STATE OF NEW HAMPSHIRE

BEFORE THE

PUBLIC UTILITIES COMMISSION

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE INVESTIGATION OF MERRIMACK STATION SCRUBBER PROJECT AND COST RECOVERY	)))))	Docket No. DE 11-250

DIRECT TESTIMONY

OF

MATTHEW I. KAHAL

ON BEHALF OF THE

OFFICE OF CONSUMER ADVOCATE

DECEMBER 23, 2013

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TABLE OF CONTENTS

I. QUALIFICATIONS

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Matthew I. Kahal. I am employed as an independent consultant retained in this case by Exeter Associates, Inc., an economic consulting firm. My business address is 10480 Little Patuxent Parkway, Suite 300, Columbia, Maryland 21044.

Q. PLEASE STATE YOUR EDUCATIONAL BACKGROUND.

A. I hold B.A. and M.A. degrees in economics from the University of Maryland and have completed course work and examination requirements for the Ph.D. degree in economics. My areas of academic concentration included industrial organization, economic development and econometrics.

Q. WHAT IS YOUR PROFESSIONAL BACKGROUND?

A. I have been employed in the area of energy, utility and telecommunications consulting for the past 35 years working on a wide range of topics. Most of my work has focused on electric utility integrated planning, plant licensing, environmental issues, mergers and financial issues. I was a co-founder of Exeter Associates, and from 1981 to 2001 I was employed at that firm as a Senior Economist and Principal. During that time, I took the lead role at Exeter in performing cost of capital and financial studies. In recent years, the focus of much of my professional work has shifted to electric utility restructuring, power supply markets and competition.

Prior to entering consulting, I served on the Economics Department faculties at the University of Maryland (College Park) and Montgomery College teaching courses on economic principles, development economics and business. A complete description of my professional background is provided in Attachment MIK-1.

Q. HAVE YOU PREVIOUSLY TESTIFIED AS AN EXPERT WITNESS BEFORE UTILITY REGULATORY COMMISSIONS?

A. Yes. I have testified before approximately two dozen state and federal utility commissions, federal courts, and the U.S. Congress in more than 400 separate regulatory cases. My testimony has addressed a variety of subjects including fair rate of return, resource planning, financial assessments, load forecasting, competitive restructuring, rate design, purchased power contracts, merger economics, and other regulatory policy issues. These cases have involved electric, gas, water, and telephone utilities. A list of these cases may be found in Attachment MIK-1 with my Statement of Qualifications.

Q. WHAT PROFESSIONAL ACTIVITIES HAVE YOU ENGAGED IN SINCE LEAVING EXETER AS A PRINCIPAL IN 2001?

A. Since 2001, I have worked on a variety of consulting assignments pertaining to electric restructuring, purchase power contracts, environmental controls, cost of capital and other regulatory issues. Current and past clients include the U.S. Department of Justice, U.S. Air Force, U.S. Department of Energy, the Federal Energy Regulatory Commission, Connecticut Attorney General, Pennsylvania Office of Consumer Advocate, the Maine Office of Public Advocate, New Jersey Division of Rate Counsel, Rhode Island Division of Public Utilities, Louisiana Public Service Commission, the New Hampshire Office of Consumer Advocate, Arkansas Public Service Commission, Maryland Department of Natural Resources, the Maryland Energy Administration, and the Maryland Public Service Commission.

II. OVERVIEW

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. This docket was established by the Commission on December 1, 2012 to consider the request by the Public Service Company of New Hampshire ("PSNH" or "the Company") to consider potential cost recovery for a flue gas desulphurization system installed at the Company's Merrimack power plant. (Order of Notice.) This has been referred to as the "Scrubber Project" or the "Clean Air Project," which initially entered service on September 28, 2011.

Exeter Associates, Inc. has been retained by the Office of Consumer Advocate ("OCA") to assist and provide testimony in this docket. My assignment is to evaluate the Company's prudence with respect to management's decisions to proceed with and complete this project, given the circumstances and market conditions confronting the Company.

Q. DOES YOUR TESTIMONY ADDRESS ALL ASPECTS OF PRUDENCE OF THE CLEAN AIR PROJECT?

A. No, it does not. My testimony is limited to the Company's prudence from a planning perspective, i.e., whether, given circumstances at the time, it was appropriate to proceed with and complete this very expensive project. Other aspects of prudence which are not within the scope of my testimony include the following:

- The prudence and reasonableness of the actual costs incurred by PSNH to complete this project;
- The design and technology choices to achieve environmental compliance that were selected by the Company; and
- The construction project management structure, contracting strategy, and procurement process utilized by the Company.

In this regard, I note that in January 2010, the Commission selected Jacobs Consultancy ("Jacobs") to undertake a detailed construction monitoring review. In that role, Jacobs submitted quarterly reports, a final report, and a due diligence report. For purposes of this testimony, I take no position on the prudence issues addressed by Jacobs, including construction prudence, technology choice, and contractor procurement.

As Jacobs and the Company point out, the Clean Air Project was completed at a total cost lower than the budget estimate. While this is a positive, a below budget completion cost is not by itself a prudence "safe harbor." The Company's obligation is to obtain for its customers reliable electric service at the lowest reasonable cost, and this includes the cost of the scrubber.

Q. PLEASE EXPLAIN BRIEFLY THE PRUDENCE ISSUE THAT YOU ARE ADDRESSING.

A. This case involves PSNH's compliance with a statute enacted by the New Hampshire legislature in 2006 that requires the owner of the two-unit Merrimack coal-fired power plant to reduce emissions of mercury by at least 80 percent (RSA 125-0:11-18, or "the Scrubber law"). This compliance is to take place through the installation and operation of a scrubber system. Since the plant is used to provide retail customers with default generation service, the prudently-incurred scrubber revenue requirements would be imposed entirely on default customers.

The Company's original scrubber cost estimate, prepared in 2005, was $250 million. Based on extensive input from contractors, this was updated in May 2008 to $457 million, or more than an 80 percent cost increase. In light of this dramatic project cost increase, the Company conducted an economic viability analysis in the summer of 2008 incorporating this increased cost, along with other assumptions reflecting market

conditions prevailing at that time. This analysis was shared with the parties and the Commission. During the last half of 2008, the Company continued with its project planning, design and engineering, and contractor procurement activities, with most of the contracting completed by year-end 2008.

Q. DO YOU CONTEST THE COMPANY'S 2008 DECISION TO PROCEED WITH THE SCRUBBER PROJECT?

A. No. The 2008 analysis, as undertaken by PSNH, does appear to provide some support for the decision to proceed with the Scrubber Project despite the near doubling of project costs. However, a number of aspects of the Company's Summer 2008 economic viability analyses are potentially controversial and certain choices made concerning assumptions and data inputs in the study can be questioned. In this regard, the Company has stated or implied that it did not make an explicit decision in 2008 to proceed with the Clean Air Project based on study results. Rather, the Company maintains that the Project was mandated by the 2006 Scrubber law and that proceeding with construction was merely a matter of legal compliance. I take no position on this or any other legal issue that has been raised in this docket. I note, however, that the Commission has ruled that the prudence of management's actions (or by implication, management's inactions) are within the scope of this docket and may be addressed.

