

When, Not If: Bridgeport's Future and the Closing of PSEG's Coal Plant

By David Schlissel and Cathy Kunkel
Institute for Energy Economic and Financial Analysis



Authors

David Schlissel has been a regulatory attorney and a consultant on electric utility rate and resource planning issues since 1974. He has testified as an expert witness before regulatory commissions in more than 35 states and before the U.S. Federal Energy Regulatory Commission and Nuclear Regulatory Commission. He also has testified as an expert witness in state and federal court proceedings concerning electric utilities. His clients have included state regulatory commissions in Arkansas, Kansas, Arizona, New Mexico and California, publicly owned utilities, state governments and attorneys general, state consumer advocates, city governments, and national and local environmental organizations.

Mr. Schlissel has undergraduate and graduate engineering degrees from the Massachusetts Institute of Technology and Stanford University. He also has a Juris Doctor degree from Stanford University School of Law.

Cathy Kunkel is an independent consultant focusing on energy efficiency and utility regulation. She has testified on multiple occasions before the West Virginia Public Service Commission, as part of her consulting work for the non-profit coalition Energy Efficient West Virginia. Prior to moving to West Virginia in 2010, she was a graduate student in the Energy and Resources Group at the University of California-Berkeley and a senior research associate at Lawrence Berkeley National Laboratory. She has undergraduate and graduate degrees in physics. She is a part-time fellow with the Institute for Energy Economics and Financial Analysis.

Purpose

The purpose of this Report is to inform policymakers and other interested stakeholders regarding the future of the Bridgeport Harbor Unit 3 power plant in Bridgeport, Connecticut. The analyses presented in the Report are based on PSEG and ISO New England reports and on published industry information and analyses from SNL Financial L.L.C. and UBS Investment Research.

Introduction

Bridgeport Harbor Unit 3 is a 387.5 megawatt ("MW") coal-fired facility, with some potential to burn residual fuel oil as a secondary fuel. It is currently 45 years old, having started commercial operations in 1968.

Bridgeport Harbor Unit 3 is owned by PSEG Power Connecticut ("PSEG" or "PSEG Power"), a merchant subsidiary of the Public Service Enterprise Group. PSEG also owns the 146 MW oil-fired Bridgeport Harbor Unit 2 and the 454 MW oil-fired New Haven Harbor power plants. In addition, PSEG owns combustion turbines at the Bridgeport Harbor and New Haven Harbor sites.

Bridgeport Harbor Unit 3 is the last coal-fired electric generating unit operating in Connecticut and one of the last few coal-fired units operating in New England.

Like other aging coal-fired and oil-fired generating units in New England, Bridgeport Harbor Unit 3 was originally designed and operated to provide baseload electric power. However, due to changes in the grid, most significantly the availability of substantial amounts of low cost power from natural gas-fired combined cycle units, Bridgeport Harbor Unit 3 and the region's other aging coal and oil-fired units are now being relied on for peaking service, ramping, or reserves when the natural gas-fired units are constrained or unavailable. Unfortunately, long start-up times, perhaps as long as 24 hours to reach full power production, make it "challenging to rely on older plants for backup generation" (according to the regional electric grid operator, ISO New England).¹

Conclusion

The future for Bridgeport Harbor Unit 3 looks bleak. Significantly changed circumstances have already led the unit's output and revenues and, consequently, PSEG's pre-tax earnings from the unit, to plummet in recent years. These same changed circumstances also create great uncertainty about the unit's continuing financial viability. In fact, it is not unreasonable to anticipate that PSEG's earnings from the plant will be substantially diminished or eliminated by the end of this decade. Given this conclusion, it would be prudent for the City of Bridgeport, the State of Connecticut, and ISO New England to begin to prepare for the unit's eventual retirement.

National Trends in Coal-Fired Power Costs and Generation

The factors that have adversely affected PSEG's revenues and earnings from Bridgeport Harbor Unit 3 in recent years are consistent with broader trends impacting coal plants in deregulated markets. Nationally, the decline in the financial viability of coal plants is driven by: flat or declining electricity demands due to the recent economic downturn and increasing investments in energy efficiency and demand response; low natural gas prices; uncompetitive coal prices; and increased generation from renewable resources. In ISO New England, for example, weather-adjusted electricity usage declined by more than four percent between 2007 and 2012.

Natural gas prices have fallen 70% since 2008; in 2012, Henry Hub natural gas prices reached \$2.75/MMBTU, their lowest since 1999.² This has driven down wholesale electricity prices in competitive markets like that in New England. Wholesale market prices are set by the variable generating cost at the most expensive unit that clears the market; low natural gas prices have allowed natural gas units to reduce their operating costs and displace coal units as the marginal unit in many hours of the year.



Nationally, the price of coal delivered to the electric power sector increased 7.5% per year from 2002-2011 and is projected to continue to rise.³ Increases in coal exports have made domestic coal prices more subject to international market forces and hence more volatile.

Increased generation from renewable resources is also putting pressure on coal-fired units. Because renewable sources like wind and solar have no operating costs, they are dispatched ahead of other units and therefore contribute to reduced operations and reduced revenues for coal-fired units.

These fundamentals have driven the retirement of more than 13,000 MW of the country's aging coal fleet from 2009-2012.⁴ They have also driven coal-fired power generation to record lows in 2012: 37% of total generation, down from 48% in 2008.⁵ Natural gas prices rebounded slightly in 2013, meaning that coal enjoyed a higher share of power generation in 2013 over 2012; but coal cannot realistically be expected to regain the share of national power generation it enjoyed prior to the collapse of natural gas prices in 2009.

These economic factors have led to serious financial troubles for deregulated coal-fired power plants, including:

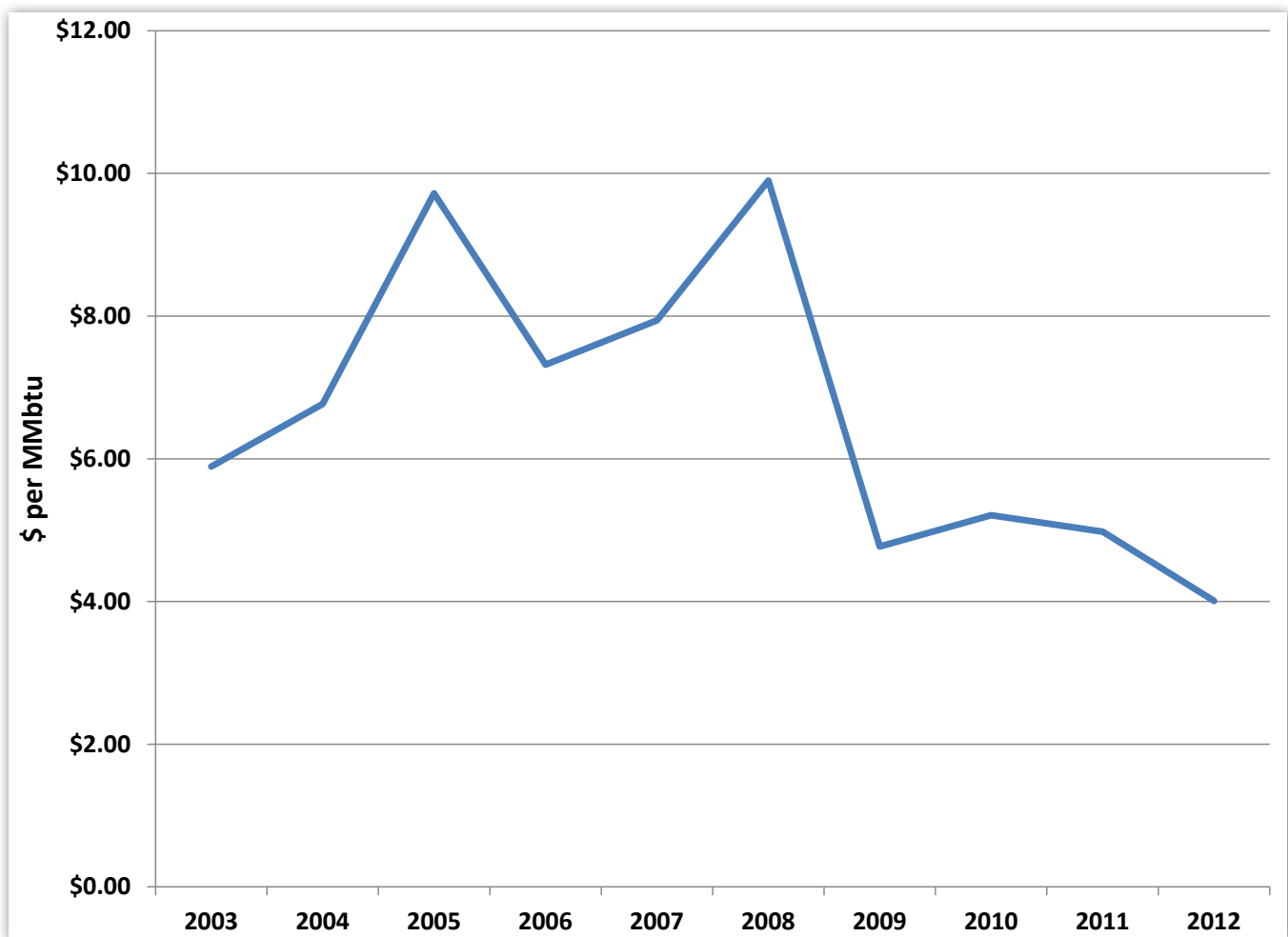
- The Hatfield's Ferry Power Station in Pennsylvania: FirstEnergy closed the supercritical Hatfield's Ferry coal plant in Pennsylvania in October 2013.⁶ Placed into service from 1969-1971, the plant is significantly younger than the average age at which coal plants have been retired in recent years.
- The Harrison Power Station in West Virginia: FirstEnergy received approval in October 2013 to transfer 80% of the Harrison power plant from its deregulated subsidiary, Allegheny Energy Supply, to its West Virginia regulated subsidiary, Monongahela Power. In a quarterly call to investors in November 2013, FirstEnergy CEO Anthony Alexander explained that the transfer was part of FirstEnergy's efforts to "reposition" its merchant generation business in expectation of continued low power prices.⁷
- AEP's Ohio coal units: By order of the Public Utilities Commission of Ohio, AEP is spinning off its Ohio-based generating assets into a separate, deregulated subsidiary. Analysis from UBS Investment Research predicts that these plants will see their earnings decline by more than 35% once the plants are forced to compete on the regional electricity market managed by PJM.⁸
- The Brayton Point Station in Southeastern Massachusetts: Immediately after finishing investments of more than \$1 billion in pollution control equipment, Dominion Resources sold the 1,580 MW Brayton Point Station for what has been estimated to be approximately \$55 million, a substantial financial loss. Moreover, within a month of closing on this transaction, the new owner gave notice of its intent to retire Brayton Point in 2017.

As this report will demonstrate, the national trends of lower natural gas prices, lower wholesale market prices, and declining coal generation are also playing out in New England and are likely to negatively impact the future operating performance and remaining service life of Bridgeport Harbor Unit 3.

The Recent Financial Viability of Bridgeport Harbor Unit 3 Has Been Adversely Impacted by Significantly Changed Circumstances Since 2008

The first, and most significant, changed circumstance that has affected the financial viability of Bridgeport Harbor Unit 3 has been a reduction in generation caused by the collapse of natural gas prices that started in late 2008/early 2009. This rapid price decline was the result of the increased supply of shale natural gas at production costs far below more traditional gas wells. Figure 1, below, shows the average natural gas prices in New England between 2003 and 2012, including the steep price drop between 2008 and 2009 and further erosion in prices through 2012.

Figure 1: Average Annual New England Natural Gas Prices 2003-2012.



