected Load Growth	• Load obligations in the delivery year are 5% less than forecast at Y-3 • Excess FM capacity sold back through rebalancing auction • Spot and Forward ultimately procure the same target of capacity

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Capacity Market Evaluation Criteria

Key Issue	Objectives Affected
Reliability Factors	
Maintaining Resource Adequacy and Reliability	Reliability
Resource Supplies to Support Reliability	Reliability, Economics
Physical v. Financial Commitments	Reliability
Resource Performance	Reliability, Economics
Regulatory Flexibility	Reliability, Economics, Institutional
Economic and Market Factors	
Efficient Capital Decisions • Treatment of lumpy investments • Implementation of a Price Lock-In • Seasonality	Economics
Price Stability	Economics
Risk Allocation	Economics
Reliance on Out of Market Actions	Economics , Reliability
Price Effects / Cost to Consumer	Economics
Administrative, Institutional, and Regulatory Factors	
Administrative (NYISO) Costs	Institutional, Economics
Timing (to Implement Market Changes)	Institutional, Reliability
Stakeholder and Regulatory Process	Institutional

- **Report includes detailed treatment of qualitative considerations. Covered here:**
  - **Reliability Factors**
  - **Economic and Market Factors**
  - **Administrative, Institutional and Regulatory Factor**

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

With a FM

- **Earlier information about available resources, particularly retirements**
  - **Supports earlier identification of reliability concerns, more options to address identified needs, and greater time to pursue such options**
  - **In turn, may lower costs, and may result in a more efficient process and more reliable solutions**
  - **Earlier information on retirements is most likely to emerge when resources face large, known costs (e.g., regulatory compliance; overhauls or repowering of aging assets)**
- **FM does not eliminate the risk of short-notice retirements (e.g., storm damage; resource can sell out obligation in balancing auctions)**

With a SM

- **Greater risk of sudden, unanticipated retirements or resource changes that lead to reliability concerns**
- **NYISO CSPP provides reliability backstop**

FM could have other implications for ability of capacity market to meet resource adequacy and reliability objectives

- **With FM**
  - Greater supply of resources able to deliver
  - More price-responsive (elastic) supply
  - Greater support for new market-based resources (e.g., reduces excess entry risk; new resources clear at offer)

- **With a FM, risk that some supply offered as financial rather than physical commitments**
  - Particular concern with DR
  - Importance of appropriate design and unbiased procurement forecasts (consistently conservative forecasts can encourage financial positions)

FM implications for performance incentives ("PI")

- Both FM and SM provide an effective market structure for implementing PI-type enhancements founded on performance in energy/ancillary service markets
- Price impact of PI-type enhancements may be greater in a FM because of greater uncertainty about expected revenue impact (given more uncertain market conditions or likely performance)

Regulatory Timing and Flexibility

- With FM, interim solutions may be required to address any market or system conditions of immediate concern given three-year lag between procurement and delivery

FM has implications for efficient use of capital, including new and existing resources

Both FM and SM can create efficient price signals given differences in resource obligations:

- **Existing resources**
  - **FM requires forward commitment, which can raise costs to existing resources (deficiency penalty risk, lost optionality)**
  - **Costs of forward commitment varies by resource type**
    - **For example, demand-response (DR) cannot lock-in customers 3 years in advance, but forward commitment allows DR providers more time to develop resources (such costs have not been a barrier to robust DR participation in ISO-NE and PJM)**
- **New Resources**
  - **FM can lower risks to new resources by avoiding excess entry and allowing market to clear at new resource offer**

Reliance on Out-of-Market Solutions

- **New investment (new resources, repowering, or major capital improvements)**
  - A FM may increase the likelihood that resources are developed solely through NYISO market revenues, without any non-market support; a price lock-in would further increase this likelihood

- **Reliability Support Service (RSS) Agreements**
  - FM may reduce the duration of RSS agreements entered into to address short-term reliability needs; such contracts potentially distort capacity prices depending on contract terms
  - A FM offers more time to address reliability concerns following retirements, which may lower RSS Agreement costs (more options and time)

Model results suggest FM will tend to increase the Cost to Load

- **Move to a FM would impact cost to load for NY consumers by between -$105 million and +$207 million in 2020**
  - Does not include incremental NYISO administrative costs
  - Does not reflect changes in long-run costs or changes in generation fleet
  - Impact varies depending on scenario assumptions
    - ***Not a forecast; scenarios are not equally likely, and do not capture all potential outcomes***
- **Clearing prices tend to be higher in a FM**
  - Price differences reflect risk factors for committing a resource three years in advance
  - No price change in zones with supply below the demand curve

- **Model results can differ substantially by region, depending on shape of the supply curve and presence of market mitigation**
  - **Both NYC and NYCA have relatively steep supply curves and face the largest impacts from a transition to FM**

- **Impact estimates across scenarios:**
  - ***Change* in the total cost to load from an FM could vary between –2% and +3% relative to the SM in the same scenario**
    - **At historical ratios (of capacity costs to total costs), the total impact to all-in prices would be between -0.2% and +0.5%**

Market Outcomes, Load Forecast Sensitivities

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Model results are most sensitive to assumptions about load forecast accuracy**
  - A FM will decrease (increase) the cost to load relative to the SM when actual demand is higher (lower) than the forecast used in the FM procurement three years earlier
  - Load forecasts may present an asymmetric risk, with higher costs for over-forecasting than any cost savings from under-forecasting

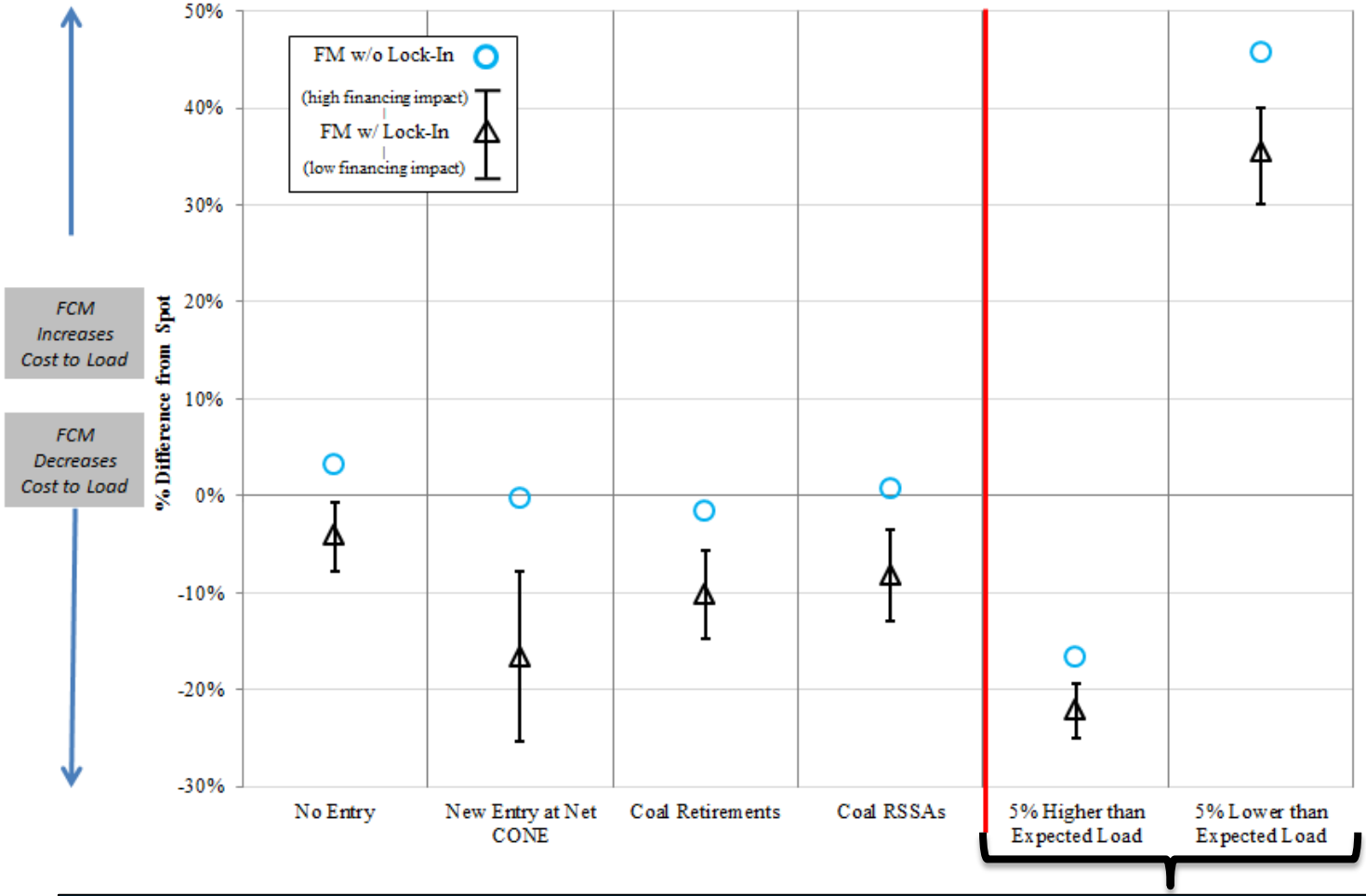
- **Impact estimates across *all* scenarios:**
  - *Change* in the total cost to load from an FM could vary between –17% and +46% relative to the SM in the same scenario
    - **At historical ratios, the total impact to all-in prices would be between -2.5 % and +6.9%**

Market Outcomes, Load Forecast Sensitivities

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Difference in Cost to Load, Percentage over Spot, New York State