While I am not specifically contesting the Company's Summer 2008 finding that the Clean Air Project appeared to be economically viable, that finding also was tentative and highly uncertain. For example, even a small reduction in the Company's very high gas price forecast in that model would eliminate the predicted economic benefits of retaining the Merrimack plant in operation. This is discussed further in Section IV. Summary results of that study were submitted to the Commission in a status report on September 2,

2008. However, within a few months after that submittal it became evident that market and economic conditions supporting the economic viability of the Clean Air Project were changing rapidly and drastically.

Q. WHAT WERE THE IMPLICATIONS OF THOSE MARKET AND ECONOMIC CHANGES?

A. By late 2008 and early 2009, the changes were becoming increasingly obvious to professionals in the energy and electric utility industry. These included sharp downturns in commodity markets, particularly for natural gas (spot and forwards), distress in financial markets, and a severe economic downturn portending the deepest recession since the Great Depression of the 1930s. Given that the Summer 2008 study results could fairly be described as uncertain (or even "fragile") due to the modeling issues discussed in Section IV of my testimony, and given the Company's enormous financial commitment for the Clean Air Project, prudent management should have moved quickly to revisit and update the study. This was not done. Hence, I am forced to conclude that PSNH's management acted unreasonably by failing to carefully monitor and respond to changing economic and market conditions and to give careful consideration to the logical alternatives.

Q. WOULD AN UPDATED STUDY HAVE SHOWN THAT THE CLEAN AIR PROJECT NO LONGER WAS ECONOMICALLY VIABLE?

A. An update would have drastically altered the Summer 2008 study results indicating that, on an expectational basis, the Clean Air Project no longer appeared to be economically viable. My testimony illustrates the potential economic losses confronting ratepayers at that time from proceeding with the Project. While no study can prove with absolute

certainty that a major investment will end up being economically viable or economically infeasible over the next 15 to 20 years, my analysis indicates that PSNH was imprudent by failing to update its crucial Summer 2008 study, resulting in severe cost consequences for default customers.

Q. PSNH ARGUES THAT IT WAS LEGALLY OBLIGATED TO COMPLETE THE CLEAN AIR PROJECT AT MERRIMACK. DOES THIS SET ASIDE THE PRUDENCE ISSUE?

A. No. While I do not address the Company's legal arguments, the threshold issue is the much less controversial question as to whether the Company should have updated its economic viability study six months, nine months, and/or one year after the Summer 2008 study to reflect the changing economic and market environment at that time. Certainly, there was no legal restriction prohibiting PSNH from monitoring volatile economic and market conditions and promptly reporting its results to this Commission and the New Hampshire legislature.

As the Company's statements have suggested (including its September 2, 2008 filing), the New Hampshire legislature's interest in its 2006 law was to reduce mercury emissions in New Hampshire by at least 80 percent and do so at reasonable cost to electric default customers. Given these public interest objectives, it was incumbent upon the Company to undertake the appropriate studies – as the Company was the entity in the best position to do so – and provide its analyses and recommendations to policymakers. I am not aware of any legal impediments to developing and providing this information.

I have identified at least three potential alternative actions by PSNH that could meet the required mercury emissions reduction target and minimize the ratepayer burden objectives that could have been pursued if authorized by the lawful authority:

- Promptly suspend the Clean Air Project in early 2009 and monitor economic conditions. Decide at a later date whether to resume the Project or retire the plant.
- Cancel the Clean Air Project and retire Merrimack units 1 and 2 at the compliance deadline of July 1, 2013.
- Divest the Merrimack plant (if possible), with the buyer determining how best to comply with any legislature requirements.

None of these options were even considered by PSNH because the underlying studies that likely would have demonstrated to policymakers a need and merits for such action were not undertaken.

Q. YOU HAVE CONCLUDED THAT PSNH MANAGEMENT WAS IMPRUDENT. DO YOU HAVE A RECOMMENDATION?

A. Yes. I conclude that some portion of the scrubber costs appear to be imprudent, but it is difficult at this time to determine the exact amount. What is relevant under the prudence standard is the reasonableness of management and decision-making (given PSNH's high level of expertise and sophistication) at the point in time when the decisions were made or could have been made. I conclude that the relevant time frame was 2008/2009, with the emphasis on the first half of 2009. I recommend the Commission consider remedies which go beyond a straight dollar disallowance from rate base. These potential remedies include: (a) denial of an equity return on the scrubber net investment (or a discounted equity return); or (b) requiring shareholders to absorb an equitable portion of the Clean Air Project investment deemed to be imprudent. An appropriate remedy should take into account the circumstances and context of PSNH management's decision-making, including legal or regulatory mandates and market uncertainties. Moreover, it may be the case that the continued operation of the scrubbed Merrimack plant (after July 1, 2013, the Project compliance deadline) provides some benefits to customers, albeit benefits much

less than the full costs of the scrubber-equipped Merrimack plant. In addition, the appropriate imprudence remedy may depend upon decisions over the long-run treatment of Merrimack, e.g., potentially pursuing divestiture as suggested in a recent Staff report on default service.

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. Section III provides background information on the Clean Air Project. In Section IV, I describe how the Company conducted its Summer 2008 economic viability study, the study results, and how those results would have changed under an update conducted six to nine months later. This section then discusses potential alternatives that the Company might have pursued (assuming lawful authorization) that could have mitigated an uneconomic outcome. Section V of my testimony describes similar circumstances in another state jurisdiction (Louisiana) in which the electric utility chose to cancel a major coal-fired project under development, thereby avoiding an imprudent and uneconomic investment. This project cancellation took place during essentially the same late 2008/early 2009 time period that is at issue for PSNH. Section VI summarizes my conclusions and briefly discusses potential imprudence remedies in this case.

III. BACKGROUND

Q. PLEASE DESCRIBE THE MERRIMACK POWER PLANT.

A. The Merrimack plant consists of two coal-fired units with 432 MW of rated capacity plus two oil-fired combustion turbines with about 40 MW of capacity. This plant accounts for the vast majority of PSNH's coal-fired generating capacity. The plant is relatively old, with unit 1 constructed in 1961 and unit 2 constructed in 1968. The two Merrimack coal

units are equipped with cyclone boilers. The plant is located on the Merrimack River in central New Hampshire in the Town of Bow.