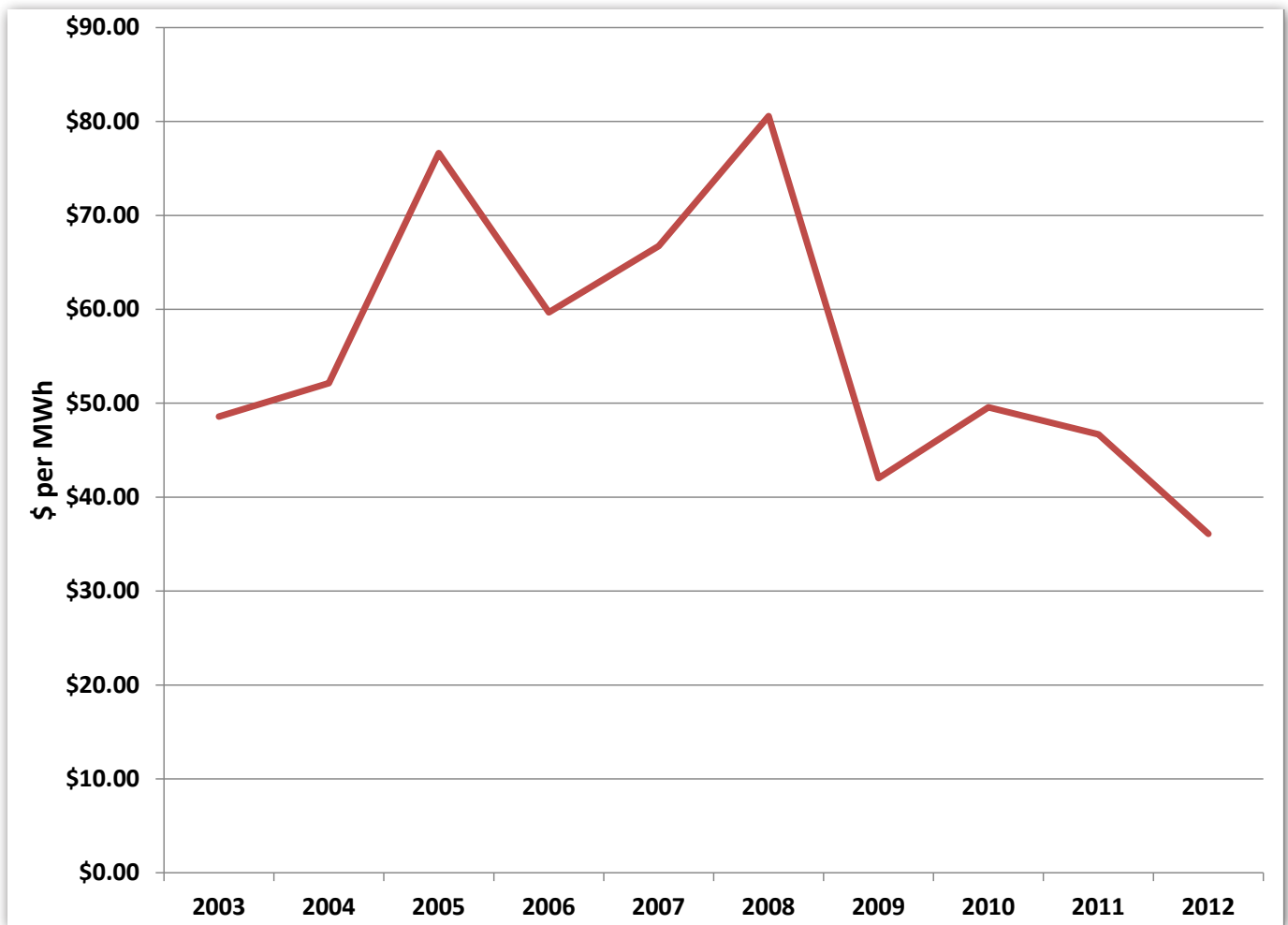
Thus, average natural gas prices in New England in 2012 were some 32 percent lower than in 2003 and nearly 20 percent lower than they had been just the year before in 2011.⁹¹⁰

Natural gas has in recent years increasingly been the marginal fuel in ISO New England, rising from being the marginal fuel in 62 percent of the pricing intervals in 2009 to

approximately 80 percent of the pricing intervals in 2012. Natural gas-fired units have thereby increasingly displaced coal-fired generation and set energy market prices.

Thus, it is not a surprise that ISO New England wholesale electricity prices have decreased almost in tandem with dropping natural gas prices. Figure 2, below, then shows a steep decline in average wholesale electricity prices in ISO New England from 2003 through 2012 (energy prices only) including a steep decline in prices between 2008 and 2009 that reflects the sharp drop in natural gas prices shown in Figure 1, above.

Figure 2: Average New England Wholesale Electricity Prices 2003-2012 (Energy Market Only).

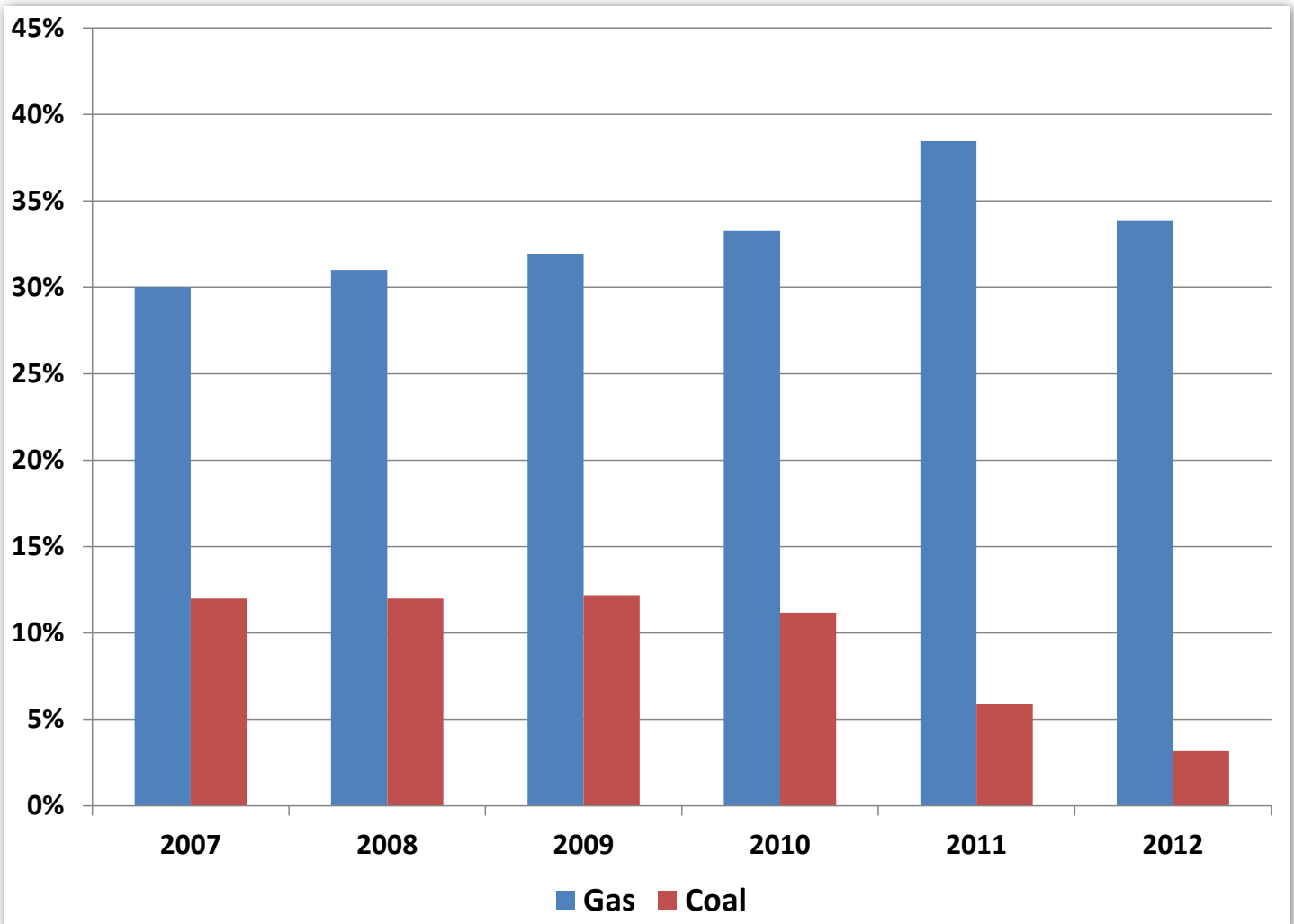


These lower energy market prices have meant both reduced generation at coal-fired power plants, like Bridgeport Harbor Unit 3, and reduced revenues for coal plant owners like PSEG Power, as coal has been increasingly displaced by natural gas-fired generation.

The recent displacement of coal by gas-fired generation in New England is shown clearly in Figure 3, below, which presents the percentages of ISO New England's generation from natural gas and coal in the years between 2007 through 2012. As can be seen, natural

gas's contribution to ISO New England's generation generally has been increasing since 2007, while coal's contribution has been declining steadily since 2009.

Figure 3: Coal and Natural Gas as a Percentage of ISO New England's Generation in the years 2007 through 2012.

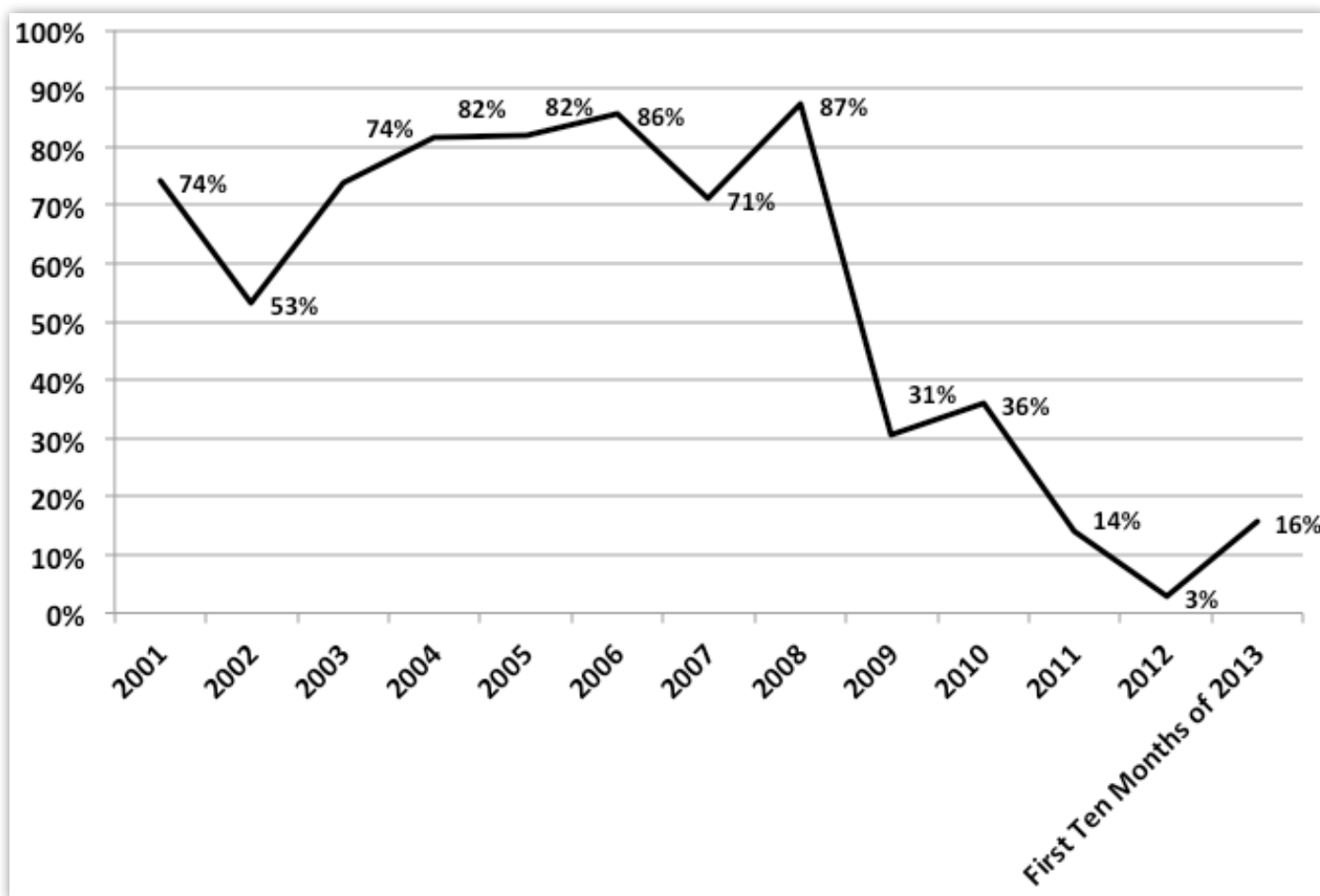


Generation from New England's coal-fired units dropped by 75 percent, or more than 10,857 MWh, in just the three years between 2009 and 2012.