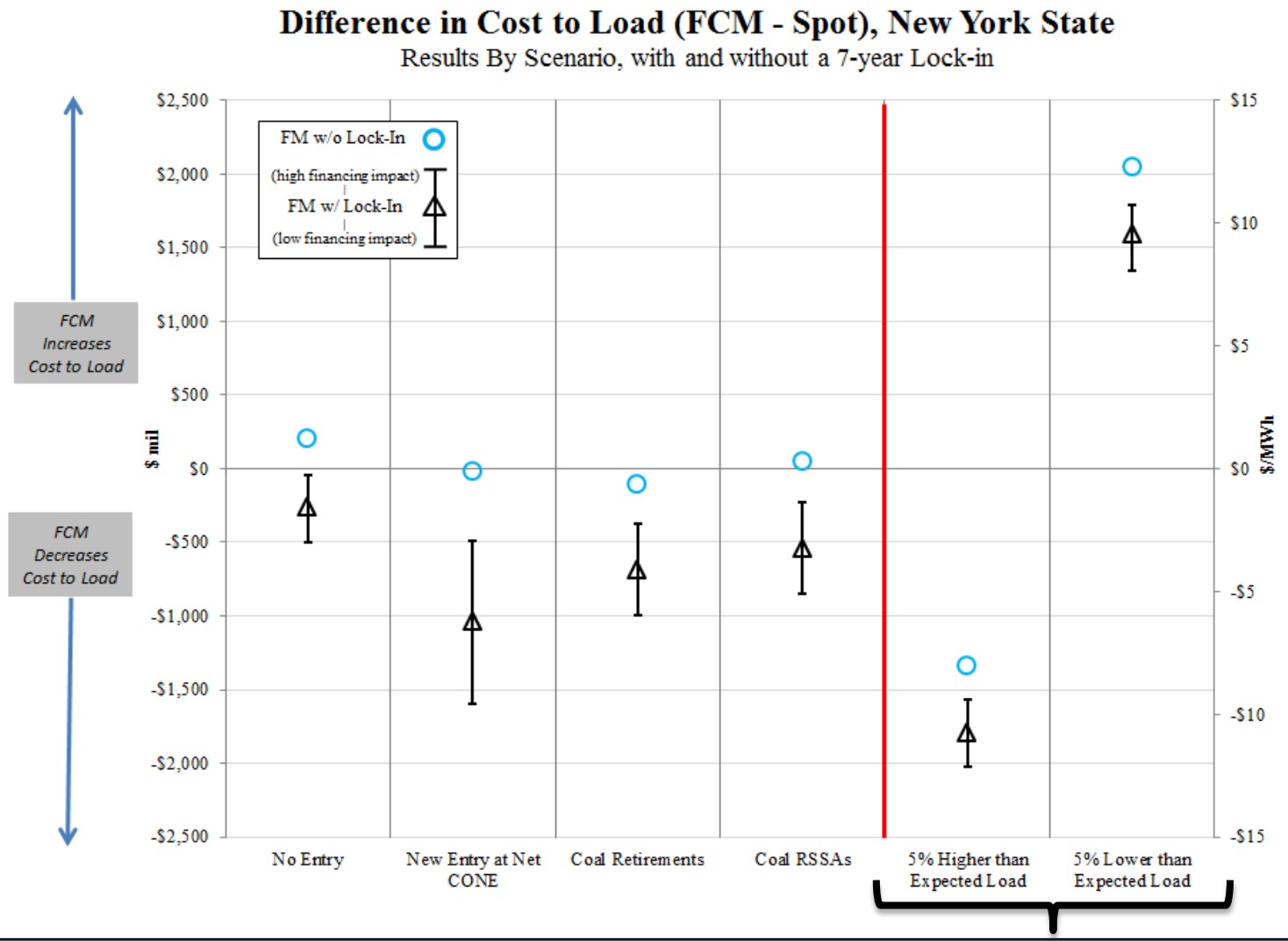
Results By Scenario, with and without a 7-year Lock-in



- **Results for Higher/Lower than Expected Load reflect different potential outcomes among a distribution of load outcomes – cannot look at one result in isolation**
- **Over-procurement (due to conservative forecasts) would lead to higher expected costs**

Market Outcomes, Load Forecast Sensitivities

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS



- Results for Higher/Lower than Expected Load reflect different potential outcomes among a distribution of load outcomes – cannot look at one result in isolation
- Over-procurement (due to conservative forecasts) would lead to higher expected costs

- **Price Stability and Risk**
  - In principle, FM results in less volatile outcomes, although measuring the degree of price stability gained is difficult, in practice
  - Price stability will lower cost of capital, all else equal
  - Price stability will lower variation in cost to load, and therefore risk to load and suppliers (in aggregate)

- **FM can lower volatility in payments to load arising from changes in required procurement quantity (e.g., due to uncertain load forecasts)**
  - Impact for volatility and expected level of payments depends on the ISO's ability to developed unbiased procurement targets

Timing and resources are the key considerations when thinking about the transition

- **From current system to an FM to take 3 years, minimum**
  - 3-6 months: Design process of understanding what the new FM will look like, learn from other ISOs
  - 1.5 years (minimum): stakeholders, shared governance, regulatory
  - 1 year (minimum): system build, planning processes (some concurrent with prior steps)
- **Move to FM would likely require the building of an IT system from a clean slate**
  - Estimated capital and/or labor costs run in the tens of $ millions, depending on the choice for in-house development or outsourcing
    - In-house operations may allow for more efficient and timely future updates
  - Will likely require at least 10 new FTE, spread across Legal, IT, Market Design, and Market Mitigation and Analysis
- **Annual operations are not expected to significantly increase costs relative to existing SM operations**
  - May require some repurposing of existing FTEs

Design alternatives within current SM structure could potentially create some of the benefits that would be created by the shift to a FM

- **Earlier PSC Retirement Notification Requirements**
  - Potentially provides earlier information about retirements
  - Could impose costs (e.g., lost optionality)
- **Smaller capacity zones**
  - In principle, could address certain local reliability issues arising from retirements, although in practice, such gains may be quite limited
- **Better scarcity pricing and/or performance incentives**
  - Shifting cost recovery from capacity to energy markets may reduce the need to support market-based new entry

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Use of Lock-in as an Element of Forward Capacity Market

- **Both ISO-NE and PJM have price lock-in provisions**
  - ISO-NE: was 5 years, recently increased to 7 years
  - PJM: 3 year option, but seldom used (stringent eligibility requirements)
- **A price lock-in for new resources is not a necessary element of moving to a FM structure**
  - Provides financial support for new entry, but introduces tradeoffs – for example:
    - Value of timely new entry (near-term, long-term)
    - Discrimination between existing and new resources

Implications for reliability

- **All else equal, may lead to greater new entry, which could support reliability objectives; incremental impacts beyond CSPP unclear**
- **If demand curve is adjusted to reflect change in net CONE, resource supply is reduced (for any given IRM target)**

Implications for market and economic outcomes: efficient use of capital, including new and existing resources

- **Discriminates against existing generation**
  - Risk of premature retirement, excess new resources
  - Potentially justified if significant regulatory risk (real or perceived) exists
- **Market offers and strategic bidding**
  - SM and FM designs can create incentives for resources to submit offers above true costs (because the marginal resource's offer affects the market price)
  - Competition from new and existing resources and market monitoring are the prime deterrent to such incentives
  - Price lock-in may exacerbate incentive by increasing reward of an above-cost new resource offer (i.e., number of years with higher payment)
  - In addition, new resource offers may time entry decisions to maximize lock-in prices

Change in Cost of Capital from Lock-In

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Modeling analysis evaluates the potential impact of lock-in

Results based on *estimate* of impact of a 7-year price lock-in on new resource cost of capital

- **Estimates reflect limited information and many uncertainties (financing approach – balance sheet, project-based, etc.; available market hedges/contracts; etc.)**

Relies on several types of information to inform estimated impact

- **Reviewed recently financed projects,**
- **Modeled changes in Debt Service Coverage Ratio (DSCRs) and corresponding change in historical credit rating spreads**
- **Reviewed recent merchant beta estimates**

Introducing a new entrant price lock-in would impact cost to load through changes in both the demand curve and supply curve (lower cost of new entry)