Q. WHAT STANDARDS OF ENVIRONMENTAL COMPLIANCE DID THE STATE OF NEW HAMPSHIRE ESTABLISH FOR THE MERRIMACK PLANT?

A. In 2002, the New Hampshire legislature enacted the New Hampshire Clean Power Act which addressed four air pollutants – sulfur dioxide (SO_2), nitrogen oxide (NO_x), carbon dioxide (CO_2) and mercury (Hg). This law was amended in June 2006, effectively requiring that coal-fired units achieve an 80 percent reduction in mercury emissions. The Act specified a compliance deadline of July 1, 2013 (i.e., seven years). Based on investigations conducted prior to this amendment, it was determined that the installation of wet flue gas desulphurization ("scrubbers") would be a proven and practical technology that could achieve the required level of emissions reduction. PSNH had investigated a less expensive technology (i.e., activated carbon injection), but this technology could not achieve the 80 percent reduction target. Scrubbing, while an expensive technology, also provides a co-benefit of reducing SO_2 emissions (potentially by more than 90 percent), thereby also reducing utility expenditures on SO_2 allowances. The 2006 Act specified wet scrubbing as the appropriate control technology.

Q. PRIOR TO THE 2006 LEGISLATION, DID PSNH DEVELOP AN ESTIMATE FOR THE COST OF WET SCRUBBING?

A. Yes. In 2005, the Company retained the engineering firm of Sargent and Lundy to develop a capital cost estimate to install wet scrubbing for the plant. The firm prepared an initial estimate of $250 million (for the entire plant), or about $578 per kW. While

quite preliminary and conceptual, it nonetheless was the Company's stated cost estimate at the time the 2006 legislation requiring wet scrubbing was enacted.

Q. AS YOU STATED EARLIER, THE $250 MILLION COST ESTIMATE WAS SUBSEQUENTLY REVISED TO $457 MILLION. WHAT ACCOUNTED FOR THIS MORE THAN 80 PERCENT INCREASE?

A. The reasons for the cost increase are discussed in considerable detail in the Jacobs due diligence report of June 2011. The original cost estimate of $250 million prepared in 2005 has been characterized as conceptual, based on general industry experience with wet scrubbing projects. However, it was not based on the Merrimack site specific constraints, the requirements for mercury emission reduction guarantees, or the specific technical characteristics (i.e., cyclone boilers) of the Merrimack units. Moreover, it was claimed that the $250 million cost estimate reflected only contractor/vendor costs and did not include PSNH and Northeast Utilities ("NU") project costs or Allowance for Funds Used During Construction ("AFUDC"), i.e., carrying charge accruals during construction. Most important, the electric utility industry at that time was experiencing very rapid cost escalation for major construction projects, particularly those pertaining to coal-fired generation, as the Company noted in its September 2, 2008 status report. For that reason, I believe that PSNH, at a minimum, understood that the $250 million cost estimate was very uncertain and subject to a potentially large upward revision.

As planning took place for the project, PSNH retained URS Corporation ("URS") as the overall engineering, procurement, and construction ("EPC") contractor, and R.W. Beck to serve as an independent engineer. An updated and more detailed project cost estimate was completed in the May 2008 time frame (about two years after the enactment of the Scrubber law), which incorporated actual construction bid information, site specific

considerations, the PSNH/NU in-house costs, and expected AFUDC accruals. This was based on an expected completion date of mid-2012, or about a year in advance of the compliance deadline.

Q. DID PSNH REASSESS THE PROJECT BASED ON THIS DRASTICALLY REVISED PROJECT COST ESTIMATE?

A. Yes. As a major procurement, the capital spending authorization required the approval and oversight of NU management committees, including the Risk and Capital Committee ("RaCC"). As part of this effort, PSNH undertook economic viability analysis studies using the revised $457 million cost estimate (about $1,057 per kW) in its Summer 2008 study. I discuss this study further in Section IV of my testimony. In addition, the Company evaluated the implications of this new cost estimate to assess the potential impact on retail customer default rates after the Clean Air Project was scheduled to enter into service.

It appears that the new project cost estimate was first publically announced in August 2008. Shortly thereafter, the Commission directed the Company to submit a status report on the Project. The report was submitted on September 2, 2008 and included a description of activities to date, the economic viability studies, projections of retail default rate impacts (with and without the project), and other supporting information. Over time, the Company submitted to the Commission additional status reports, but the September 2008 report was the most detailed and the only report providing a comprehensive economic viability study of the project and the Merrimack plant.

Q. WAS THE $457 MILLION COST ESTIMATE SUBSEQUENTLY REVISED?

A. Yes. Over time, this cost estimate was revised downward to $422 million. This cost reduction has been attributed by Jacobs to a somewhat shorter construction schedule than originally assumed, less cost escalation than expected, higher than assumed productivity, and good weather (which favored timely on-site construction activity). Partially offsetting these savings was a decision by the Company to install a secondary or supplemental wastewater treatment facility, a relatively expensive project enhancement.

Q. DID THE COMPANY CHOOSE TO EXPEDITE THE CONSTRUCTION SCHEDULE?

A. Yes. The Company completed the Clean Air Project well in advance of its already expedited schedule of mid-2012 completion. The scrubber was declared in service on September 28, 2011 with the tie-in of Unit 1. In late November 2011, the project team completed the tie-in of Unit 2 to the scrubber facility. Additional ancillary construction activity (e.g., the secondary wastewater facility, testing, various punch-list items, etc.) continued in the early part of 2012. Substantially, the Clean Air Project was fully operational by late 2011, or more than a year and a half ahead of the compliance deadline specified in the Scrubber law. In late 2011, the Company filed with the Commission for interim rate recovery of the Clean Air Project compliance costs for the portions of the Project completed and deemed to be in-service at that time.

Q. DO YOU CONSIDER THE CLEAN AIR PROJECT TO BE A LARGE FINANCIAL COMMITMENT FOR PSNH?

A. Yes, very much so. At the beginning of 2008, the Company had net electric utility plant of less than $1.4 billion (inclusive of construction work in progress) and capitalization of

$1.1 billion. Thus, relative to the size of the Company (i.e., its existing asset and capital base), $457 million represents an enormous increase in resources. (Source: Northeast Utilities SEC Form 10-K for the year ended December 31, 2008.)

In a sense, while the PSNH financial impact is obviously huge, the retail customer impact is even larger. This is because New Hampshire law requires that the (prudent) costs of the Clean Air Project be recovered only from default service, which is a portion (and diminishing portion) of total retail service. All of this was known to PSNH and the NU RaCC at the onset of the Clean Air Project in 2008 and in the early stages of construction activity in 2009.