A power plant's "capacity factor" compares the plant's actual generation during a month or year with the generation that the plant would have produced if it had operated at 100 percent power for 100 percent of the hours in the month or year. As can be seen from Figure 4, Bridgeport Harbor Unit 3's annual capacity factors from 2001 through 2008 (except for one year) were in the range of 71 percent to 87 percent, which are typical of low-cost baseload generating plants that are operated as much of the year as possible as long as it is economic to operate them. However, given the collapse of natural gas prices

in recent years and, consequently, coal's sharply declining share of ISO New England generation, it is no surprise that Bridgeport Harbor Unit 3's generation, as measured by its capacity factor, plummeted from 87 percent in 2008 to a mere 3 percent in 2012.

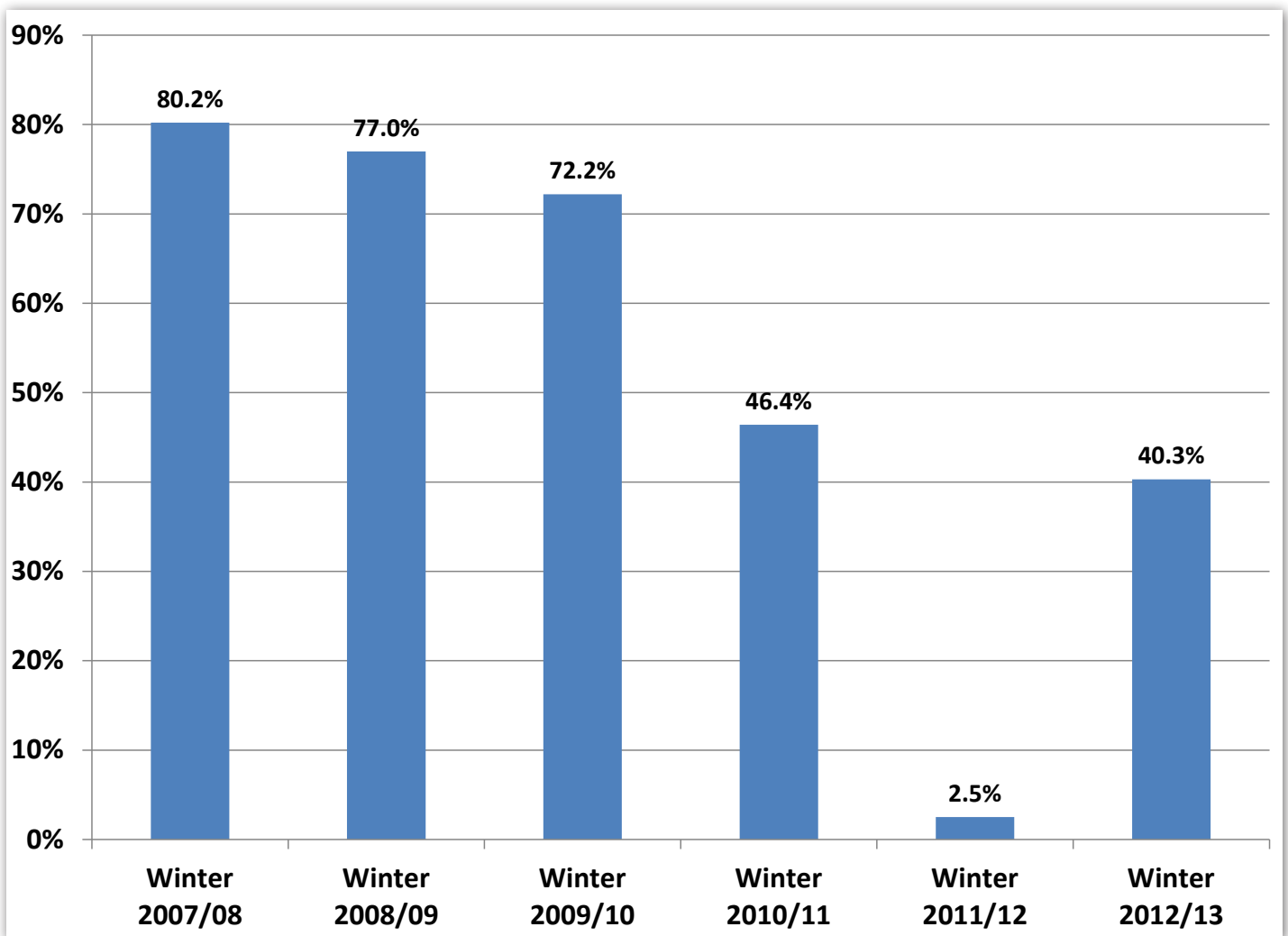
Figure 4: Annual Bridgeport Harbor Unit 3 Capacity Factors 2001-First Ten Months of 2013.



Bridgeport Harbor Unit 2 and New Haven Harbor, PSEG Power's other large fossil-fired units in Connecticut, also have operated less in recent years. The oil-fired Bridgeport Harbor Unit 2's capacity factor declined from approximately 5 percent in 2006 to 1.55 percent, or lower, in each year since 2007. The annual capacity factor of the oil-fired New Haven Harbor unit similarly declined from 13.53 percent in 2007 to below 3.1 percent in the years 2008 through 2012.

However, it is important to recognize that the capacity factor of Bridgeport Harbor Unit 3 recovered somewhat this past winter, rising to 40.3 percent during the months of December 2012 and January and February 2013 as shown in Figure 5, below:

Figure 5: Annual Bridgeport Harbor Unit 3 Capacity Factors during the Months of December, January, and February in the Winters of 2007/08 through 2012/13.

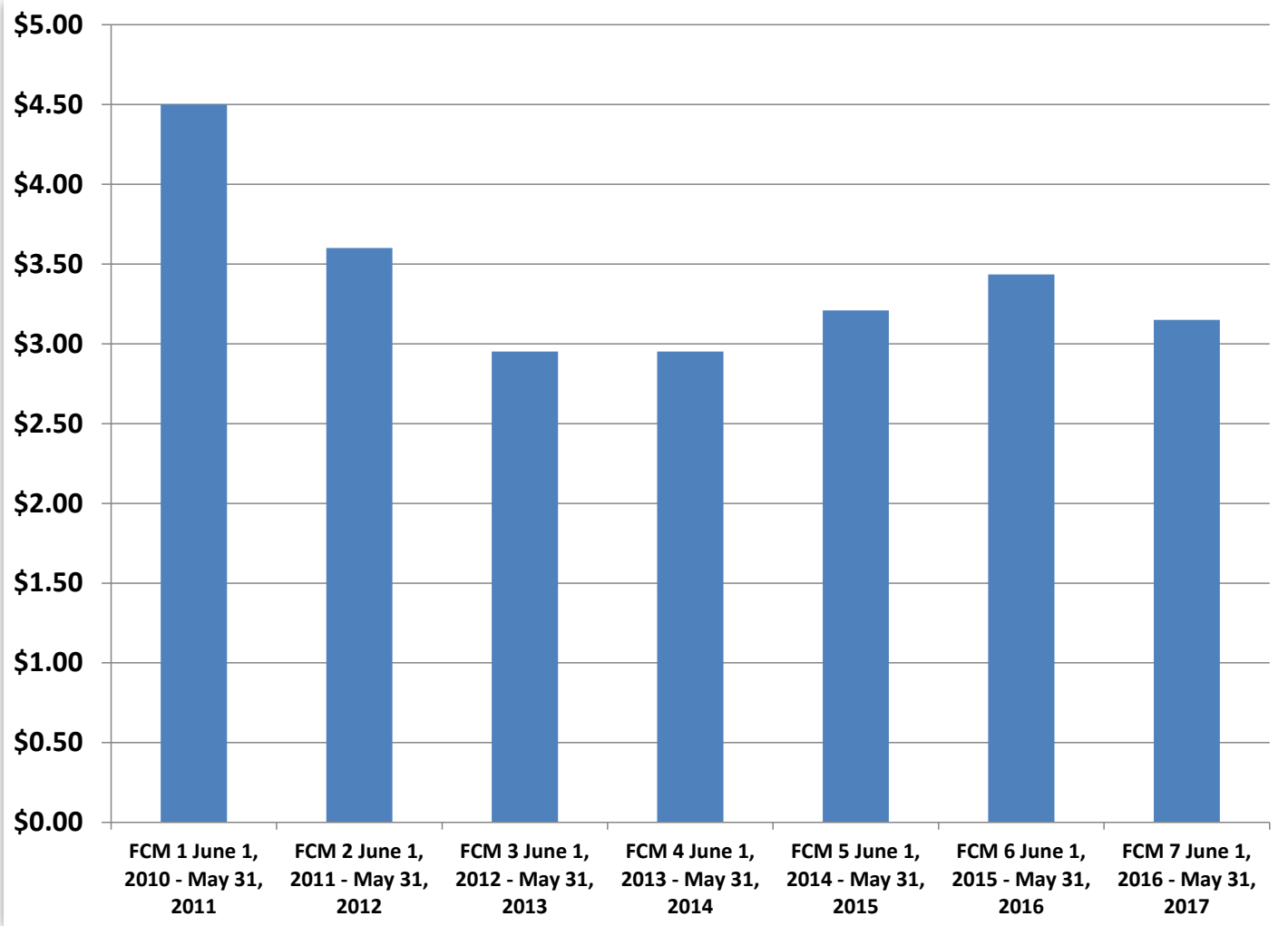


Nevertheless, Bridgeport Harbor Unit 3's 40.3 percent capacity factor in the winter of 2012/13, even though higher than the unit had achieved in the winter of 2011/12, still remained far below the capacity factors that the unit had regularly achieved during the winter months in the years before the winter of 2009/10. Moreover, the Unit's capacity factor for the first ten months of 2013 was only 15.9 percent. So it appears that although the plant's capacity factor will rebound some in 2013, and maybe in future years, it is unlikely to reach the 71 percent to 87 percent capacity factors achieved before the collapse of natural gas prices in 2009.