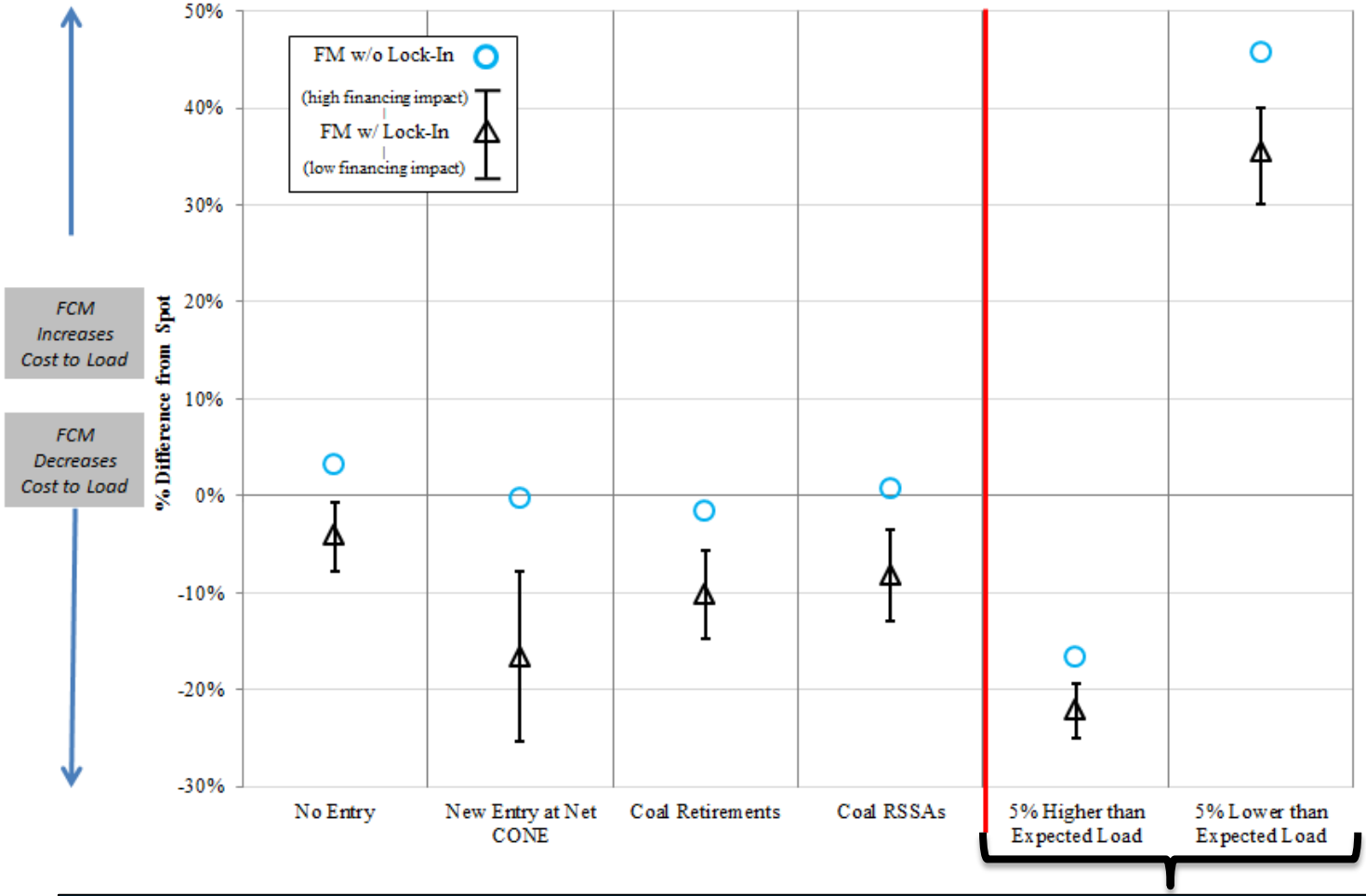
- **Price lock-in for new resource provides additional certainty and may lower financing costs**
  - **Reduces net CONE and reduces total cost to load, relative to a FM without a price lock-in**
  - **Across range of scenarios the change in total cost to load is –4 % to -17%**
    - **Impact to all-in prices would be between -0.6% and -2.5%**
- **Reduction in cost arises largely from a transfer from existing resources to load**

Market Outcomes, Load Forecast Sensitivities

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Difference in Cost to Load, Percentage over Spot, New York State

Results By Scenario, with and without a 7-year Lock-in



- **Results for Higher/Lower than Expected Load reflect different potential outcomes among a distribution of load outcomes – cannot look at one result in isolation**
- **Over-procurement (due to conservative forecasts) would lead to higher expected costs**

Conclusions

- **The existing Capacity Market has worked reasonably well, in part due to a well-designed and functioning energy market and the NYISO's biannual Comprehensive System Planning Process (CSPP)**

- **Careful consideration of Capacity and other market structures is warranted, given the pace and magnitude of changes over the planning horizon**

- **The move to a forward market would be somewhat costly and resource intensive, but manageable with sufficient lead time**

Conclusions

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Move to a FM would impact annual cost to load for NY consumers by -$105 million to +$207 million in 2020**
  - Does not consider long-run changes in generation fleet
  - Depends on load forecast, level of new entry, and other factors
  - Does not consider likely incremental NYISO administrative costs
- **Lock-in for new entry may reduce new entry capital costs, but poses tradeoffs**
  - Discriminates against existing generation and may lead to premature retirements
  - Bidding incentives for new resources

Overall, based on the modeling of potential market outcomes and our review of associated issues, we conclude that the move to a forward capacity market structure in New York is not warranted

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

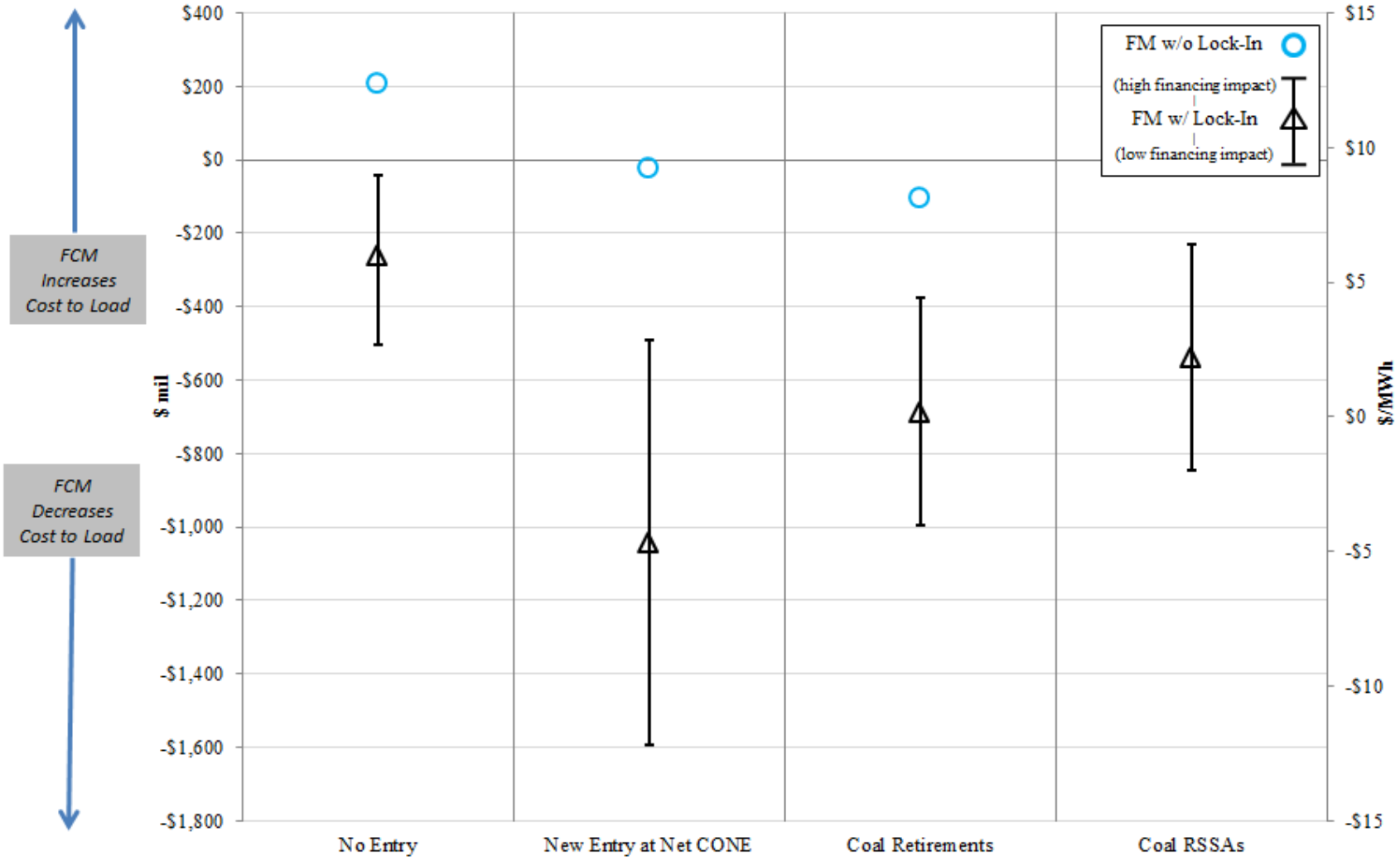
Additional Model Results

Difference in Cost to Load

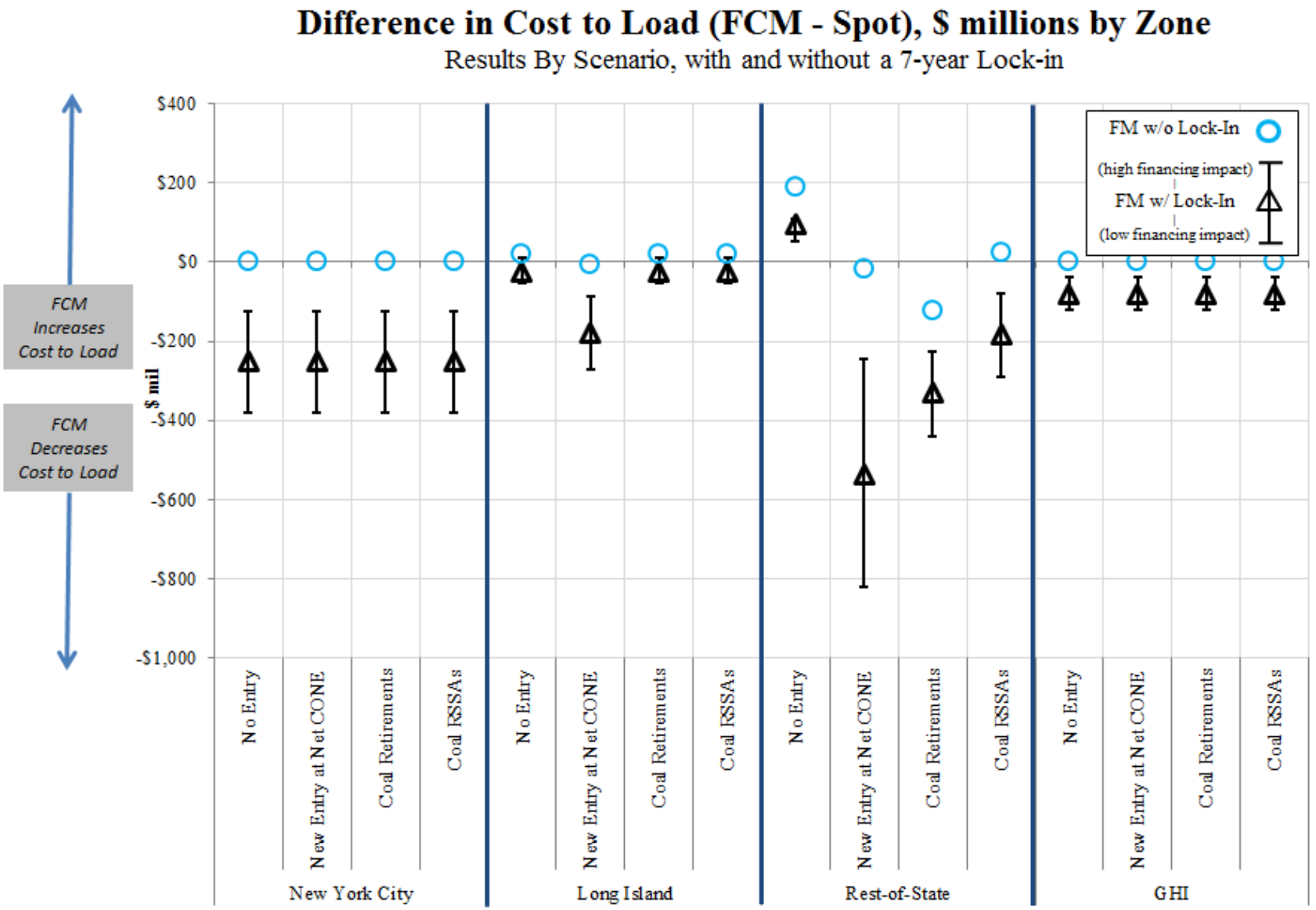
ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Difference in Cost to Load (FCM - Spot), New York State