Q. AT THE TIME OF THE SEPTEMBER 2008 STATUS REPORT, WHAT WAS THE TOTAL EXPENDITURE TO DATE?

A. Page 6 of that report (submitted in Docket No. DE 08-103) states total project expenditures to date of only about $10 million. This is obviously a very small percentage of the total. On Attachment MIK-2, I present the Company's construction spending plan (inclusive of all NU/PSNH costs and AFUDC accruals) by year. This shows very rapid ramp-up of spending, with the vast majority of Project spending and total costs incurred to have taken place by the end of 2010.

Q. THE COMPANY PROVIDED ADDITIONAL INFORMATION IN DOCKET NO. DE 08-103. DID THIS INCLUDE ANY UPDATED ECONOMIC VIABILITY ANALYSES?

A. The only economic viability update is included in the Company's October 15, 2010 status report filing – less than a year prior to the scrubber in-service date. This report provided an updated rate impact analysis and an economic viability assessment (albeit a very

truncated, four-year analysis) "with and without" the Project. That limited analysis seems to imply that the Clean Air Project is preferable to plant retirement (i.e., incurring replacement energy and capacity), but that result may stem from the assumption that most of the Clean Air Project investment as of late 2010 had become a "sunk" cost and must be recovered from default customers regardless of the status of the plant.

Q. WHAT IS THE CURRENT STATUS OF THE MERRIMACK PLANT?

A. The Clean Air Project has been operational since late 2011 and the Merrimack plant continues to provide default service to the diminishing default load. On June 7, 2013, the Commission Staff, assisted by the Liberty Consulting Group, filed a report on the status of default service.[1] This report provides considerable analysis on the economic viability of the currently-structured default service and the now-scrubbed Merrimack plant in particular.

The report makes a number of important observations concerning the weakening economic viability of the Merrimack plant. It makes note of the plant's declining capacity factor trend in recent years, high costs of operation (as compared to the market cost of replacement power), and the likelihood that the Merrimack plant has a minimal market or economic value today based on the current market outlook. The report also indicates that the Company's investment in the plant is $504 million and a total for the entire PSNH generation fleet of $674 million (Report, page 33). Thus, the scrubber accounts for over 80 percent of today's Merrimack plant net investment and about 60 percent of the net book value of PSNH's entire generation fleet.

[1] *Report on Investigation into Market Conditions, Default Service Rate, Generation Ownership and Impacts on the Competitive Electricity Market*, IR 13-020.

If the Staff report is correct that the Merrimack plant has minimal economic value (and the report provides considerable analytical support for this position), then this indicates that the Clean Air Project is essentially a dead weight loss for customers.

Q. HAS THE COMMISSION PROVIDED GUIDANCE ON STANDARDS OF PRUDENCE AS APPLICABLE TO THIS CASE?

A. Yes, the Commission clarified its position on the prudence standard in Order No. 25,565 (August 27, 2013), citing its July 15, 2013 order (Second Rehearing Order):

> The Commission concluded that PSNH retained the management discretion to divest itself of the Merrimack Station under RSA 125-0:18 or to retire Merrimack Station under RSA 369-B: -a, if appropriate. (Order, page 3.)

In noting this utility decision-making discretion, the Commission reiterated its earlier position:

> No utility may proceed blindly with management of its assets or act irrationally with rate payer funds; PSNH had a duty to its rate payers to consider the appropriate response, possibly even including a decision to no longer own and operate the Merrimack Station when facing changing circumstances. (Order, page 7, footnote omitted.)

Importantly, the Commission cites to language on the prudence standard from a recent decision issued by the Indiana Utility Regulatory Commission ("IURC") in a Duke Energy Indiana case:

> [Prudence] is the degree of care required by the circumstances under which the action or conduct is to be exercised and judged by what is known, or could have reasonably been known, at the time of conduct. In other words, whether an action will be considered prudent depends on whether the action would be considered reasonable by a person with similar skills and knowledge under similar circumstances. It is a term often used interchangeably with what is considered "reasonable" under the circumstances. The Commission must determine whether decisions were made in a reasonable manner in light of the conditions

or circumstances that were known when the decision was made. [Order, page 20, case citation omitted].

Q. HAVE YOU ATTEMPTED TO FOLLOW THE PRUDENCE STANDARDS ENUNCIATED BY THE COMMISSION?

A. As reflected in my analysis in Section IV, I have attempted to do so. The Commission's prudence standard begins with the concept that PSNH had some decision-making discretion, despite the Company's protest that construction of the scrubber was a legislative mandate. In addition to the Merrimack plant retirement and for the divestiture option identified by the Commission, I believe that the Company had an explicit obligation to diligently and aggressively track the Project's economic viability in light of rapidly changing economic and market conditions and keep policymakers informed of all findings and risks promptly, thoroughly, and clearly. Moreover, what is relevant under the prudence standard is the reasonableness of management and decision-making (given PSNH's high level of expertise and sophistication) at the point in time when the decisions were made or could have been made. I conclude that the relevant time frame was 2008/2009, with the emphasis on the first half of 2009.

IV. PRUDENCE AND THE SUMMER 2008 STUDY

A. Study Overview

Q. WHAT IS YOUR UNDERSTANDING CONCERNING THE REASON FOR THE COMPANY UNDERTAKING THE SUMMER 2008 STUDY?

A. Based on documents that I have reviewed, the Summer 2008 study appears to have been prompted by the more than 80 percent revision in the cost of the Clean Air Project, i.e., from $250 million to $457 million. An increase that large, and the sheer magnitude of

such an investment relative to the Company's then current $1.1 billion capitalization, raises questions concerning both customer impacts and economic feasibility.

The Summer 2008 study reached the conclusion that although the Clean Air Project would adversely affect customer rates, it would be far preferable to supplying the same amount of power from alternative sources. In other words, the study showed that the Merrimack plant retirement would render customers significantly worse off.

As of the time period when the study was conducted, only a relatively minimal amount of spending had taken place on the Clean Air Project. This is important because Summer 2008 would have been the best time to cancel the Clean Air Project in terms of minimizing the burden on customers of paying for abandonment costs.

Q. WHAT WAS THE SCOPE OF THE SUMMER 2008 STUDY?

A. The study consisted of a collection of analyses intended to evaluate both economic viability and rate impacts. The study considered three alternatives to Merrimack retirement: (a) purchase replacement capacity and energy from the New England ISO wholesale market; (b) build a new gas-fired combined cycle plant roughly the size of Merrimack; or (c) construct a new coal-fired power plant. Since purchasing replacement power on the grid was determined to be the most economical alternative to retiring Merrimack, that was the main focus of the study. The study also included 12 alternative scenarios or sensitivity cases along with a "base case" analysis. All 12 such cases assumed market purchases as the alternative to Merrimack.

Q. DID THE COMPANY CONDUCT OR PROVIDE ANY SUBSEQUENT ECONOMIC VIABILITY STUDIES?

A. No, other than the very limited study that accompanied the Company's October 15, 2010 status report. (See, Long Deposition, pages 115 and 171).