In addition to operating energy markets, ISO New England also conducts annual Forward Capacity Auctions in which the owners of generating units sell the capacity from their plants. Although these Forward Capacity Auctions have been a significant source of revenues for generating plant owners, capacity prices have been declining along with

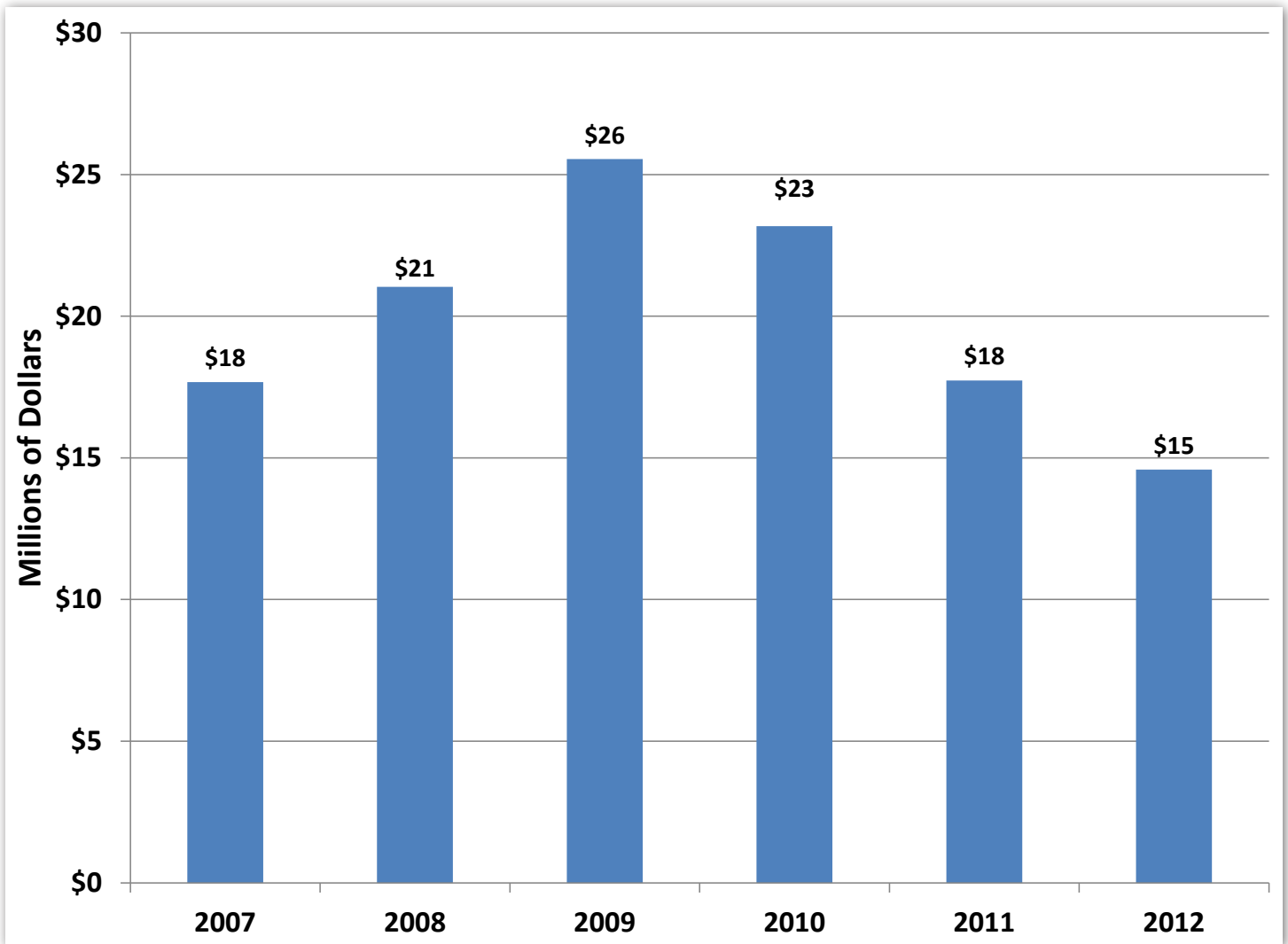
the energy market prices -- with a 35 percent decrease in the capacity price obtained in the Forward Capacity Auction in 2012 as compared to the price for 2010. Figure 6, below, shows the results of ISO New England's first seven Forward Capacity Auctions for the Commitment Periods Years between June 2010 and May 2017.¹¹

Figure 6: ISO New England Forward Capacity Auction Results (kW-Month).¹²



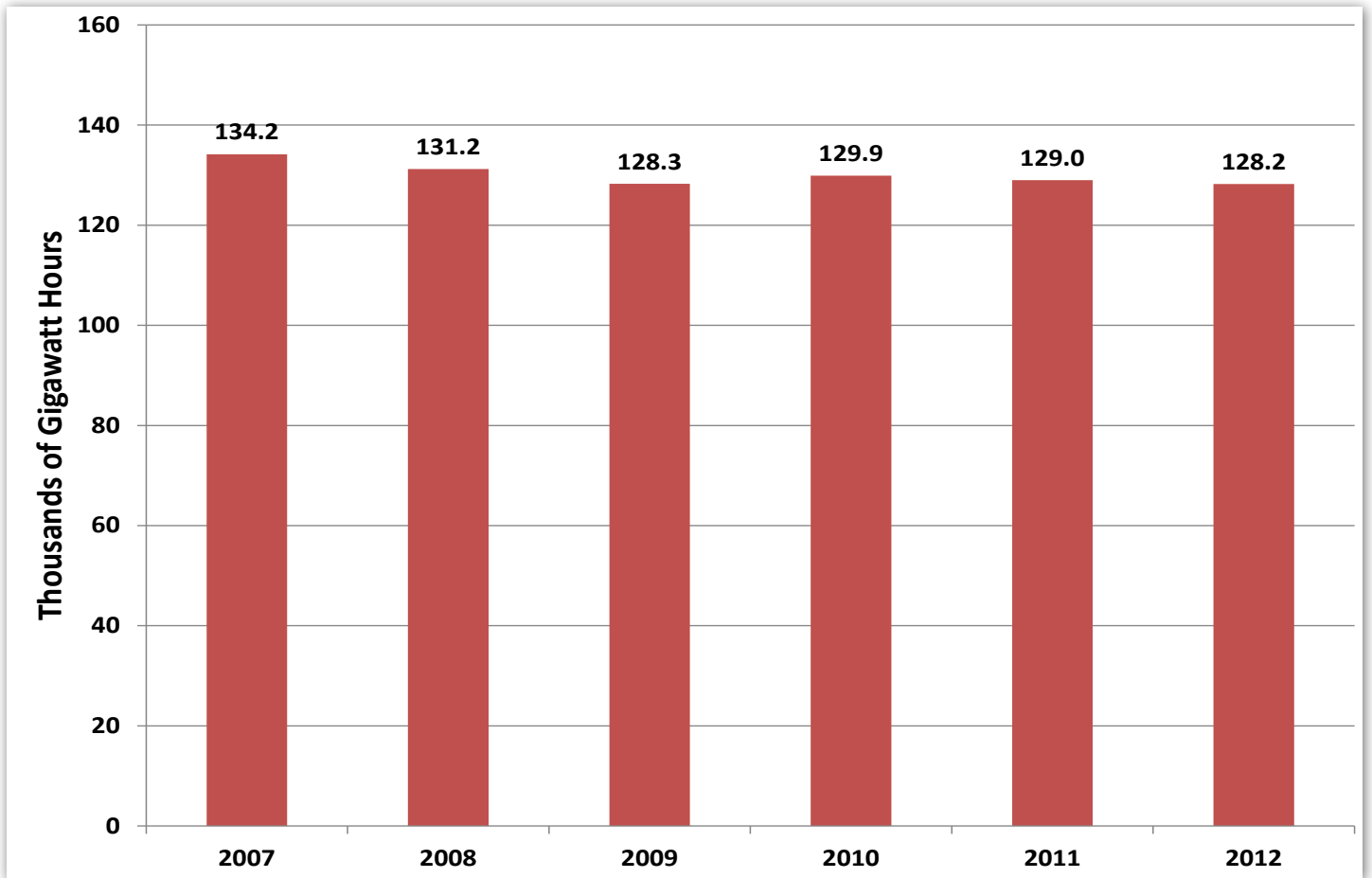
These declining auction results have meant steep declines in capacity revenues for PSEG after 2009 from selling Bridgeport Harbor Unit 3's capacity, as can be seen in Figure 7, below.

Figure 7: PSEG Power's Revenues from Selling Bridgeport Harbor Unit 3's Capacity in the ISO New England Capacity Market in the years 2007-2012.



At the same time that energy and capacity market prices have been declining, energy usage in ISO New England has decreased by more than four percent, or approximately 6,000 gigawatt hours ("GWh"), between 2007 and 2012 as a result of the economic downturn and increasing investments in energy efficiency.¹³ This decline is shown in Figure 8 below.

Figure 8: Weather Adjusted ISO NEW ENGLAND Energy Usage from 2007 to 2012.

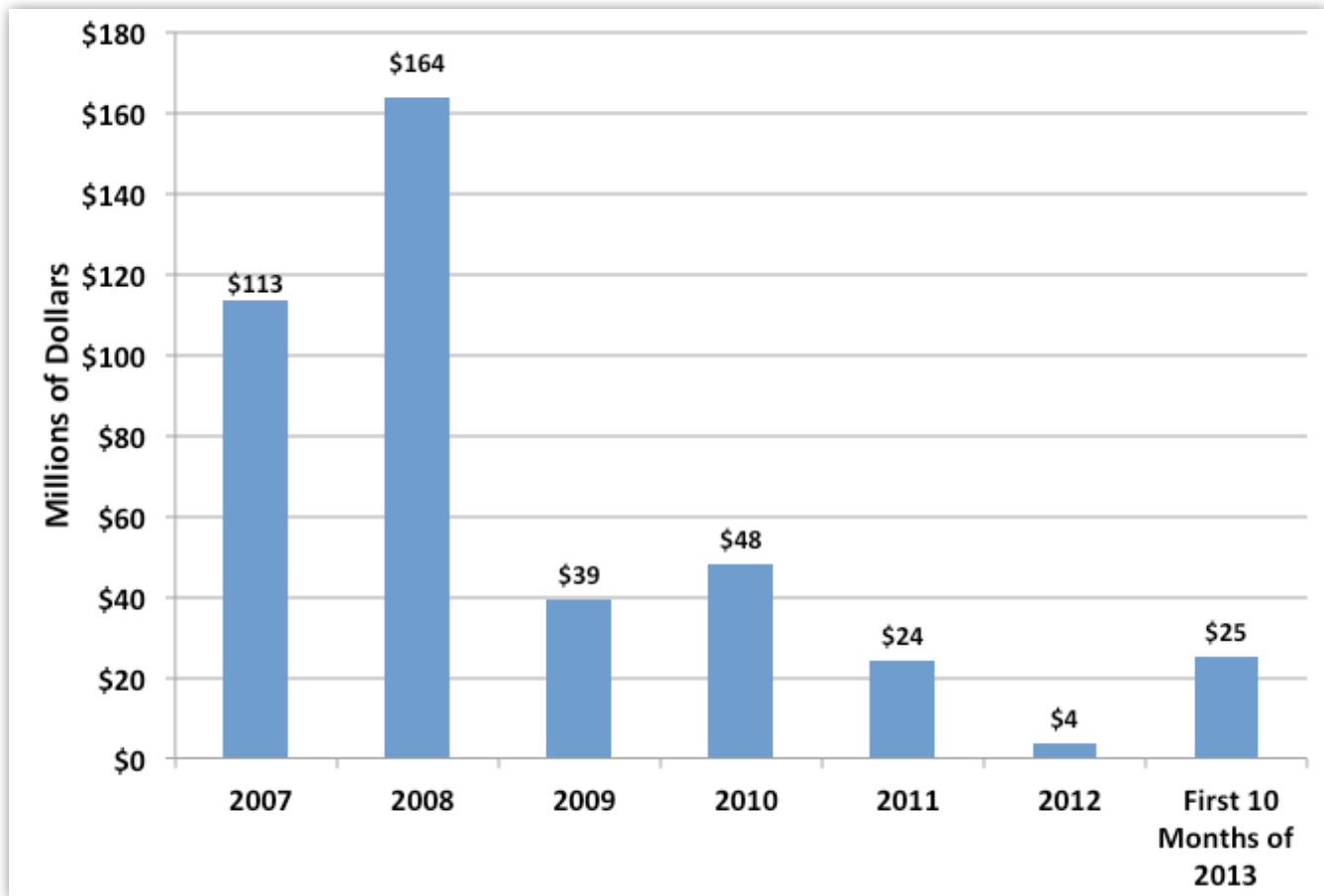


ISO New England's annual peak loads also decreased slightly during these same years.

Unfortunately, PSEG does not publish its individual generating unit revenues and earnings. However, based on the steep reductions in Bridgeport Harbor Unit 3's generation and sharp drops in ISO New England's energy and capacity market prices, it is reasonable to expect that PSEG's pre-tax EBITDA earnings ("Earnings Before Interest, Taxes, Depreciation and Amortization") from the plant have fallen precipitously since 2008.

This conclusion is supported by an analysis of PSEG's estimated EBITDA from Bridgeport Harbor Unit 3 between 2007 and the first half of 2013.