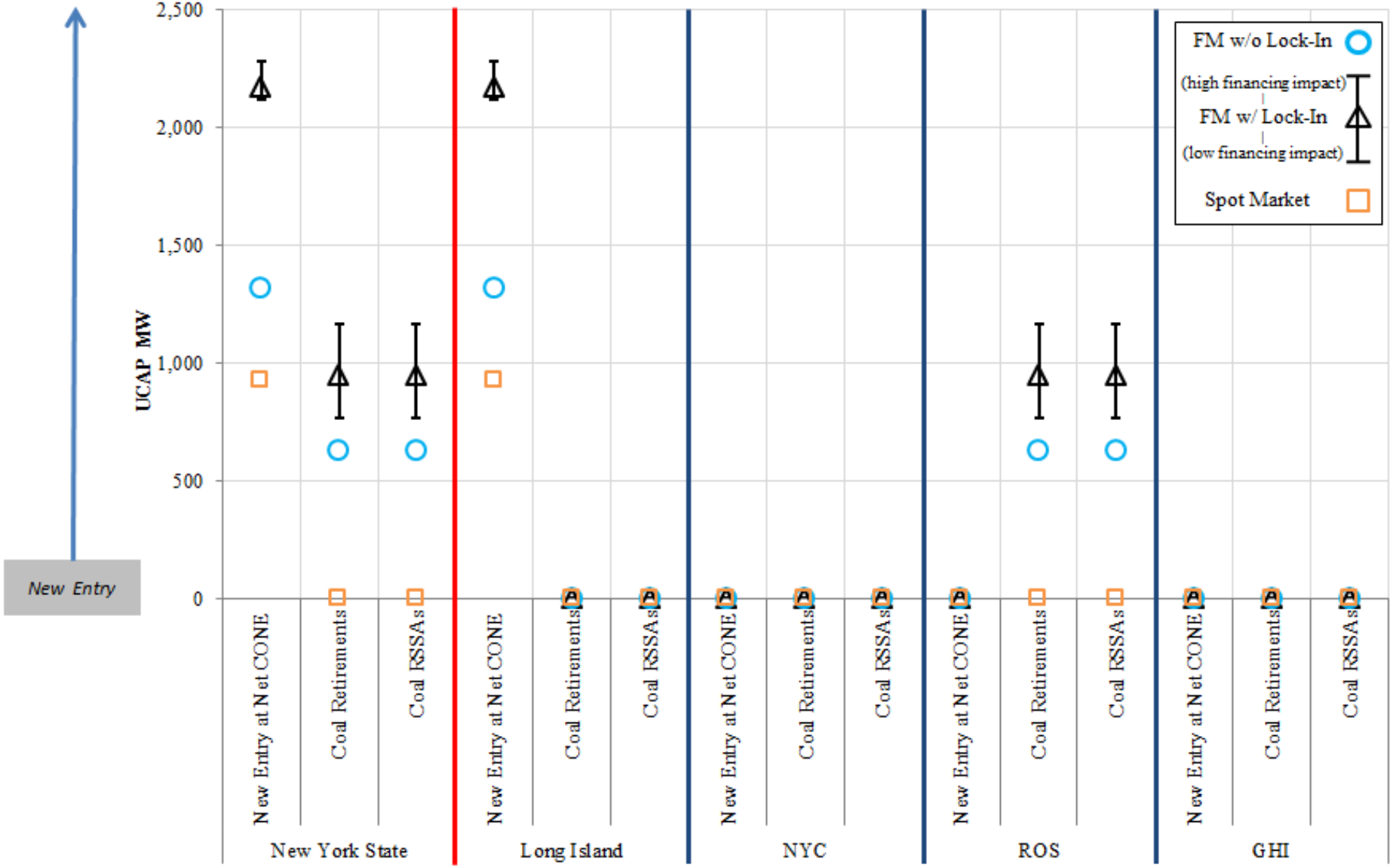
Results By Scenario, with and without a 7-year Lock-in



Difference in Cost to Load



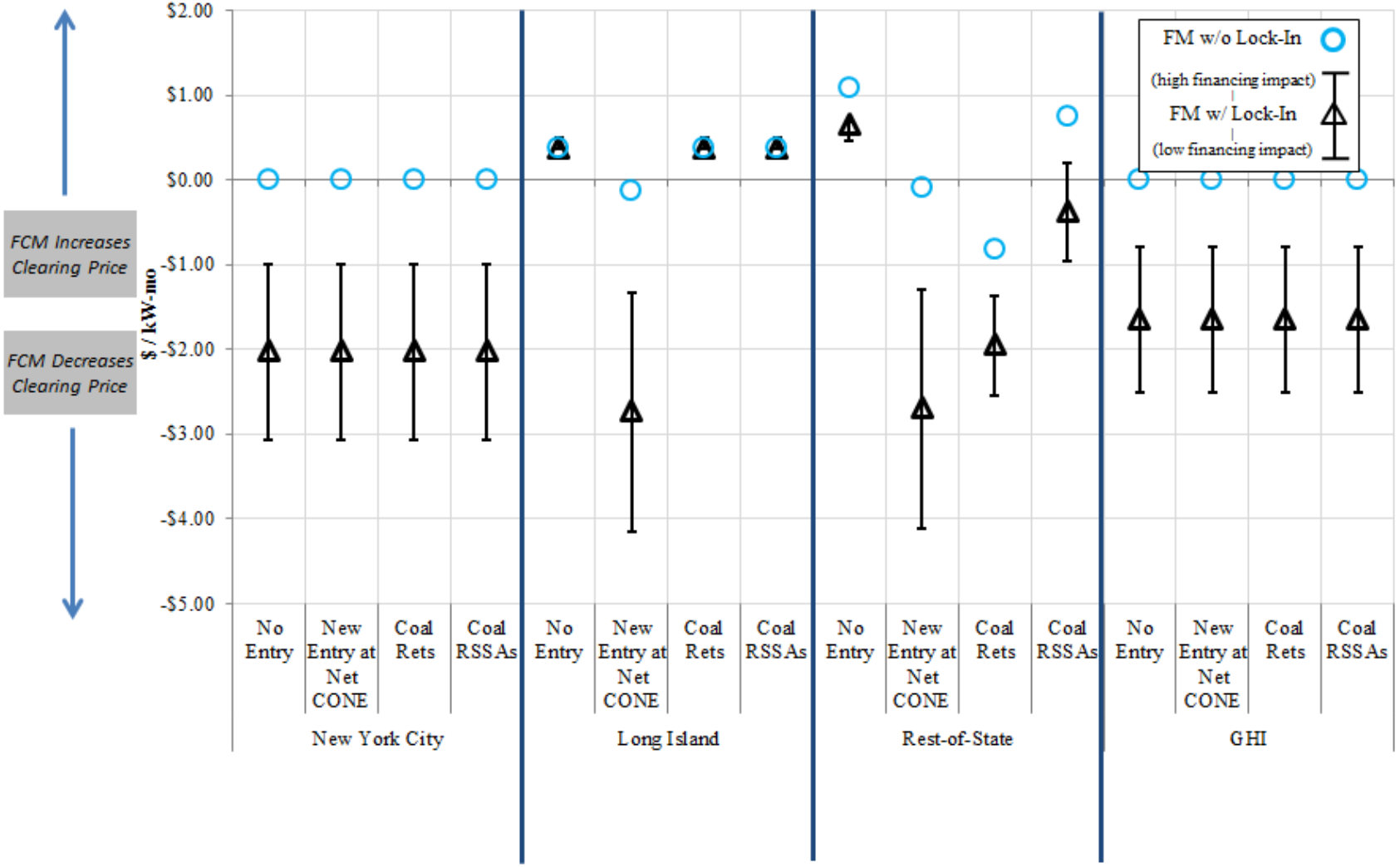
New Entry Quantity, UCAP MW



ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Difference in Clearing Price (FCM - Spot), $/kW-month by Zone