Q. HOW WAS THE SUMMER 2008 STUDY STRUCTURED?

A. This is essentially a "with and without" Merrimack study that covers the time period 2012-2027, which is the assumed cost recovery period and useful life for the environmentally-compliant Merrimack plant.[2] In the "with" case, the model calculates the Merrimack total revenue requirements based on the assumption that the scrubber is operational beginning in 2012. This includes ownership costs for the then current Merrimack plant net investment, plus the budgeted $457 million scrubber investment (which includes return on rate base, associated income taxes, fixed O&M, and annual depreciation expense), plus operating costs (i.e., cost of coal, variable non-fuel O&M, scrubber operating costs, and emissions allowance costs).

The "without case" is much simpler. In that case, the model calculates the market cost of energy for the same number of MWhs that the now retired Merrimack plant would have produced plus the capacity purchases from the market to replace the Merrimack capacity credits. Again, these calculations are performed for each year 2012-2027. The market cost of energy is based on a natural gas price projection for 2011, escalated at 2.5 percent per year through 2027. The gas price is converted to an electric energy price based on the historical relationship between natural gas prices and New England ISO spot electricity prices. This method is a tacit acknowledgement by the Company that the New England ISO energy market is driven by natural gas prices, and the Company was fully aware of the importance of this connection.

[2] By 2027, Unit 1 of Merrimack would be 66 years old.

Finally, the "with" Merrimack annual revenue requirement stream and the "without" replacement market power stream for 2012-2027 are both discounted back to 2012 using the Company's cost of capital as a discount rate. The "without" net present value ("NPV") of market energy and capacity is subtracted from the "with" NPV of a scrubbed Merrimack to obtain the customer net savings from Merrimack retirement.[3] In addition to the NPV results, the Company notes that in the event of a Merrimack retirement, there would remain a net investment of about $63 million that it believes is recoverable from default customers. As I understand the Company's model, that $63 million has been reflected as a cost (i.e., revenue requirements) in the "with" case.

Q. WHAT RESULTS DID THE COMPANY OBTAIN?

A. The Company concluded that the plant retirement produces a negative customer impact of about $190 million on a 2012-2027 NPV base. This represents roughly an 8 percent economic penalty as compared to the $2.4 billion Merrimack NPV revenue requirements for the study period. The Company produces a substantially larger economic benefit for Merrimack if it is instead compared to two other planning scenarios: (a) constructing a new coal plant; or (b) constructing a new gas-fired, combined cycle plant.

This study validates the Company's belief that the Clean Air Project is economically viable, in the sense of being less expensive than other alternatives, and it therefore should proceed expeditiously as planned.

Q. WHAT ALTERNATIVE CASES WERE CONSIDERED?

[3] The Company also reports NPVs based on discounting back to 2008, but this is merely a presentation issue and has no effect on the underlying analysis.

A. The Company ran through its model 12 alternative cases, eight of which are sensitivities and four of which are scenarios. A sensitivity case represents the "with" and "without" model runs in which only one model parameter is permitted to change, so that the importance of that individual parameter can be assessed. An alternative scenario is a model run in which multiple parameter changes are made in order to better understand the implications of alternative futures.

I show the results for all 12 cases on Attachment MIK-3. The 12 cases modified either/or (1) the assumed cost of the scrubber; (2) natural gas prices; (3) cost of CO_2 allowances; and (4) Merrimack coal prices. Theses 12 cases were based upon the Company's belief that either these were the critically important study parameters and/or the assumed parameters embodied substantial uncertainty.

Q. WHAT DO THESE 12 CASES SHOW?

A. They show that the modeled Merrimack benefits are highly volatile and can change considerably given only small changes in assumptions. All sensitivity cases except one (a lower gas price) show a net benefit from keeping Merrimack as a scrubbed plant. The four scenarios, however, vary from a net savings from retaining Merrimack of $734 million to a net economic penalty of $459 million. Hence, the 12 cases – taken together – tend to support scrubbing and retaining Merrimack, but with a very large element of uncertainty.

B. Infirmities and Uncertainties in the Summer 2008 Study

Q. DO YOU CONSIDER THE SUMMER 2008 STUDY TO BE VALID?

A. In a very general sense, it is correctly structured to investigate the economic viability question as of that point in time. While many of the data inputs and/or assumptions are

not particularly controversial, I do have a number of concerns regarding data input assumptions and/or procedures. These include the following:

- The largest uncertainty in the study is the assumption of $11 per MMBtu natural gas in 2011, escalating every year thereafter. This is the "driver" of expensive replacement market energy if the Merrimack unit were to be retired.
- The study employed a very aggressive assumption for the Merrimack plant capacity factor.
- No major capital additions projects over and beyond the Clean Air Project are assumed.
- The study assumes that the Merrimack plant is retired at the beginning of 2012 (in the "without" case), even though compliance is not required until July 1, 2013.
- Only a modest level of CO_2 compliance costs are assumed, although larger costs are included in an alternative scenario.
- An important concern is the potential loss of default load due to both economic conditions and migration to competition. This does not alter the Merrimack plant's economic viability, but it does affect the default rate impact calculations.

As discussed above, the four alternative scenarios included in the study produce a very wide range of results, ranging from a net benefit from Merrimack (relative to retirement) of $734 million NPV to an economic penalty from retaining Merrimack of $459 million NPV.

(1) **Natural Gas Prices**

Q. WHAT IS THE MOST SERIOUS CONCERN THAT YOU HAVE WITH THE COMPANY'S ECONOMIC MODELING?

A. The most serious concern with the study pertains to the gas price assumption, which effectively serves as a surrogate for the New England ISO wholesale energy prices.

There are two reasons for this concern. The first reason is that the assumed $11 per MMBtu is far out of line with pre-2008 historical experience in the gas market. The $11 figure selected by the Company was largely an accident of timing. That is, the summer of 2008, when the study was prepared, was a time when gas prices were spiking both in the spot market and futures market. It turned out that these spot and futures price spikes were short lived, although that was not necessarily known at the time. Second, as shown on Attachment MIK-4, the economic value of scrubbing and operating Merrimack is highly sensitive to the gas price assumption. A mere $1 per MMBtu decline in the price of natural gas (all else equal) would eliminate all net economic value from the scrubber investment and Merrimack plant, producing a net loss for customers.

Taken together, these two problems with the price of natural gas are an indication that the study conclusions – while not necessarily wrong at the time – were questionable and warranted careful monitoring. The natural gas pricing issue should have been viewed as a "flashing yellow light" of caution in drawing conclusions regarding proceeding with the Clean Air Project $457 million expenditure.

Q. CAN YOU SUBSTANTIATE YOUR STATEMENT THAT THE SUMMER OF 2008 GAS PRICES WERE OUT OF LINE WITH RECENT HISTORICAL EXPERIENCE?