Figure 9: PSEG's Estimated EBITDA from Selling Power from Bridgeport Harbor Unit 3, 2008 through the Ten Months of 2013.



Because there is no published unit-specific financial data for Bridgeport Harbor Unit 3, the individual EBITDA shown in Figure 9 might be somewhat higher or lower than the actual pre-tax earnings. Moreover, at least once in 2011, PSEG has offset low market prices for Bridgeport Harbor Unit 3's power by selling unburned coal.¹⁴

However, the overall downward trend after 2008 is clearly accurate and reflects the steep declines in both plant generation and in energy and capacity market prices, with some recovery in 2013, as the plant produced more energy and market prices were higher than in 2012. In fact, PSEG repeatedly reported to investors in the years 2009 through 2012 that the Gross Margins on its sales of energy and capacity from Bridgeport Harbor were hurt by "low energy prices," "high cost of coal", and lower sales due to "low gas pricing [resulting] in gas displacing coal-fired generation."¹⁵

Given the very low pre-tax EBITDA earnings from Bridgeport Harbor Unit 3 during the years 2009-2012, it is hard to conceive of the circumstances where PSEG Power would have been able to pay taxes, amortization, depreciation and interest on invested funds and still have earned substantial post-tax profits on Bridgeport Harbor Unit 3.¹⁶

The Future Financial Viability of Bridgeport Harbor Unit 3

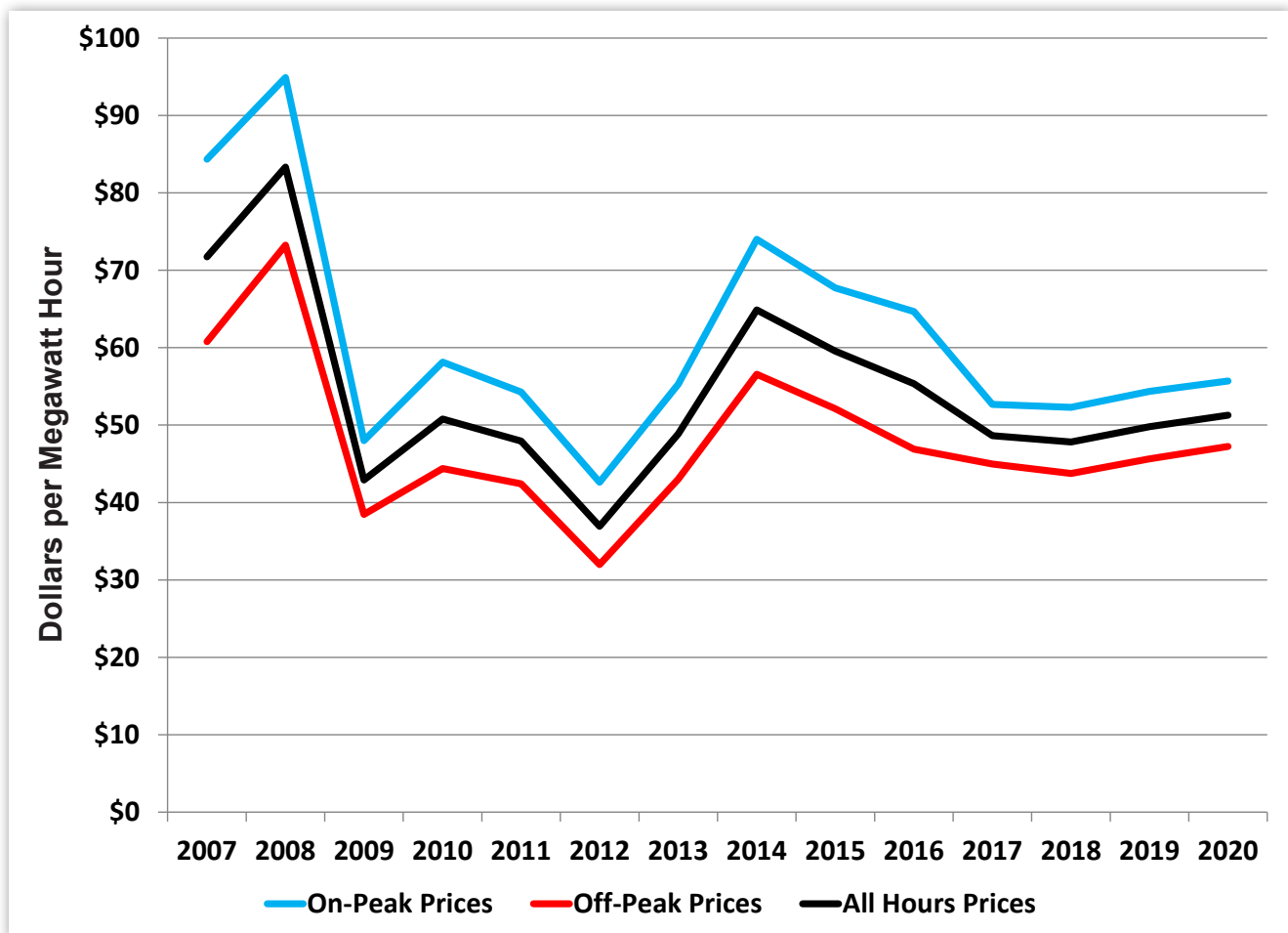
In order to significantly increase the earnings from owning and operating Bridgeport Harbor Unit 3, and to be able to pay the interest and profits on invested funds, PSEG Power will need some combination of higher revenues from increased generation, higher energy prices and/or capacity market prices and lower costs. However, from today's perspective, it is highly unlikely that future energy market prices, ISO New England capacity market prices, and plant generation will rebound so substantially that PSEG Power will once again earn the levels of profits from Bridgeport Harbor Unit 3 that it earned prior to 2009. Instead, there are a number of circumstances that together can be expected to lead to continued low, or maybe even lower, pre-tax EBITDA earnings from the plant. These circumstances include:

- Except for the peak winter months, energy market prices will remain very low as a result of low natural gas prices. The anticipated addition of increased gas pipeline supply into the Northeast starting sometime in 2016-2018 will lower energy market prices even during the peak winter months.
- A combination of high operating costs and low energy market prices will mean relatively low generation from the plant on an annual basis, with very little generation outside of the peak winter months of December, January and February.
- Planned changes in ISO New England's Forward Capacity Market are likely to mean significantly reduced revenues for PSEG Power in the longer term (4 to 5 years).
- Relatively flat demand for energy in the New England markets will mean very little need for any increased generation from Bridgeport Harbor Unit 3.
- Federal action on climate change will mean significantly higher costs for carbon dioxide emissions, perhaps as early as the end of this decade.

Future Energy Market Prices

As shown in Figure 10, below, current energy market forwards prices for the Connecticut Zone of ISO New England show that prices can be expected to be significantly below their pre-2008 levels through the foreseeable future – and will decline over time after 2015. These results are consistent with natural gas futures prices that also show no significant increases for the next 5-7 years, and with the general expectation that there will be an expansion of natural gas pipeline capacity into New England in the 2016-2018 timeframe.¹⁷

Figure 10: Recent Energy Market Futures Prices for ISO New England.



Although energy market prices are expected to remain very low on an annual basis, prices are currently expected to continue to spike in the winter months. These seasonal price spikes are caused by currently constrained pipeline capacity that limits the amounts of natural gas delivered into New England and by the increased demand for natural gas for home heating during the months of December, January and February. However, as noted earlier, it is currently expected that increased supplies of natural gas will be imported into New England through the addition of new pipeline capacity sometime in the 2016-2018 timeframe.

Future decreases in energy market prices would certainly further disadvantage Bridgeport Harbor Unit 3's financial and economic viability. As explained by UBS Investment Research, a notable secondary effect of further pipeline capacity expansions would be additional depression of natural gas prices in New England, which would further erode regional market power prices.¹⁸

Future Bridgeport Harbor Unit 3 Generation

A plant like Bridgeport Harbor Unit 3 can only expect to generate during those hours in which energy market prices are expected to be higher than the unit's variable cost of producing power. Otherwise the unit would be selling power at a loss.

Figure 11, below, compares Bridgeport Harbor Unit 3's variable operating costs (fuel, non-fuel operating & maintenance costs, and emissions costs – mainly the costs of emitting carbon dioxide) with the current monthly on-peak and off-peak forwards prices for ISO New England's Connecticut Zone.

Figure 11: Bridgeport Harbor Unit 3 Variable Operating Costs vs. Forward Energy Market Prices.¹⁹

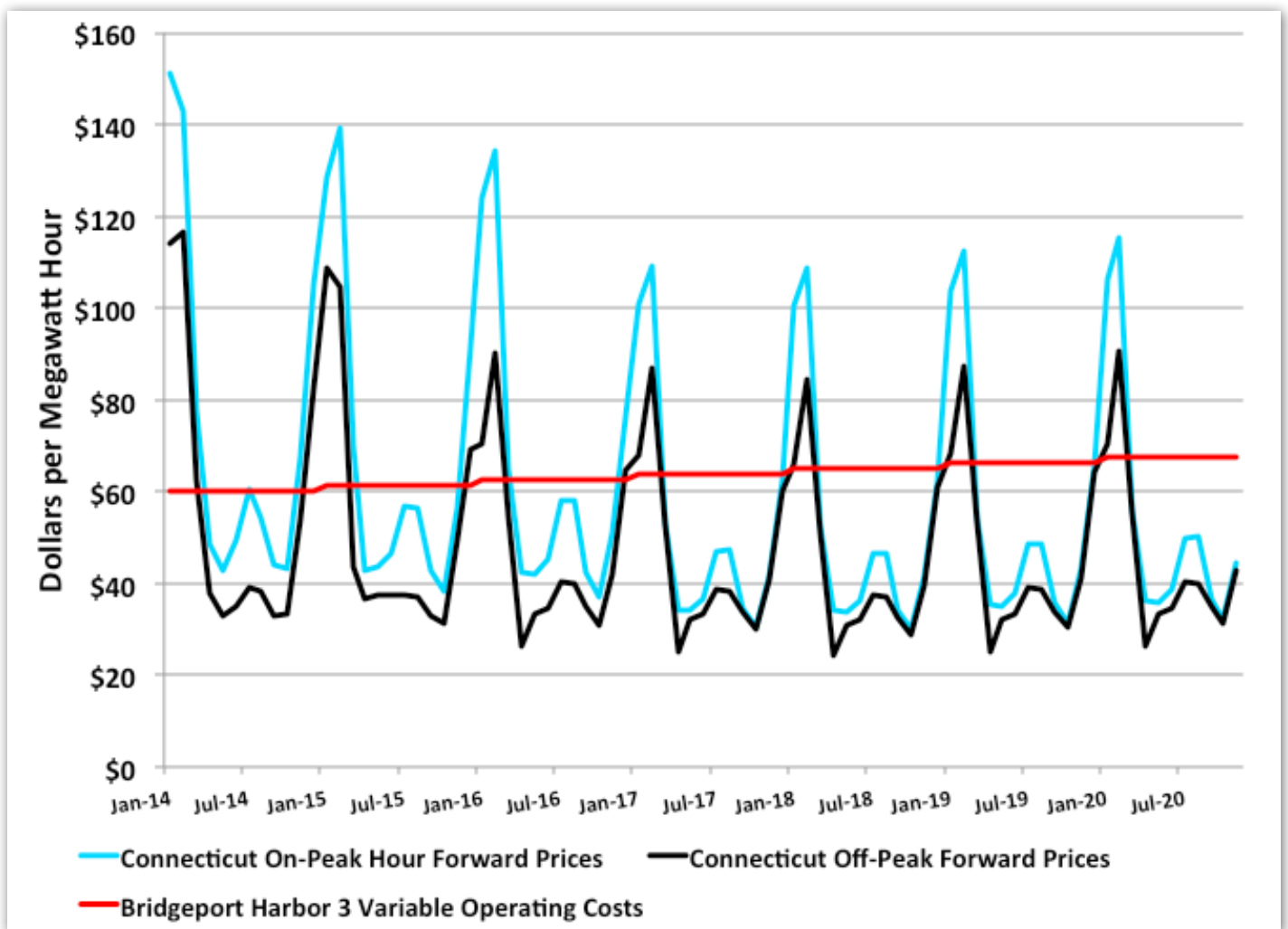


Figure 11 shows that energy market prices are currently expected to be higher than Bridgeport Harbor Unit 3's variable operating costs only during on-peak and off-peak periods in the winter months through 2020. During all other months (that is, most of the year), Bridgeport Harbor Unit 3's variable operating costs can be expected to be higher than energy market prices. Consequently, it is reasonable to expect that there will be no significant power produced by the plant during these months except, perhaps, for some generation during peak summer months if the grid requires that power due to unexpectedly high loads or the unanticipated unavailability of other power plants or key transmission lines. For this reason, it is not reasonable to expect that Bridgeport Harbor Unit 3's annual generation will return to the 70 percent to 80 percent capacity factors it achieved prior to 2009. In fact, our best estimate is that over the long-term the unit's future generation will, at best, more closely approximate the 14 percent capacity factor achieved during the recent twelve month period, November 2012-October 2013, the last twelve month period for which generation data is publicly available.