Results By Scenario, with and without a 7-year Lock-in

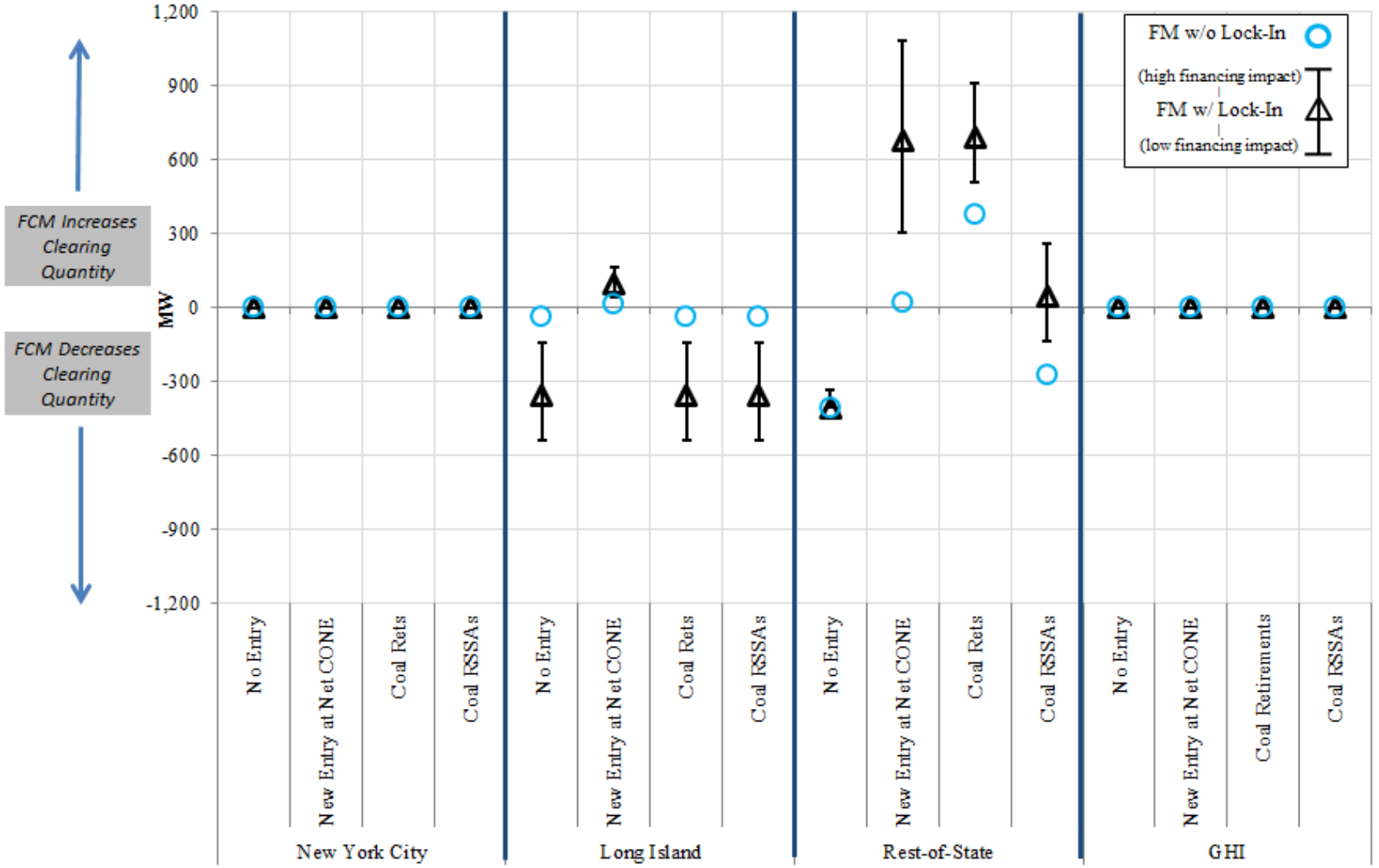


Change in Clearing Quantity, UCAP MW

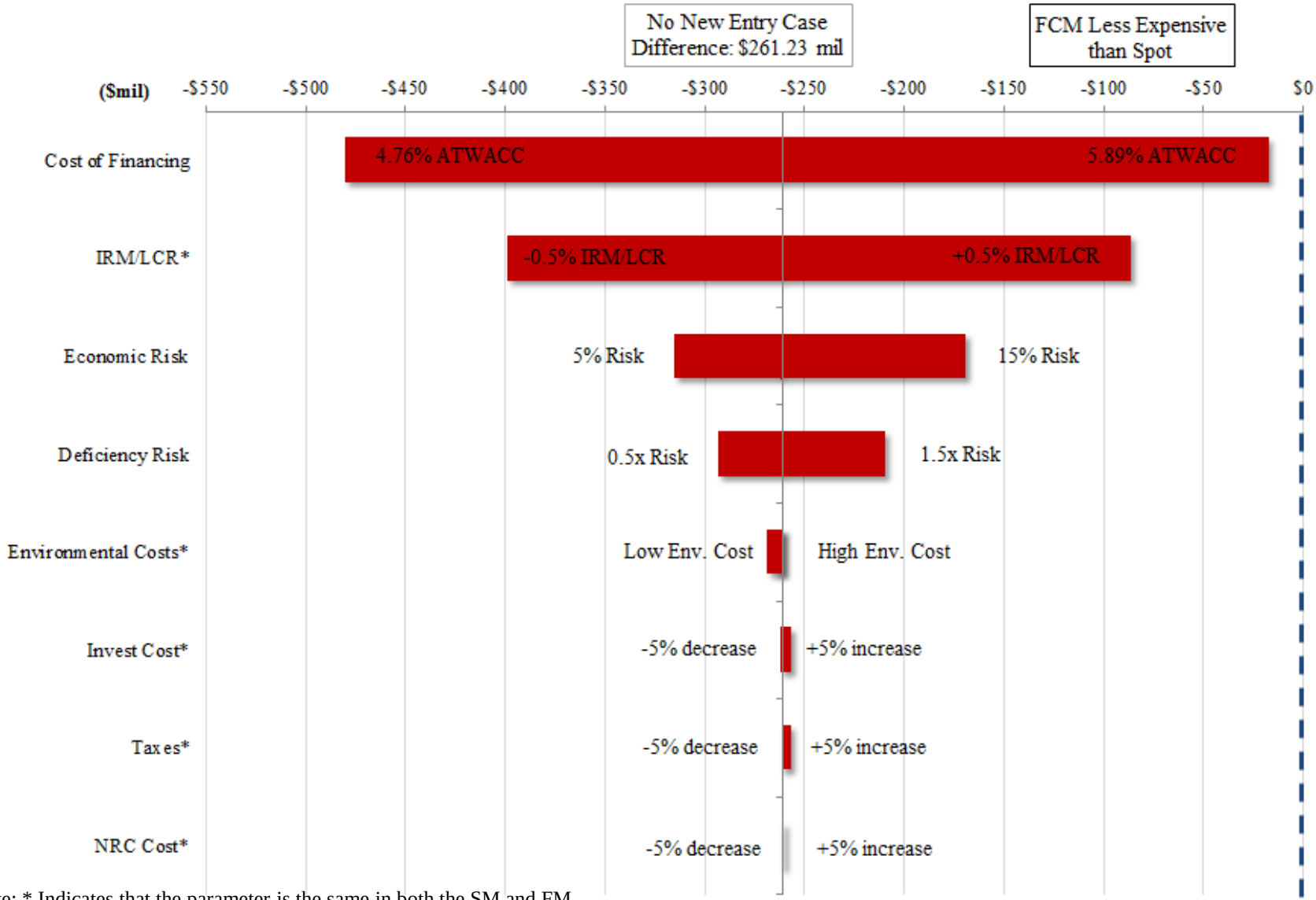
ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Difference in Clearing Quantity (FCM - Spot), MW by Zone