A. The Company is correct that in the summer of 2008, spot and future natural gas prices were in the $10 to $11 per MMBtu range. It is also correct that NYMEX futures markets can be used as a tool for projecting future market conditions. However, it is also at least reasonable to consider the possibility that gas prices in the future could have a tendency to return to historical norms. The table below shows the annual average spot wellhead

gas prices published in the U.S. Energy Information Administration's *Natural Gas Monthly*:

Year	Average Price $/Mcf
2001	$4.00
2002	2.95
2003	4.88
2004	5.46
2005	7.33
2006	6.39
2007	6.25
2008	7.96
June – July 2008	11.06
2009	3.67

Setting aside the summer of 2008, the historical norm for spot wellhead gas during this decade was typically in the range of about $4 to $6 per Mcf. I discuss the implications of the gas price assumption for prudence later in this section.

Q. **IN THE SUMMER OF 2008, DID THE COMPANY UNDERSTAND THE CRUCIAL IMPORTANCE OF ITS FUEL PRICE ASSUMPTIONS IN ITS FINDING THAT THE SCRUBBER PROJECT WOULD BE ECONOMICALLY VIABLE?**

A. Yes, very much so, and this risk factor clearly was communicated to Northeast Utilities' corporate management at that time. Mr. Long made presentations to the RaCC on June 25, 2008 and the Board of Trustees on July 15, 2008 (with both presentations later supplied in response to Staff 2-002, 8/30/12 and provided here as Attachment MIK-5). The presentations noted that with the updated $457 million Project cost, the "break-even" spread between the prices of delivered natural gas and coal must be at least $5.29 per

MMBtu in order for the Project to be economically viable[4]. (Page 37 of 50, Company response to Staff 2-002). The response noted that the actual spread had averaged $6.22 per MMBtu since Hurricanes Katrina and Rita in the Summer 2005. (Those hurricanes seriously disrupted gas supply at the time leading to sharp, though temporary, price spikes.) The gas price spikes largely dissipated after 2005 but then re-emerged in 2008, resulting in an extraordinary $9 per MMBtu price spread by the Summer 2008.

It should be noted, however, that the historic price spreads included in those management presentations also could be interpreted as an aberration. The management presentations showed that the price spreads in the 1990s averaged only about $1.52 per MMBtu, and for the 15 years preceding 2008 averaged about $3.18 per MMBtu—far below the estimated "break-even" price threshold for economic viability. Thus, the presentations demonstrated, at a minimum, that there was a huge risk that the $5.29 price spread going forward could not be sustained, based on longer-term historical experience. In fact, the empirical support for the $5.29 price-spread threshold being sustained was relatively narrow. At a minimum, this meant that this price-spread variable should have been aggressively and carefully monitored during the critical early phases of Project development.

[4] The June 25, 2008 presentation slides to the RaCC conclude:

"Customer value of scrubber installation extremely sensitive to future expected gas/coal spread

- At assumed 2012 price levels and other base case parameters, a spread of approximately $5.29/MMBtu (escalating) is required to create customer benefits."

(Staff 2-002, page 15 of 50)

Q. DID THESE MANAGEMENT PRESENTATIONS IDENTIFY OTHER BENEFITS ASSOCIATED WITH PROCEEDING WITH PROJECT DEVELOPMENT NOT PRESENTED TO THE COMMISSION?

A. Yes, the management presentations in the Summer 2008 indicated that in addition to the likely, though uncertain, customer net benefit from the Project, there would be a highly certain Northeast Utilities shareholder benefit. For example, the June 25, 2008 presentation to the RaCC states that the Project "provides a significant investment opportunity for PSNH" with the "Incremental Net Income estimate at $18.5 m[illion] in 2013—[the] first full year of [Project] operation." (Page 6 of 50, Staff 2-002, request dated 8/30/12) The presentation also quantifies the Project's contribution to Northeast Utilities' earnings per share. (Id., page 11 of 50).

Q. DID PSNH MANAGEMENT PRESENT THESE FINDINGS TO THE PUC?

A. No. On July 30, 2008, the PSNH presentation to the PUC omits the $5.29/MMbtu "break even" figure required to create customer benefits. See Attachment MIK-6. The graph presentation also omits the historic data showing the low 1990 price spreads averaging $1.52 per MMBtu and the 15 years preceding 2008 which showed a price spread averaging $3.18/MMBtu. Instead the graph presented to PUC Staff emphasizes an average spread from 2006-2008 of $6.22.

(2) Retirement Date

Q. WHY IS THE MODELED RETIREMENT DATE AN ISSUE?

A. As I understand the structure of the Company's model, it assumes that in the "with" case the scrubber is fully operational and in rates as of the beginning of 2012, and the energy and capacity supplied to default customers by that plant must be replaced. In fact, the

Scrubber law does not require compliance until July 1, 2013. Consequently, one would think that in a retirement scenario the Merrimack plant would remain in-service until that date, thereby eliminating from the "without" case the costs of 18 months of replacement energy and capacity. This would *reduce* the cost of the "without" case compared to the Company's modeling by about $46 million (or somewhat less than that on a 2012 NPV basis).

(3) **Merrimack Capacity Factor**

Q. HOW DOES THE CAPACITY FACTOR ASSUMPTION AFFECT THE RESULTS?

A. For modeling purposes, the Company selected a very aggressive capacity factor for the Merrimack plant, well in excess of 80 percent. This assumption benefits the economics of the scrubber and the Merrimack plant's viability. The higher the assumed plant capacity factor in the "with" case, the greater the number of MWhs per year of replacement energy that must be purchased in the "without" case. The assumed high capacity factor therefore raises the total annual cost of retiring Merrimack and replacing the energy.

Q. IS THE VERY HIGH ASSUMED CAPACITY FACTOR REALISTIC?

A. The assumed very high capacity factor implies a very good availability performance for the plant and that the plant would run (at its full capacity) in almost all hours that is it available. While obviously not impossible, this seems like a very optimistic assumption favoring the Merrimack plant.

In this regard, it is instructive to consider Figure 4 on page 15 of the June 7, 2013 Staff report which shows much lower capacity factors for 2008 – 2012 for the Merrimack and

other PSNH power plants based on those power plants' actual operating experience. The report observes, "The coal units at Merrimack Station and Schiller Station have experienced a sharp downward trend in operation." (Report, page 16.)

Q. ARE THERE ANY OTHER IMPLICATIONS OF A HIGH CAPACITY FACTOR ASSUMPTION?

A. Yes. Assuming an optimistically high capacity factor tends to minimize the calculated adverse busbar cost and therefore the rate impact resulting from the scrubber costs.[5] For example, if the fixed costs of the scrubber (i.e., return on rate base, depreciation, fixed O&M, income taxes) total $40 million per year, and it is assumed that the plant generates 2 million MWhs per year, the busbar cost increase is $40 million / 2 million MWhs = $20 per MWh (i.e., 2 cents per kWh). However if, annual operation is 1 million MWhs per year, the Merrimack busbar cost increases by $40 million / 1 million MWhs = $40 per MWh.