Figure 11 reflects the current forward prices for ISO New England's Connecticut Zone. These forward prices, in turn, reflect the currently expected energy market price spikes in the winter months due to the natural gas price constraints discussed above. But as additional gas pipeline capacity is added, winter month natural gas prices and, consequently, energy market prices can be expected to moderate significantly perhaps to levels much lower than the forwards prices shown in Figure 11.

This will have two impacts on the profitability of Bridgeport Harbor Unit 3. First, the revenue from the sale of each MWh of power is likely to be lower because energy market prices will be lower. Second, the unit is likely to generate significantly less power as natural gas becomes more available in the peak winter months and gas-fired facilities become even more economically competitive due to the lower gas prices.



by Roger Smith

Future Capacity Market Prices

There is significant uncertainty about future ISO New England capacity prices beginning in June 2017 with the 2017/2018 Commitment Period. On the one hand, capacity prices may rise considerably starting in June 2017 as a result of a tightening of supply due to the retirement of existing plants including the units at Brayton Point. However, even if capacity prices do rise, it is uncertain how long it will be before they drop as a result of new market design proposals under consideration by ISO New England. Higher capacity prices benefit PSEG Power's earnings from Bridgeport Harbor Unit 3. Lower capacity prices do not.

As shown in Figure 6, above, the results of ISO New England's recent Forward Capacity

Auctions do not show much recovery through May 2017 from the substantial capacity price decreases experienced between the auctions for the 2010/2011 and the 2012/2013 Commitment Periods. Moreover, the Federal Energy Regulatory Commission's mandate that the price floor be removed from future Capacity Auctions has led UBS Investment Research to expect a bust in future capacity markets and for a "sharp downtick in capacity [price] to drive economic retirements" of legacy oil-fired units in New England and much of the remaining coal capacity.²⁰ UBS also expects that new market designs under consideration by ISO New England (targeted for implementation in the 2018/2019 auction) would put a preference on payments for flexible units (such as new combined cycle plants) at the expense of less flexible units (such as coal plants like Bridgeport Harbor Unit 3).

The goal of the new capacity market design that ISO New England is developing has been described as follows:

To improve the effectiveness of the FCM [Forward Capacity Market] performance incentives and to better align them with energy market incentives, the ISO has undertaken a major initiative to improve the performance incentives in the FCM. In the proposed pay-for-performance design, resource payments would depend upon performance. If the ISO were short of operating reserves, capacity resources would be expected to supply energy or reserves. Resources that do not perform during these periods would receive reduced capacity payments, while resources that perform above their expected level could earn more than their capacity payments. Resources with superior performance during scarcity conditions would receive transfer payments from resources with inferior performance during these conditions. The new design should meet the [Independent Market Monitor's] performance recommendations included in the [ISO New England] 2011 [Annual Market Review] and encourage new and existing resources, such as efficient, flexible units, to be available when called....²¹

This pay-for-performance incentive market design would provide strong incentives for investment in new capacity that is either (1) low-cost and highly reliable or (2) highly flexible and highly reliable (that is, capable of getting online quickly and reliably).²² When implemented, this capacity market design will further disadvantage legacy steam units like Bridgeport Harbor Unit 3, which are rather inflexible in comparison to the predominant newer natural gas-fired units in New England and to the new capacity that will be built.

At the same time that these proposals can be expected to lead to substantially lower revenues for PSEG from the sale of the capacity from Bridgeport Harbor Unit 3, regional capacity prices may spike beginning in 2017, at least for a short time, as a result of the announced plant retirements including the Brayton Point coal and oil-fired units in southeastern Massachusetts. For example, UBS Investment Research has estimated that capacity prices could increase to \$7.025 per kilowatt-month in the FCM 8 auction for the 2017/2018 Commitment Period.²³ However, efforts are being undertaken by ISO New

England and the New England states to encourage the addition of new transmission and generation facilities that would offset the retirement of existing units and reduce future capacity market prices.

Future ISO New England Loads and Energy Consumption

PSEG Power cannot rely on future growth in regional energy usage as the basis for any significant increases in plant generation and revenue. As shown in Figures 12 and 13, below, ISO New England's current energy and peak load forecasts are relatively flat through 2022 when expected energy efficiency savings are considered (the forecasts in black in both Figures). Consequently, instead of serving higher energy loads, Bridgeport Harbor Unit 3 will have to continue to compete with low cost natural gas-fired units and new renewable resources to serve existing energy demands.

"RSP13" in each of the following two figures refers to ISO New England's "Regional System Plan" issued in 2013.

Figure 12: ISO New England 2014-2022 Energy Forecast for New England Reflecting Energy Efficiency.²⁴

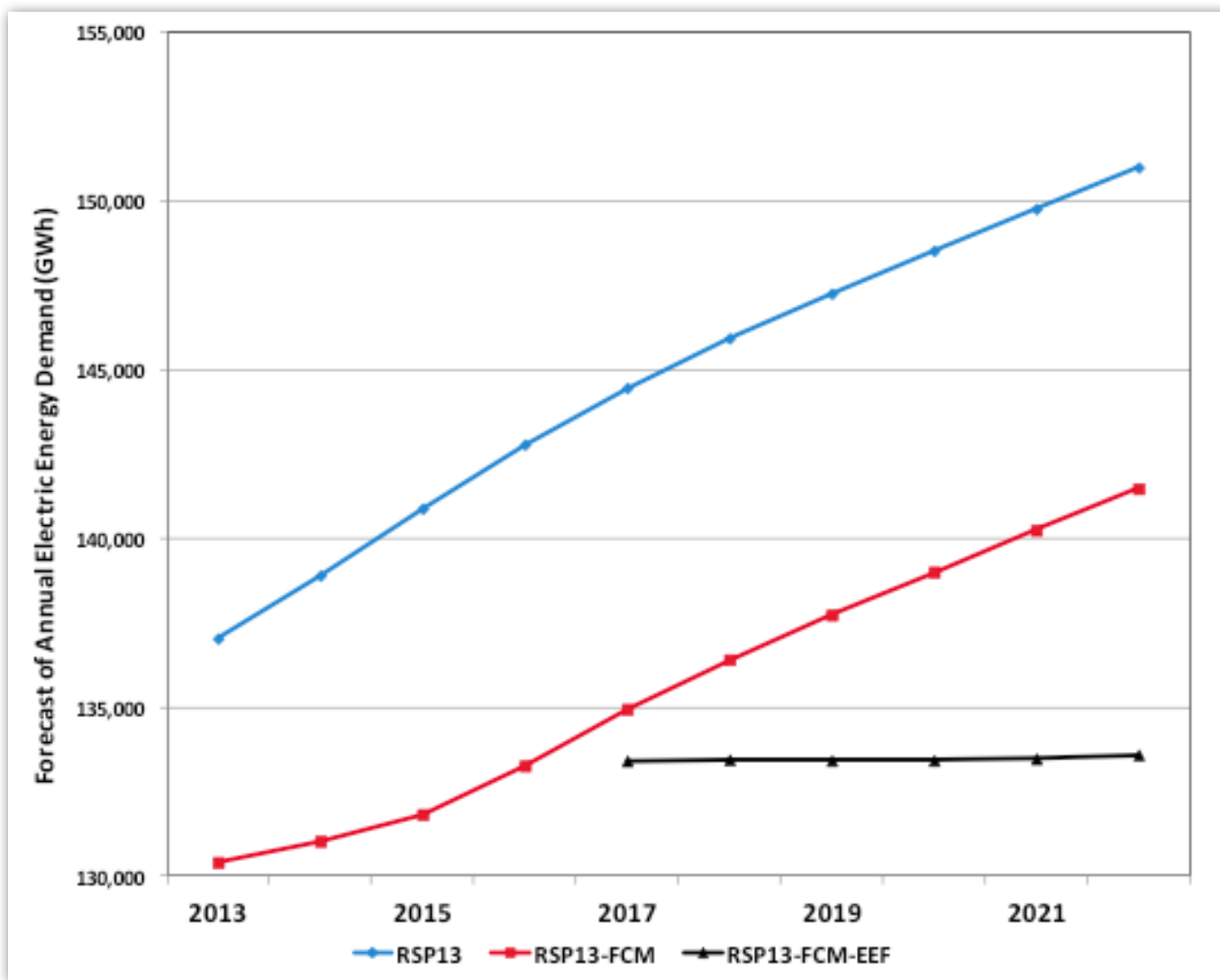
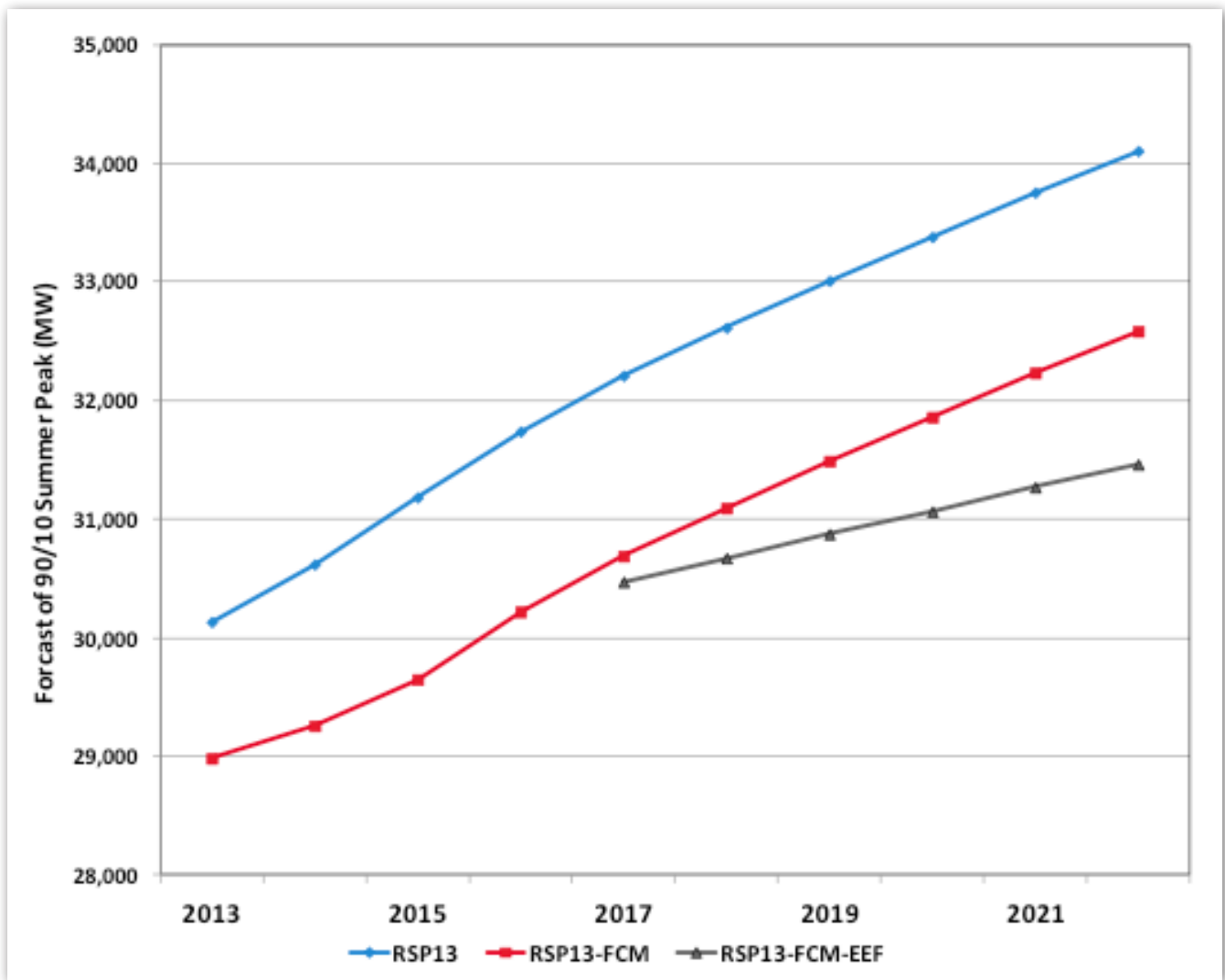