Results By Scenario, with and without a 7-year Lock-in



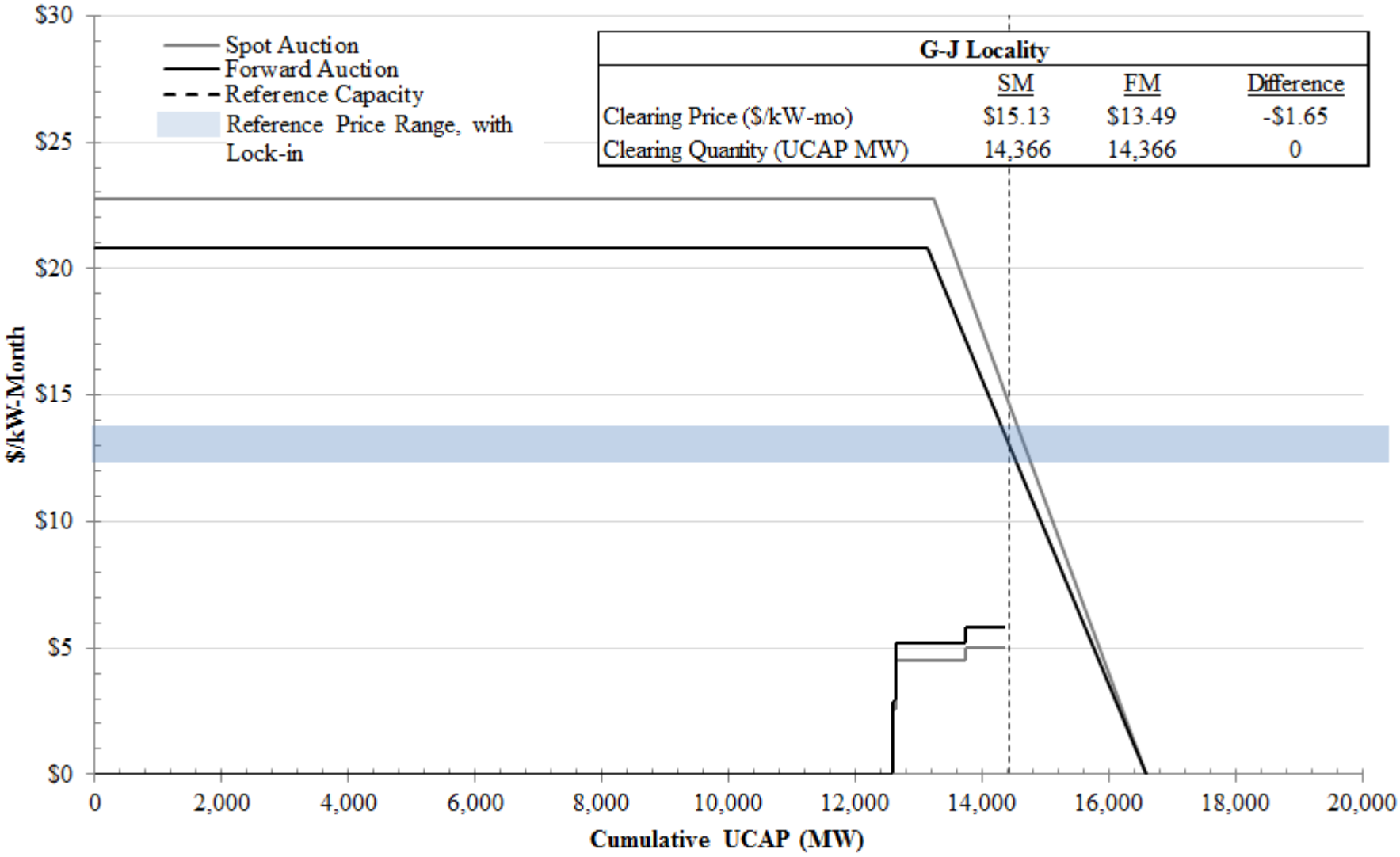
Sensitivity Analysis, No New Entry



Note: * Indicates that the parameter is the same in both the SM and FM.

G-J, No New Entry

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS



G-J Locality	SM	FM	Difference
Clearing Price ($/kW-mo)	$15.13	$13.49	-$1.65
Clearing Quantity (UCAP MW)	14,366	14,366	0

Additional Administrative Cost Considerations

Administrative Costs

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Timeline of Implementation**
  - **PJM and NEISO could not implement FCM in fewer than 2.5 years (optimistic estimate)**
    - Implications: NYISO would want to plan 3 years minimum; decision on software development (in-house, outsource) will affect cost and timing
    - Degree of commonality of viewpoints among NYISO, state, stakeholders will govern both length of process and whether ultimate design is consistent with NYISO's expectations
- **Resources (FTEs and $)**
  - **Implementation: IT platform, stakeholder process are the key drivers**
    - New England: $ range from a couple to few tens of million (plus commitment of FTEs) – less than this if not reinventing wheel?
    - Significant commitment of existing FTE's for market design, stakeholder, and regulatory processes over multiple years
    - IT approach affects up-front and ongoing costs
      - » **Outsource FCM: Smaller upfront investment, but lose flexibility and control over schedule – will be annual costs to run system and implement design changes**
      - » **Keep In-House: Larger upfront investment, but can control design and scheduling of updates; potentially lower annual costs if system is designed correctly**
  - **Annually: FTEs (in total) working on current capacity markets not more than ISONE or PJM have working on their FCM**
    - Implications: NYISO potentially has the internal resources to run FCM, but may require functional transfers

Transition to FM - Timing

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Timeline of Transition

- **Initial assessment of transition from current system to an FM to take 3 years, minimum**
  - **3-6 months: Design process of understanding what the new FM will look like, learn from other ISOs**
  - **1.5 years (min): stakeholders, shared governance, regulatory**
  - **1 year, min: system build, planning processes (some concurrent with prior steps**

Lessons Learned from ISONE and PJM

Implementation	Timeline	Main Challenges
New England ISO	• Took 5 years to design, process and build the software for FCM in-house	• Political, stakeholder processes • Design challenges (felt rushed doing the initial design, IT intensive)
PJM	• Took 2.5 years to get RPM going from initial FERC filing in Aug. 2005 to the first auction in 2007	• Stakeholders: Managing the stakeholders was a time-intensive process and more difficult than the actual implementation

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

NYISO Implementation - Resources Required (rough estimate)

Resources	FTEs (~9-12 FTEs total – ½ new hires)	$ Investment
NYSIO	• Market design / operations ~ 5-6 FTEs • Market mitigation and analysis ~ 1-2 FTEs • Counsel ~ 2-3 FTEs • IT ~ 10-12 FTEs for internal development • Additional: Management, admin, etc.	• IT (Unknown) – will depend heavily on the decision to use a vendor for the IT platform or to build the system internally • Will also depend on number of new FTEs needed

Lessons Learned from ISONE and PJM

Resources	FTEs	$ Investment
New England ISO	• Not many new hires, but took significant effort from legal and market development	• couple tens of million investment to internally design and build FCM
PJM	• No additional hires, but significant burden on outside counsel	• ~ a few million in transition costs to FCM in millions, not including vendor costs

Annual Running of FCM

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Departments	NYISO Current Capacity Responsibilities	NYISO FCM Responsibilities
MMA	• MMA • ICAP Market Mitigation	• Will continue to play a pivotal role in the capacity market process
Market Structures	• Energy Market Products • Capacity Market Products (Demand Curve)	• Demand curve analysis will still be needed
ICAP Operations	• ICAP Market Operations • Operations Performance	• Facing significant additional work in the planning and implementation process
Legal	• Legal Compliance	• Legal is facing a significant additional workload based on the experiences in NEISO and PJM
IT	• QA Reliability & Markets • Markets Operations Products	• Potentially large additional resources needed to design/facilitate the FCM process • Challenge to redesign/incorporate new cyber security standards
Planning	• Interconnection Studies, Deliverability Test • LCR/IRM and Forecast	• Increased Responsibility to pre-define zones, pre-certify bids before auctions; increased importance of annual updates to forecasts
External Affairs	• Stakeholder Services • Regulatory Affairs	• Stakeholder Services • Regulatory Affairs
Shared Services (HR, Finance, Corporate, Internal Audit)	• No specification in budget although significant resources provided	• Unknown, but plays a significant role and is understated in the current budget as it pertains to CM expenditures

NYISO Resources Required – $ Investment

Resources	Current Costs	FCM Impact on Costs
NYSIO	• 2014 Enterprise Cost Management will provide detailed cost estimate • May be necessary to allocate shared service expenditures for IT, Legal, HR	• NYISO's costs should not increase drastically on an annual basis. Would reflect a reallocation of current resources.

Lessons Learned from ISONE and PJM

Resources	FCM Impact on Annual Costs	Notes
New England ISO	• Annual costs have ranged from $4-5 million per year for the last five years • $2 million in software capex	• Costs have been high in part due to market design improvements
PJM	• Annual costs are unknown, but are heavily relegated to the annual vendor fee and legal fees	• There is limited transparency to PJM's annual costs

NYISO Resources Required – FTEs

FTEs	Current Capacity Market FTEs	FCM Impact on FTEs
NYISO	• Approximately 30 FTEs run the capacity markets (across MMA, Operations, Planning, Design, etc.)	• There are potentially sufficient FTE resources that can be reallocated to run FCM, but all roles need to be defined for FCM • Potential to increase FTE for IT and development

Lessons Learned from ISONE and PJM (order of magnitude)

FTEs	FCM Annual FTEs	Notes
New England ISO	• Planning (~10 FTEs year round) • Market Monitoring (~5 FTEs during peak months) • Legal (1-2 FTEs) • Other (IT, Consultants, Operations, Market Admin, Settlements, Finance)	• NEISO is able to run FCM with these FTE allocations, although at times certain groups are very busy (i.e. market monitoring during peak months)
PJM	• Running RPM (~7-8 FTEs) • Legal (~3 FTEs)	• PJM notes that many operations needed to run RPM were already being run by current department functions • Legal incurs significant additional work on an annual basis due to additional filings

New Entry Price Lock-in

Demand Curve Parameters

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Demand Curve Parameters:**
  - 2014 Gold Book load forecast for 2020
  - 2014 IRM/LCR Values, Zero Crossing Points
  - 2014 ICAP/UCAP Translation factors
  - NERA/Brattle Reference Prices
    - *(including adjustment for 7-year lock-in, described below)*

7-Year Lock-In lowers costs to new generation

- **Lock-in lowers financial risk and therefore cost of capital for new entry**
  - **Lower financial risk achieved through transfer of risk from merchant generation to load**
- **With lock-in, mix of resources supported by capacity market may shift**
  - **Analysis does not consider likely resource shifts from a forward market, particularly in light of other NYISO market changes being considered**
  - **For example, both PI mechanism and forward markets (with price lock-in) may adversely affect similar resources (e.g., older, less efficient resources)**
- **With lock-in, additional payments from load to new resources over lock-in period if market clears below lock-in price**

Impact of 7-year Lock-in on Financing

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Modeling Scenarios assume:**
  - **125 bps (+/ – 75 bps) change in cost of debt**
  - **139 bps (+/ – 60 bps) change in cost of equity**
- **Represents an after tax WACC of 5.32% (5.89%/4.76%), compared to reference case of 6.37%**
  - **Developed using 50/50 debt/equity ratio**
  - **Reference estimates include 7% cost of debt, 12.5% cost of equity**
- **Choice reflects information discussed above: 1) recently financed projects, 2) modeled changes in DSCRs (and corresponding change in historical credit rating spreads) and, 3) recent merchant beta estimates**