(4) **Capital Additions for Merrimack**

Q. OTHER THAN THE CLEAN AIR PROJECT, DOES THE COMPANY'S MODEL RECOGNIZE THE NEED FOR ONGOING CAPITAL ADDITIONS AT THE MERRIMACK PLANT?

A. Yes, to a limited extent. It appears that the model assumes that ongoing capital additions of about $9 million per year would be needed at the plant above and beyond the $457

[5] The "busbar cost" refers to the total cost (capital carrying charges plus operating expense) per MWh for a given power plant or generating unit (in this case, Merrimack). It differs from the default price that the customer pays because that price is based on the "blended" cost of all the power plants and purchased power used by the utility to provide default service.

million for the scrubber project. This amounts to annual capital spending of about $21 per kW of capacity.

Q. DO YOU HAVE ANY REASON TO QUESTION THIS ASSUMPTION?

A. Yes. The Merrimack plant is more than 50 years old and the $9 million in capital additions does not reflect further large scale spending on coal-plant environmental compliance. Such requirements in the future may or may not be imposed on the plant. As noted in the Staff report of June 2013 (page 29), the Merrimack plant may be required by the U.S. EPA to install a cooling tower to address thermal discharge and water consumption concerns at a capital cost of $111 million.

The Company takes the position that the cooling tower is not needed. The EPA position on the cooling tower and water quality mitigation was not known at the time the Summer 2008 study was undertaken. It is not my position that the Company was imprudent for omitting this investment from its model. However, as a general matter, it is fair to recognize that unknown capital additions and environmental compliance is a major cost risk for coal plants.

(5) <u>Federal CO_2 Legislation</u>

Q. DID THE SUMMER 2008 STUDY ACCOUNT FOR CO_2 COSTS?

A. Yes, it did, but in a very limited way. It is included in the relatively modest CO_2 emissions costs imposed under the Regional Greenhouse Gas Initiative ("RGGI"), the regional "cap and trade" program in which New Hampshire participates. The base case did not account for the potentially much larger costs of a federal program, although such costs were reflected in two of the alternative scenarios.

It should be noted that CO_2 emissions charges would affect both Merrimack's costs and the replacement energy cost purchased from the wholesale market. However CO_2 costs tend to be larger for coal plants than for the wholesale market which (at the margin) is based mostly on lower emitting gas-fired plants.

Q. WHAT DO YOU CONCLUDE ON THIS MODELING ISSUE?

A. While uncertain, potential federal CO_2 costs should have been considered as a major risk that would be adverse to Merrimack in the Summer 2008 study. The Company's exclusion of federal CO_2 costs for Merrimack was understandable since there was no such federal legislation in place in the summer of 2008. However, even at that time there was a reason to believe that such a program might be imposed on the industry in the near future, particularly following the 2007 U.S. Supreme Court decision establishing that CO_2 emissions could be considered a pollutant under the Clean Air Act (Massachusetts v. EPA, 549 U.S. 497 (2007)). This Court decision prompted EPA's subsequent endangerment finding issued in 2009.

(6) <u>Default Load</u>

Q. IN RECENT YEARS, THERE HAS BEEN CONCERN REGARDING THE MAGNITUDE OF THE DEFAULT LOAD. WHAT EFFECT DOES THIS ISSUE HAVE ON THE ECONOMIC VIABILITY OF THE SCRUBBED MERRIMACK PLANT?

A. As a technical matter, the magnitude of the default load, by itself, does not determine whether or not the decision to scrub and continue to operate the Merrimack plant is an economic decision, as compared to the retirement decision. That assessment is

unaffected by the magnitude of the default load as the Company's model correctly suggests.

This does not mean that the default load trends are irrelevant to prudent decision-making. If the default load is sharply declining, this means that the default rate impact of any increase in costs due to scrubbing (even if justified) would be magnified. In fact, if the default load declines by a large amount, the rate increases, as a practical matter, may be infeasible.

Q. WHAT ARE THE IMPLICATIONS FOR PRUDENCE IN THIS INSTANCE OF A DECLINING DEFAULT LOAD?

A. A declining default load should not cause a power plant deemed economically viable (when including scrubbing costs) to be retired. However, due to a potentially severe rate impact, it does suggest that the utility give this issue heightened scrutiny, and it does color how the decision-makers view risk if economic viability is judged to be uncertain. In addition, the declining default load could influence the appropriate policy response. Even if it is concluded that the Merrimack plant, with scrubber costs, is economic (the Company's position in 2008), it could suggest divestiture as being an appropriate response.

Q. WAS DECLINING DEFAULT LOAD A CONCERN DURING THE CLEAN AIR PROJECT CONSTRUCTION PERIOD?

A. Yes, very much so. The Company's October 15, 2010 status report in Docket No. DE 08-103 states that projected default sales since 2008 had dropped precipitously, from over 8 million MWh per year in 2008 to less than 5.5 million MWh in its 2010 assessment.

C. Updating the Study

Q. WHAT DO YOU CONCLUDE CONCERNING THE 2008 STUDY?

A. The Company's Summer 2008 economic viability study, submitted on September 2, 2008, was technically defensible and not unreasonable as a "snap shot" evaluation of investing $457 million in the Clean Air Project. At the same time, the alternative cases in that study demonstrate that the economic viability finding was uncertain and heavily dependent on one documented but nonetheless questionable assumption – the gas price path (or the gas/coal price spread) beginning in 2011. That assumption was consistent with published forward prices, but at the same time it was anomalous.

The study was submitted to the Commission just weeks before the onset of the great financial crisis which played out over the next six to nine months and the accompanying sharp economic recession. Partly related to these developments was an unmistakable down turn in the natural gas prices in both spot and forward markets. Within a few months, the $11 per MMBtu gas price outlook (which was highly anomalous to begin with) no longer was a reality. Prudent management called for tracking changes in gas price projections as the study scenarios clearly demonstrated that gas prices were a major driver of the Clean Air Project's economic viability.

Q. CAN YOU ILLUSTRATE THE GAS MARKET CHANGES TAKING PLACE?

A. Yes. Attachment MIK-7 shows the monthly pattern of gas market futures (Henry Hub NYMEX future prices) from January 2008 through December 2010. The NYMEX futures prices for the year 2011 prevailing in the summer of 2008 averaged about $10 per MMBtu, generally supporting the Company's point of view. However, by end-of-year 2008, they had fallen to about $8, and by the spring of 2009, 2011 gas forward prices had declined to $6 or less – a roughly $4 per MMBtu decline compared to Summer 2008.