Figure 13: ISO New England 2014-2022 Peak Demand Forecast Reflecting Energy Efficiency. ²⁵



Carbon (CO₂) Prices

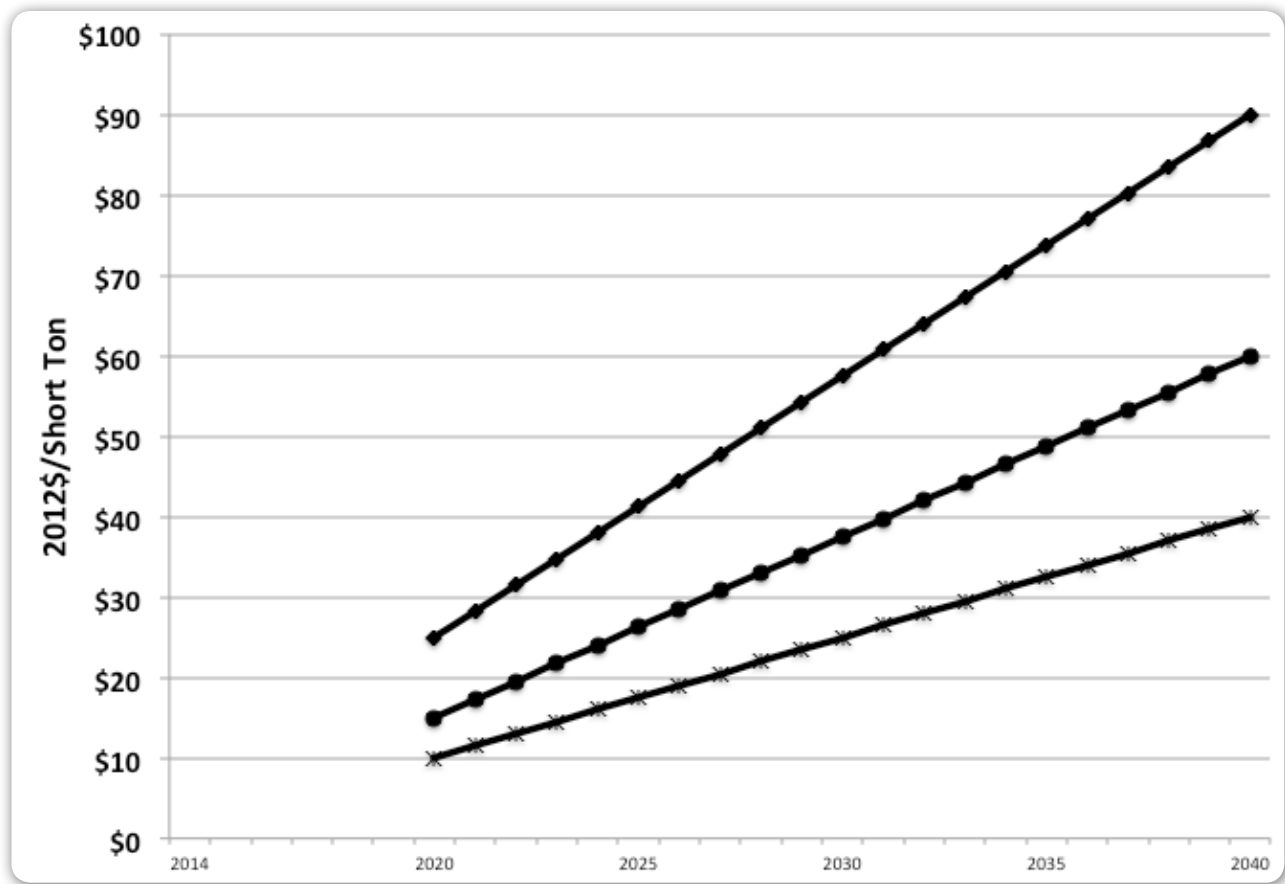
Under the Regional Greenhouse Gas Initiative (“RGGI”) generators in New England already must pay for carbon dioxide allowances, at a current rate of \$1.93 per ton. However, there are several measures that have the potential to adversely impact the future economics of selling the power from Bridgeport Harbor Unit 3. These measures include:

- The ongoing redesign of the RGGI program with a reduced emissions target of 91 million tons of CO₂ will increase costs of fossil-fired generators. As explained by UBS Investment Research, this redesign, which is tentatively being considered for implementation in 2014, could translate to a \$3-4 per ton cost for CO₂ emissions which would mean a \$3-4 per MWh cost for coal generation and a \$1-\$2 per MWh cost for gas generators.²⁶
- The U.S. Environmental Protection Agency is working on a New Source Performance Standard (“NSPS”) for existing sources, such as coal-fired power plants like Bridgeport

Harbor Unit 3. Although the design of this existing source standard is still under consideration, it is possible that it would be efficiency-based like the NSPS for new sources. It is anticipated that the proposed NSPS for existing sources could be issued for comment in 2014 with widespread implementation in 2019 or 2020.²⁷

- Given the increasing public recognition and concern over climate change, it is reasonable to expect that there will be a legislative program at some point in the not-too-distant future that will place a significant price on greenhouse gas emissions from fossil-fired power plants. Although the timing, design and stringency of such a comprehensive federal regulatory regime are unknown, we believe that the following CO₂ price forecasts from Synapse Energy Economics offer a reasonable set of prices that should be considered in resource planning and related economic evaluations. This is especially true where, as here, the power plant burns coal, the most carbon intensive fuel.

Figure 14: Synapse Energy Economics 2013 Carbon Dioxide Price Forecast. ²⁸



The three CO₂ price trajectories shown in the Synapse price forecast represent their base, high and low case forecasts. This range reflects the great uncertainty in the timing, design and stringency any comprehensive federal greenhouse gas regulatory regime.

Conclusions Concerning Future Earnings from Bridgeport Harbor Unit 3

We have investigated PSEG Power's likely future pre-tax earnings, also called EBITDA ("earnings before interest, taxes, depreciation and amortization") in two scenarios due to the significant uncertainty regarding future Bridgeport Harbor Unit 3 operations and ISO New England energy and capacity market prices.

In the first "Optimistic" scenario, we made the following assumptions:

1. ISO New England Energy market prices will continue to remain extremely high in the peak winter months through 2020 due to natural gas supply constraints.
2. ISO New England capacity prices would increase dramatically to \$7 per kilowatt-month starting with the upcoming auction for the 2017/2018 Commitment Period and remain at that high level through 2020.
3. The Bridgeport Harbor Unit 3 will operate at an average 20 percent annual capacity factor during the years 2014 through 2020. This would be approximately 40 percent higher than the capacity factor it achieved during the recent twelve month period November 2012 through October 2013 (i.e., the most recent twelve-month period for which generation data is available). This assumption is conservative given that the twelve-month period November 2012 – October 2013 included a record snowstorm across New England during the three day period, February 8-10, 2013, and the hottest month of July ever recorded throughout the state of Connecticut.²⁹

Then, in the second "Less Optimistic" Scenario, we assumed:

1. Energy market prices during the peak winter months would decrease to 20 percent below current forward prices beginning in 2018 due to the easing of natural gas supply constraints through the addition of new gas pipeline capacity.
2. Capacity market prices would only remain at \$7 per kilowatt-month for the 2017/2018 Commitment Period and then would drop down to \$2 per kilowatt-month beginning with the start of the 2018/2019 Commitment Period in June 2018. This would be in response to the market redesign proposals under consideration by ISO New England to encourage the availability of fast responding flexible generating units during peak power periods.
3. Bridgeport Harbor Unit 3's annual capacity factor will decrease to 11 percent beginning in 2018 in response to the easing of gas supply constraints. This would be approximately 20 percent below the capacity factor achieved during the recent twelve-month period, November 2012 through October 2013.

However, this “Less Optimistic” scenario should not in any way be considered a ‘worst case’ scenario, as ISO New England energy and capacity market prices could be even lower than we have assumed, as could the amount of power generated at Bridgeport Harbor Unit 3.

The results of our analyses are presented in Figures 15 and 16, below.

Figure 15: Bridgeport Harbor Unit 3 Pre-Tax Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA), 2008-2020, Optimistic Scenario for Future Earnings.