Impact of 7-year Lock-in on Financing

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

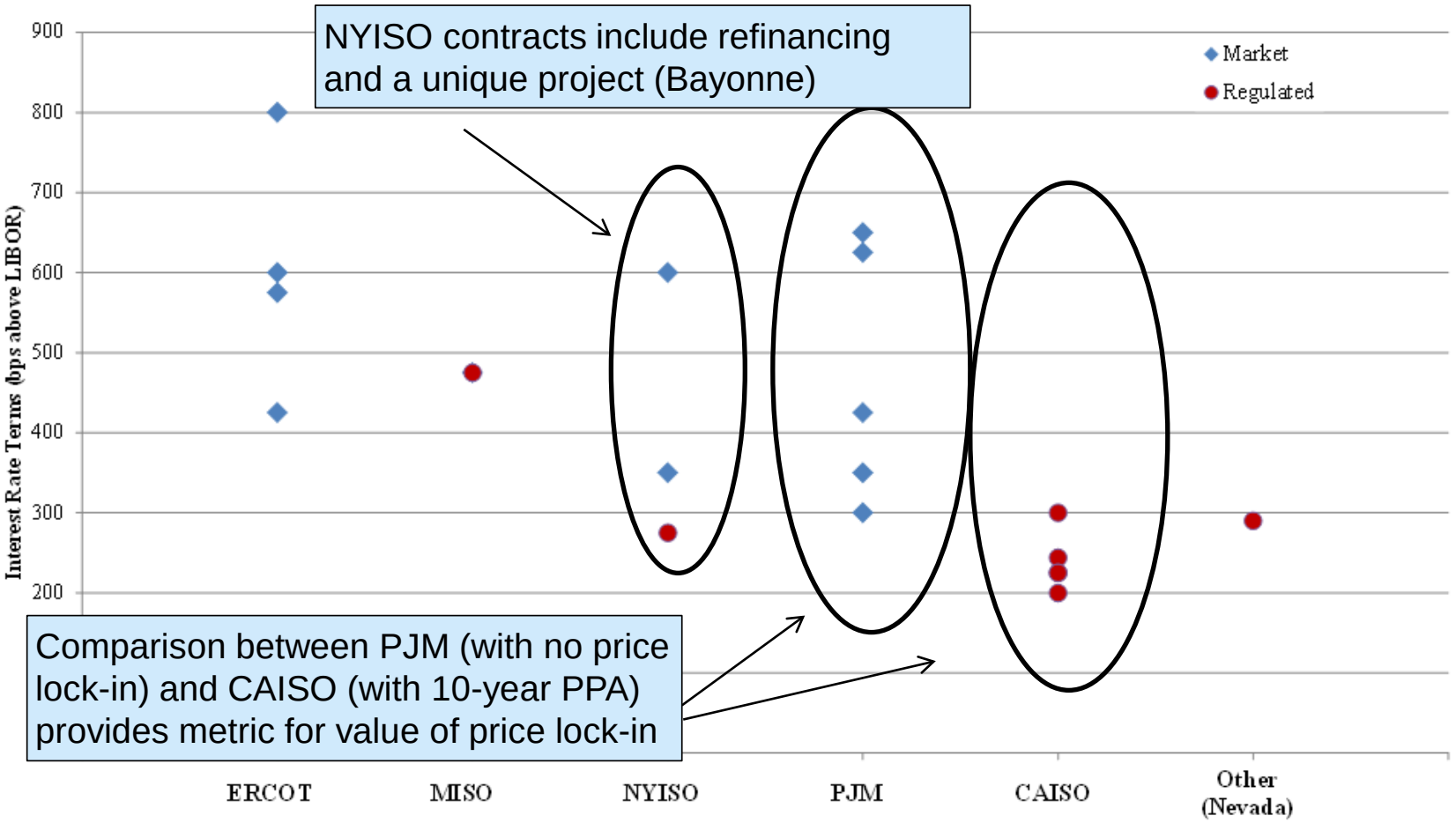
Assessment of expected change in debt and equity costs from forward price lock-in reflect several types of information

- **Financing information (debt costs) from merchant projects built between 2010 and 2014**
  - **Identified 19 projects, across multiple regions, developers, with and without long term agreements (see following slides)**
    - **Terms of deals vary and often not fully known (underlying economics, debt/equity, tenor, cash sweep, etc.)**
    - **Deals reflect a wide range from 10-year purchase power agreements (e.g., California) to fully merchant projects (e.g., ERCOT)**
- **Pro Forma analysis of impact of price lock-in on financial metrics used in evaluating credit rating ("stress tests")**
  - **Evaluate change in Debt Service Coverage Ratio, assuming changes in capacity market revenues in years 2-7**
  - **Based on Brattle/NERA demand curve reset model**
- **Market expected returns (betas) for merchant companies**

Interest Rates for New Resource Debt Issues

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

By Region, 2010-2014



Note:
[1] NYISO projects include Linden Cogeneration (948 MW CC), Bayonne Energy Center (512 MW CT), and a 2012 Astoria Generating Co. refinancing.

Sources:
[1] Project Finance International.
[2] Company specific 10-K financials.
[3] News articles.
[4] SNL Financial.

Comparison of rates across sub-groups

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Change in Cost of Debt [1]

basis points above LIBOR

	CAISO	PJM	Difference	Adjusted [2]	Adjusted [3]
By Developer					
Calpine	225	300	75	57.5	53.2
CPV	225	387.5	162.5	124.7	115.3
By ISO					
Average (by ISO)	238.8	470.0	231.2	177.4	164.0
Median (by ISO)	225	425	200	153.5	141.9

Notes:

[1] Rates are reported as basis points above LIBOR, based on stated financing terms for individual projects in each region by developer.

[2] Values are adjusted to account for the difference in net present value cash flows earn
7 compared to years 1 - 10 years, assuming an even flow of capacity revenues in each y

[3] Values are adjusted to account for the difference in net present value cash flows earn
7 compared to years 1 - 20 years, assuming capacity revenues for a PPA in years 1-10 a
RAR in years 11-20.

Metrics informing change in debt finance cost vary from 60 – 180 bps

Impact of 7-year Lock-in on Credit Ratings

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- ***Debt Service Coverage Ratio (DSCR)*** **is a key financial metric consider by agencies when assigning a credit rating**
  - **Measure of available cash to support timely debt payments under base and stress test scenarios**
- **Debt cost impact of 7-year lock-in evaluated by comparing DSCR with and without lock-in**
  - **Without lock-in assumes 5 year average historical ICAP Spot market capacity prices (a "stress test" case)**
    - **Stress test at 2011 prices (lowest historical prices) suggests new entry would be uneconomic**
  - **DSCR based on reference unit from demand curve reset models**
- **Change in DSCR is associated with credit rating change**

Figure 6: Indicative Rating Category Cover Ratios (Rating Case)

	DSCR Profile	
(x)	'BB' Category	'BBB' Category
Fully Contracted Projects	1.15–1.45	1.40–1.50
Partially Contracted Projects	1.25–1.60	1.50–1.70
Fully Merchant Projects	1.40–2.00	1.80 and above depending on risk profile.

Source: Fitch.

Source: Fitch

DSCR by Locality ($/kW-ICAP)

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

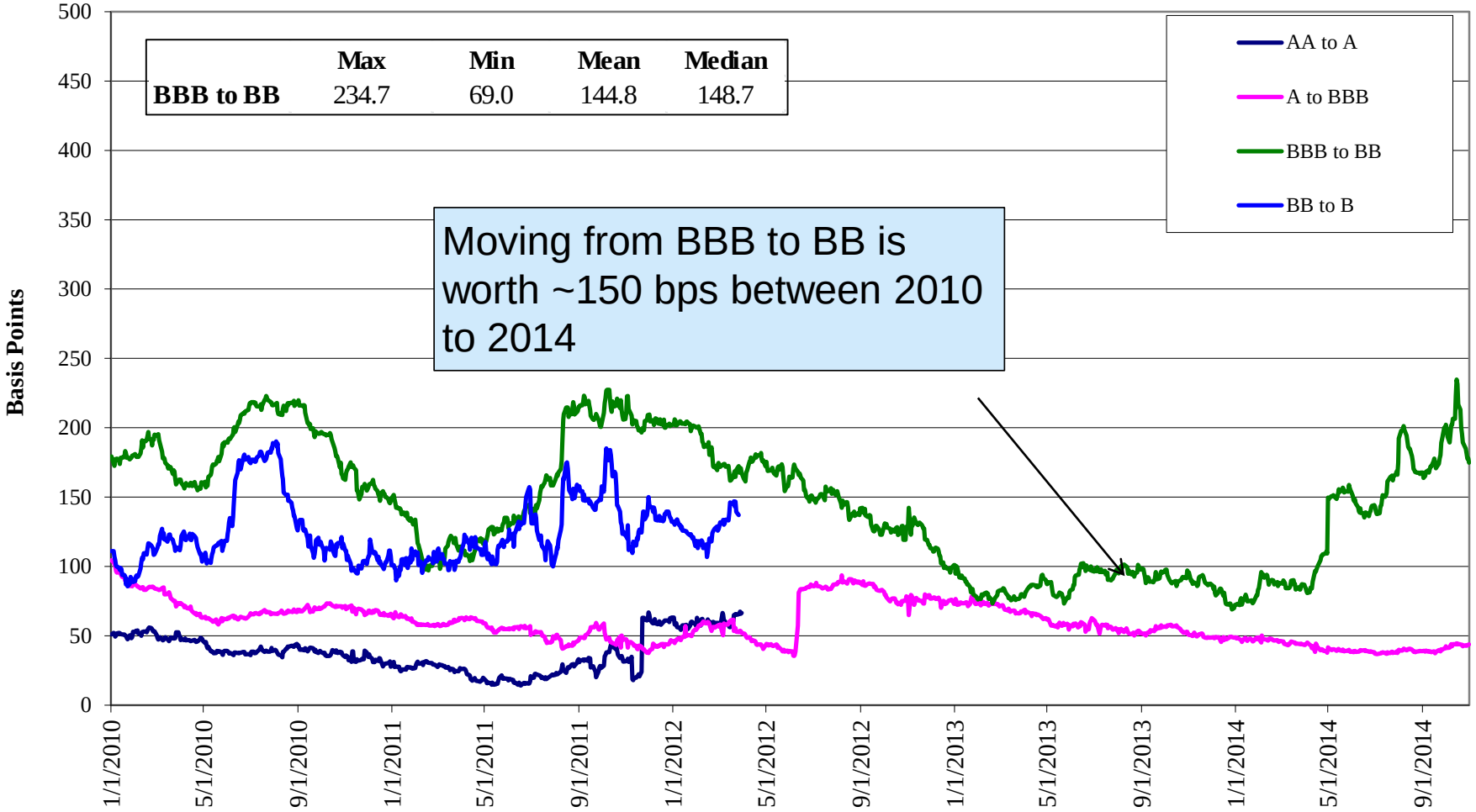
7-year Lock-in	Notes	NYCA	NYC	Long Island	G-J Locality
[a] Energy Margin		$1.00	$1.81	$4.68	$1.77
[b] Capacity Payments		$6.92	$12.06	$4.89	$8.36
[c] Insurance + O&M		$1.07	$2.71	$1.71	$1.57
[d] Property and Income Taxes		$1.27	$1.65	$1.80	$1.65
[e] Net Cash Flow	= [a]+[b]-[c]-[d]	$5.57	$9.51	$6.05	$6.91
[f] Debt Service		$2.37	$3.80	$3.36	$3.07
[g] Debt Service Coverage Ratio	= [e]/[f]	**2.35**	**2.50**	**1.80**	**2.25**
Stress Test Scenarios					
Decline in Capacity Prices	-25%				
[h] Weighted Average Prices		$5.19	$9.05		
[i] Implied Annual Net Cash Flow	= [a]+[h]-[c]-[d]	$3.84	$6.50		
[j] Implied Annual 2013 DSCR	= [i]/[f]	**1.62**	**1.71**	**1.44**	**1.57**
[k] Difference from Year 7 DSCR	= [g]-[j]	**0.73**	**0.79**	**0.36**	**0.68**
5-year Historical Average Price					
[l] Weighted Average Prices		$2.34	$9.60	$2.69	-
[m] Implied Annual Net Cash Flow	= [a]+[l]-[c]-[d]	$0.99	$7.05	$3.85	-
[n] Implied Annual DSCR	= [m]/[f]	**0.42**	**1.86**	**1.15**	-
[o] Difference from Year 7 DSCR	= [g]-[o]	**1.93**	**0.65**		

Change in DSCR from > 2.5 to 2 (or lower) is consistent with a change in rating of BBB to BB

Table 4, Combustion Turbine

Change in credit ratings

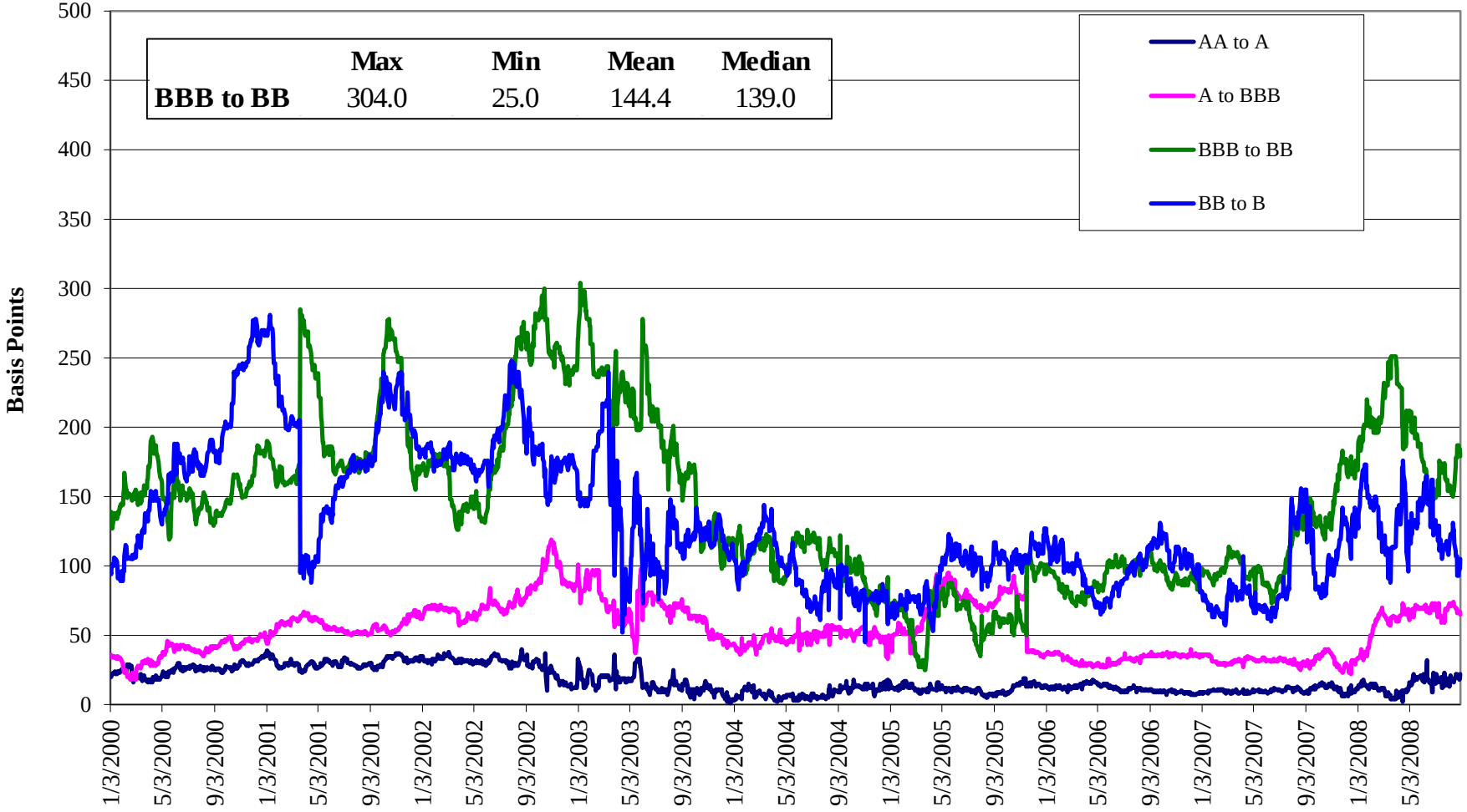
Credit Spreads, Bloomberg Fair Value Effective Bond Yields for 5-Year Bonds
Change in Yield between credit ratings



Source:
[1] Bloomberg, accessed November 3, 2014

Recent experience matches long run averages

Credit Spreads, Bloomberg Fair Value Effective Bond Yields for 10-Year Bonds
Change in Yield between credit ratings



Source:
[1] Bloomberg, accessed November 3, 2014

Impact of 7-year Lock-in on ROE (1)

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Return on equity: informed by CAPM model and differences in beta for different types of power sector equities**
  - NERA Study reports range of beta values for different types of firms within electricity sector :
    - 1.10 – 1.20 for merchant companies (AES, Calpine, NRG)
    - 0.65 – 0.85 for vertically-integrated utilities with merchant affiliates
    - 0.55 – 0.70 for vertically-integrated utilities
  - Beta values among merchant companies vary by company and debt/equity profile

Company	5-yr Daily Beta as of 11/25/14	Re-Levered Beta Assuming 1:1 Debt-To-Equity Ratio
Calpine	0.85	0.68
NRG Energy	0.97	1.09
Dynegy	0.69	0.86

Source:

[1] Bloomberg, Accessed November 5, 2014.

Impact of 7-year Lock-in on ROE (2)

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

- **Change in ROE calculated as change in beta from price lock-in times expected economy-wide risk premium – that is:**

$$\Delta ROE = \Delta \beta * EERP$$

  - $\Delta\beta$ = 0.2 plus/minus 0.1
  - Expected Economy-wide Risk Premium (EERP) = 6.96% (Ibbotson, 2014)

  - Suggests change in ROE from 7-year lock-in would range from 0.69% to 2.09%, with middle estimate of 1.39%

Supply Curve Model Parameters

- **All Model Scenarios include the following:**
  - **Supply Curve Parameters**
    - **CARIS II GE MAPS data from July 2014 System Planning Working Group**
    - **Includes variable costs (VOM, fuel, emissions, and start-up) and expected energy revenues**
      - Base Case assumes TOTS in-service (2016)
      - Dunkirk, Cayuga, Selkirk, and Bowline are in-service throughout the study period; Danskammer out-of-service
      - Market Based Solutions from 2012 CRP included (500 MW in-service 2018) at Astoria; Generic GT (210 MW) installed at Barrett Station in 2016 for RA
    - **Imports/UDRS/SCRs at summer 2014 averages**
    - **Fixed O&M (NYISO Data)**
    - **Annual Capital Expenditures ($/kW-mo), FERC Form 1 Data**
    - **Annual Property Taxes ($/MW), Public Assessments**
    - **Environmental Retrofits (select generators)**

Existing Resources – Additional Data

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

Model includes data and estimates for:

- ***Taxes***
  - Estimated separately for NYC and all other zones
    - Includes assessment data and PILOT information for select NYCA units
    - NYC estimate based on Utility Property Full Market Value, effective tax rates, and total NYC generation capacity
- ***Annual Investment Costs***
  - National sample (445 plants), investment calculated as the difference between annual FERC Form 1 Gross Capital Expenditures by technology/fuel
  - Included in bid costs, annualized over 6-years, assuming 6.73% after-tax WACC
- ***Environmental Retrofit Costs and Nuclear Fukushima Costs***
  - Includes capital investments to comply with:
    - MATS, CSAPR/CAIR, NO_x RACT, BART, and BTA