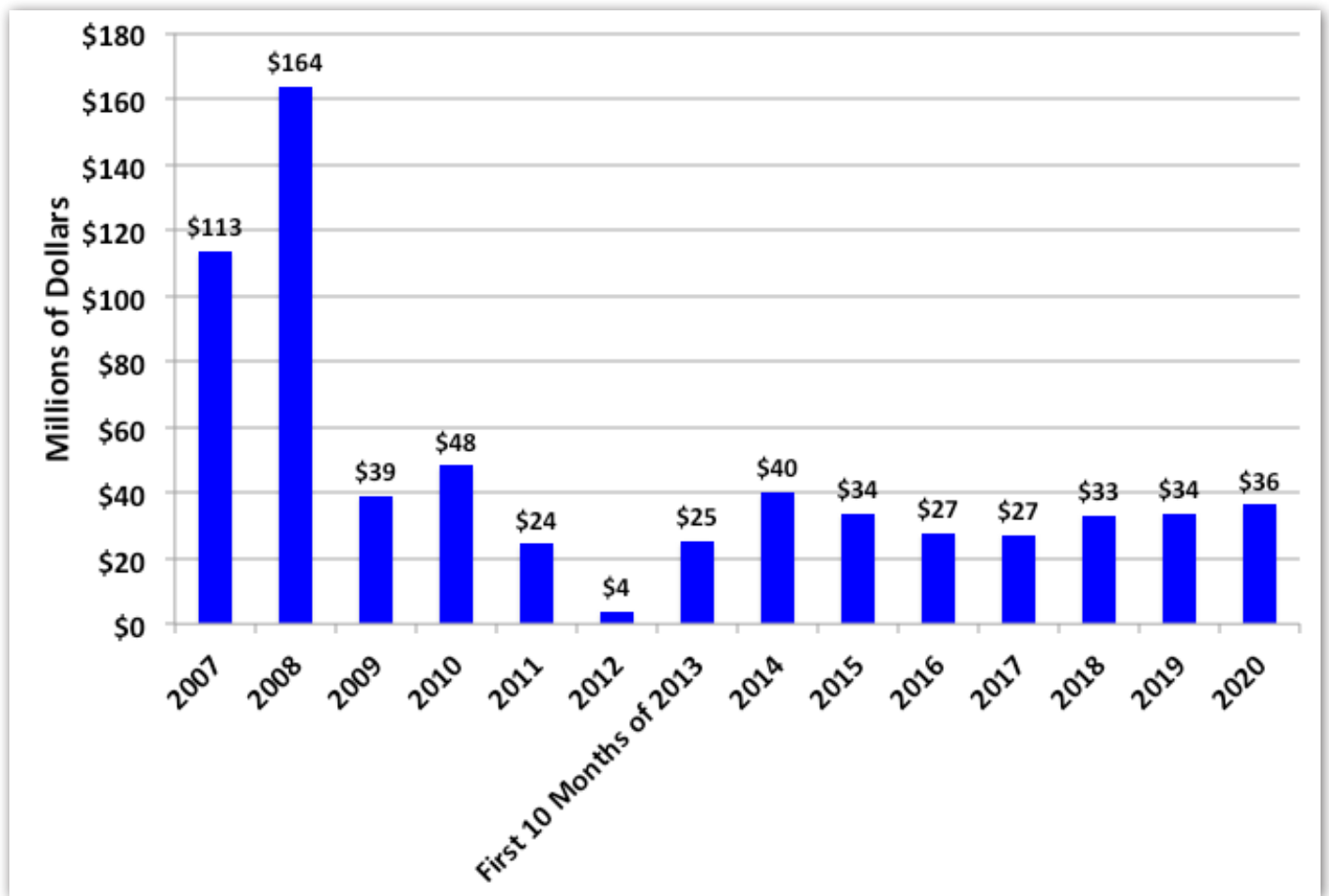
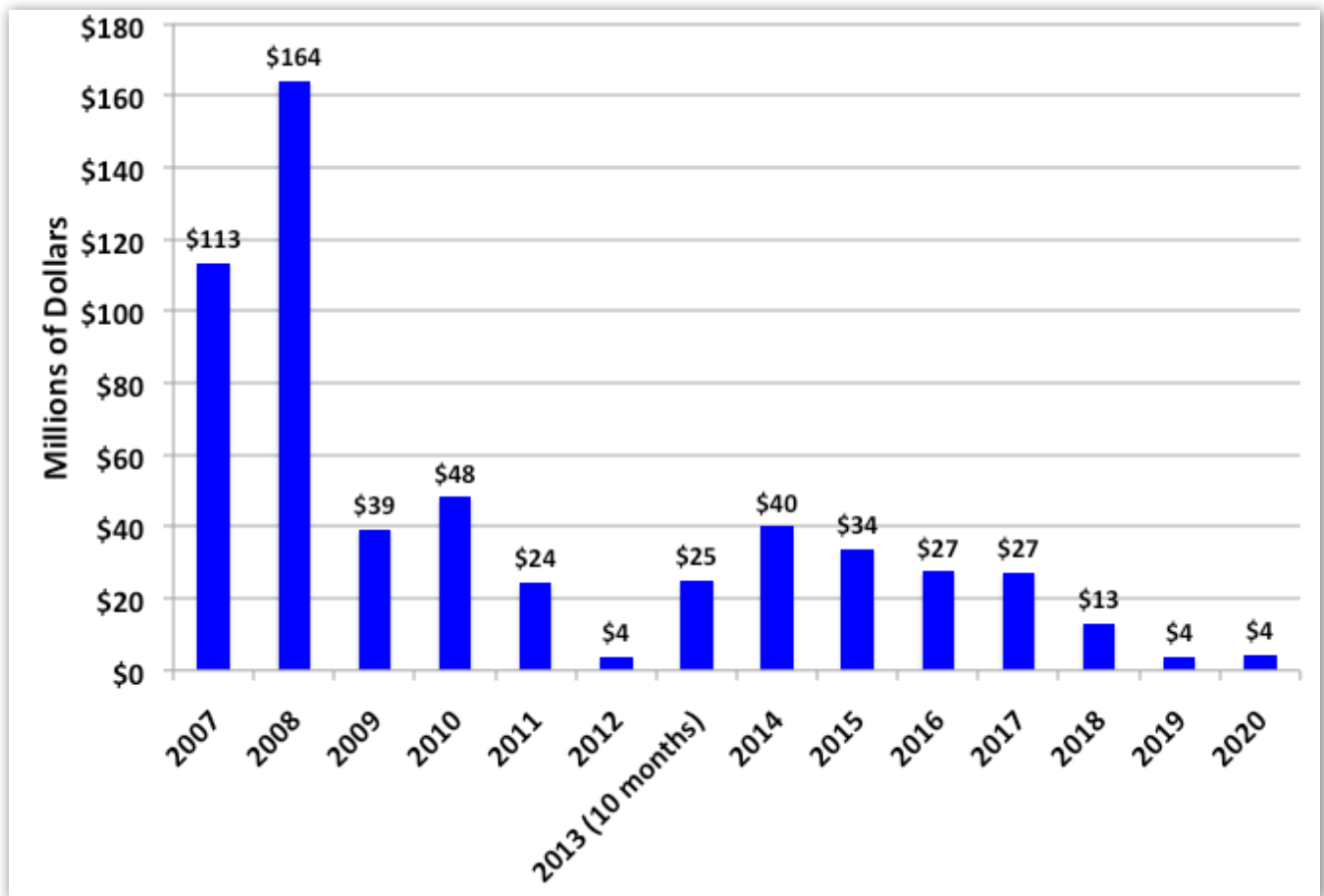


Figure 16: Bridgeport Harbor Unit 3 Pre-Tax Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA), 2008-2020, Less Optimistic Scenario for Future Earnings.



Thus, even in the “Optimistic” scenario, shown in Figure 15, there is no reasonable prospect that PSEG Power will have anywhere near the pre-tax earnings from Bridgeport Harbor Unit 3 that it had through 2008. Instead, even with very optimistic assumptions about future circumstances, PSEG’s pre-tax earnings from Bridgeport Harbor Unit 3 are likely to be significantly lower than the company earned before 2009. Figure 15, above, shows that at best, PSEG Power’s pre-tax earnings will be somewhat marginal, coming in large part from the revenues from the sale of its capacity in the ISO New England capacity market and not from the sale of electricity into the grid.

Moreover, Figure 16 shows that, in fact, PSEG Power’s pre-tax earnings from Bridgeport Harbor Unit 3 could essentially disappear by the end of this decade if ISO New England and the New England states take reasonably expectable actions to reduce or eliminate natural gas supply constraints and add new capacity to replace that being retired at Brayton Point in Massachusetts. These changes would result in substantially lower natural gas and energy and capacity market prices. All of these would negatively impact PSEG’s earnings from Bridgeport Harbor Unit 3.

The analyses presented in Figures 15 and 16 are based on information from SNL Financial, NYMEX futures prices, and data from the ISO New England website. These analyses also reflect the following other conservative assumptions:

- Bridgeport Harbor Unit 3 continues to operate as a coal-fired plant during the period 2014-2020.
- Current on-peak and off-peak forward prices through 2020 for the Connecticut Zone of the ISO New England energy market.³⁰
- The results of ISO New England's forward capacity auctions through May 2017 with the capacity prices in subsequent months increased to \$7 per kilowatt-month during the 2017/18 Commitment Period to reflect capacity shortages resulting from the retirement of the Brayton Point plant in Massachusetts. In the "Less Optimistic" scenario, we assume that capacity prices would decrease to \$2 per kilowatt-month in the 2018/19 Commitment Period.
- Overall non-fuel O&M costs reflecting the average of SNL's estimated costs for Bridgeport Harbor Unit 3 and the actual non-fuel O&M costs of other coal-fired units in New England.
- PSEG's statement that the current coal prices for Bridgeport Harbor are in the mid-fifties per megawatt hour.³¹
- Expected RGGI CO₂ prices of \$3-4 per ton between 2014 and 2019.

Consequently, given all of the factors discussed in our report, it is unlikely that PSEG Power can expect to obtain earnings sufficient to cover operating expenses, debt and an adequate return from Bridgeport Harbor Unit 3 over the long term, especially with the prospect for the adoption of significant CO₂ emissions costs, perhaps by the end of this decade. Given this conclusion, it would be prudent for the City of Bridgeport, the State of Connecticut, and ISO New England to prepare for the Unit's eventual retirement at some time in the not-too-distant future.

Endnotes

1. ISO New England's *2013 Regional Electricity Outlook*, at page 24.
2. U.S. Energy Information Administration, "Henry Hub Gulf Coast Natural Gas Spot Price," released September 25, 2013, accessed September 30, 2013 <http://www.eia.gov/dnav/ng/hist/rngwhhdA.htm>.
3. U.S. Energy Information Administration, "Receipts, Average Cost, and Quality of Fossil Fuels for the Electric Power Industry, 2002 through 2011," accessed September 30, 2013 http://www.eia.gov/electricity/annual/html/epa_07_01.html.
4. U.S. Energy Information Administration, "27 gigawatts of coal-fired capacity to retire over next five years," July 27, 2012 <http://www.eia.gov/todayinenergy/detail.cfm?id=7290>.
5. U.S. Energy Information Administration, "Electric Power Monthly: Net Generation by Energy Source: Total (All Sectors), 2003-July 2013," released September 20, 2013, accessed September 30, 2013. http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_01
6. http://www.heraldstandard.com/new_today/hatfield-s-ferry-power-station-quietly-closes-for-good/article_cd0133e1-9adb-58c2-8f8d-66769de34835.html.
7. <http://seekingalpha.com/article/1808342-firstenergy-management-discusses-q3-2013-results-earnings-call-transcript>
8. "AEP: Cutting its way to growth," UBS Investment Research, July 29, 2013.
9. ISO New England Press Release 2012 Wholesale Electricity Prices in New England Feel to Lowest Level Since 2003, dated January 23, 2013.
10. Source: SNL Financial.
11. Each year ISO New England conducts a forward capacity auction ("FCA" or "FCM") for a Commitment Period three years in the future. Each Commitment Period begins on June 1 and ends on May 31 of the next year. For example, FCA 7 was conducted in 2013 to provide capacity in the 2016/2017 Commitment Period that will begin on June 1, 2016 and end on May 31, 2017.
12. Connecticut was treated as a separate zone in FCA 7 for the 2016-2017 Commitment Period.
13. A gigawatt hour is one thousand megawatt hours or one million kilowatt hours.
14. Handouts for PSEG Earnings Conference Call 4th Quarter & Year-end 2010, February 22, 2011, at page 21.
15. See for example, the handouts for PSEG's Earnings Conference Calls for the 3rd Quarter 2009, the 4th Quarter 2009 and Year-end 2009, 4th Quarter and Year-end 2010, 4th Quarter and Year-end 2011.
16. The sources of the data used in the development of the estimated recent EBITDA shown in Figure 9 were ISO New England documents, data from SNL Financial and Company presentations and reports. Actual Bridgeport Harbor Unit 3 monthly generation, capacity prices and on-peak and off-peak energy market prices were used, as were actual Regional Greenhouse Gas Initiative ("RGGI") CO₂ prices and ancillary market prices. The unit's assumed non-fuel O&M expenses were based on both data published by SNL Financial and the actual costs at other coal-fired power plants in New England.
17. *2013 Regional System Plan (RSP)*, ISO New England, November 7, 2013, at pages 108-110.
18. *New England: The Next Bust and Boom*, UBS Investment Research, November 6, 2012.
19. The on-peak and off-peak forward energy market prices are from OTC Global Holdings Forward Power Index as of 09/27/2013.
20. *New England: The Next Bust and Boom*, UBS Investment Research, November 6, 2012.
21. *ISO England 2012 Annual Markets Report*, at page 85.
22. *FCM Performance Incentives: Enhancing Capacity Markets to Improve Resource Performance and Investment*, Matthew While, Ph.D., Senior Economist at ISO New England, April 24, 2013, presentation at Platt's Northeast Conference.
23. *New England: Hitting the Wall*, UBS Investment Research, December 9, 2013.

24. *2013 Regional System Plan (RSP)*, ISO New England, November 7, 2013, at page 41.
25. Id.
26. *Carbon Coming...but a Long Way Out*, UBS Investment Research, February 1, 2013.
27. Id.
28. The full Synapse 2013 CO₂ price forecast is available at www.Synapse-Energy.com.
29. For example, see ISO New England's *2013 First Quarter Quarterly Market Report*, issued on May 20, 2013, at page 15.
30. The on-peak and off-peak forward energy market prices are from OTC Global Holdings Forward Power Index as of 01/08/2014.
31. PSEG's August 8, 2013, presentation at the Goldman Sachs 12th Annual Power & Utility Conference, at slide no. 116.