Q. WOULD IT HAVE BEEN REASONABLE FOR THE COMPANY TO HAVE CONSIDERED THESE TRENDS?

A. Definitely. In fact, it would have been unreasonable to ignore these unmistakable trends. Using the Company's model, which was supplied to the OCA, I recalculated the net benefits from retiring the Merrimack plant (with no scrubber) using updated natural gas prices (i.e., for the year 2011 escalated at 2.5 percent per year through 2027). Case 1 on that attachment is the Company's own base case which shows a $190 million net cost (2012 NPV) to customers from retiring Merrimack rather than scrubbing. However, a mere $1 per MMBtu gas price reduction eliminates and reverses that loss. A $2 per MMBtu price reduction translates into a $235 million customer savings from plant retirement, and a $3 per MMBtu price reduction indicates a $447 million savings from plant retirement.

Q. ARE THESE THE RESULTS THE COMPANY WOULD HAVE OBTAINED IN UPDATING ITS STUDY IN EARLY 2009?

A. The updated study results might differ from what I show on Attachment MIK-4, but a proper update would likely show large economic losses from investing in the Clean Air Project and operating Merrimack. During the last few months of 2008, the Company was in the process of completing its contracting and procurement for the scrubber, and resources were being spent on planning and engineering activities. By year-end 2008, about $40 million had been expended on the project. (See Attachment MIK-2.) As indicated in the Company's progress reports, during early 2009, both detailed engineering work and site preparation were taking place, with a total 2009 calendar year budgeted expenditure (including PSNH/NU internal costs and AFUDC) of about $100 million.

An updated study conducted, for example, in early 2009 would have to account for these unavoided scrubber project expenditures, as well as any pre-construction Merrimack net book value (estimated by the Company to be about $63 million).[6] These "sunk" costs must be netted from the modeled retirement benefits to obtain the full picture regarding customer impacts from plant retirement. Nonetheless, the savings from retiring Merrimack (on July 1, 2013) and avoiding most of the scrubber costs are so large under a study update, that it seems clear that retirement, from an early to mid-2009 perspective, would be the more economical decision.

Q. WOULD AN UPDATE IN 2010 HAVE MADE SENSE?

A. An update prepared during 2010 may have been too late to have been helpful for decision-making concerning the Clean Air Project. By the end of 2010, the vast majority of the scrubber capital spending had already taken place. The more appropriate time frame for a study update and comprehensive reassessment therefore would have been the end of 2008 and /or early 2009. The appropriate response for the Company would be to perform the study update and a comprehensive reassessment and promptly present these results to the Commission and the legislature.

Based on such a reassessment, the Company could recommend the appropriate policy options. As noted by the Commission, policy options might include eventual plant retirement or divestiture. During this reassessment and review by the Commission and/or legislature, the Company, on its own initiative, could have ordered a slowdown or even suspension of the contracting and construction activity (at that time mostly detailed engineering, project planning, and site preparation work), to the extent such slowdown or

[6] The $63 million of pre-construction net book value must be netted from the retirement benefits because it appears that they are reflected as costs in the "with" case. Therefore, consistency requires including them in the "without" case.

suspension was feasible. As of early 2009, the Company had over four years remaining to meet the July 1, 2013 compliance date, and it did so by the end of 2011. Thus, the schedule was sufficiently flexible as to permit a temporary slowdown and/or suspension while the major decisions on the fate of the Clean Air Project were pending.

Q. TO YOUR KNOWLEDGE, WAS SUCH AN UPDATE FOLLOWING THE SUMMER OF 2008 PERFORMED?

A. I have seen no evidence that a comprehensive study update and reassessment, based on economic and market changes, was undertaken with results presented to the Commission. I have seen no indication that PSNH recognized the important economic and market changes taking place, and as a result, it failed to warn the Commission that its earlier economic study results may no longer be valid. Instead, the Company decided to proceed with its scrubber project capital spending expeditiously, completing the project almost two years in advance of the statutory compliance date. It appears to have disregarded the "flashing yellow light" of its alternative scenario modeling results.

Q. ARE THERE ANY OTHER FACTORS THAT COULD HAVE AFFECTED THE OUTCOME OF AN UPDATED STUDY AND PROJECT REASSESSMENT?

A. Certainly. The gas price projections clearly are of primary importance which is why I re-ran the Summer 2008 model with the observed declining gas price trend. In the previous section I mentioned other possible issues that could affect such a study and influence study conclusions either quantitatively or qualitatively. In fact, there may be other changes to the model in an update and reassessment that could favor Merrimack. The problem is that none of this was done despite the magnitude of the scrubber investment relative to PSNH's asset base and default load.

Q. DO YOU FIND PSNH'S CONDUCT TO BE IMPRUDENT?

A. I conclude that PSNH's failure to update its Summer 2008 study and assessment (which study was very uncertain to begin with) in the face of market and economic changes, that were both drastic and rapidly moving, was unreasonable and imprudent. While the Company seems to suggest that it had no discretion and was legally compelled to install the scrubber, at a minimum, updated study results, assessments, and recommendations should have been promptly submitted to those having decision-making authority. The Company obviously also had some degree of control over its own contracting activity to temporarily slow or stop spending on the Project, pending the major decisions over the fate of the Project. There was adequate flexibility in the compliance schedule to do so.

Q. EARLIER, YOU MENTIONED THE FINDING IN THE JUNE 2013 STAFF REPORT THAT THE SCRUBBED MERRIMACK PLANT TODAY PROBABLY HAS MINIMAL ECONOMIC VALUE. IS THAT A BASIS FOR AN IMPRUDENCE FINDING?

A. No, it is not. Prudence must be based on the facts and circumstances known or reasonably knowable at the time the decision was made. The first key decision point was just after the cost estimate of the Clean Air Project was increased from $250 million to $457 million in the summer of 2008. While perhaps questionable, I do not find that the decision to proceed at that time rises to the level of imprudence. My imprudence finding results from the absence of study or action by the Company over the next six to nine months.

The June 2013 Staff report, however, can be useful in reaching judgments regarding the extent to which ratepayers are harmed by the imprudence that occurred in 2009. For

example, if the Staff report demonstrated economic value for Merrimack close to or exceeding its $504 million current net book value, this would imply no harm to customers. A finding of zero economic value might suggest that at least a major portion of the scrubber investment was an imprudently-incurred cost.

Q. ARE YOU QUANTIFYING A RECOMMENDED IMPRUDENCE DISALLOWANCE?

A. No, not at this time. It appears that an updated study in early or mid-2009 with a prompt project suspension and subsequent cancellation would have avoided a major portion, if not most of the scrubber investment cost. Developing a precise quantification would require assumptions and further analysis, including how much capital spending at the time of project cancellation was unavoidable. The crucial threshold question for the Commission at this point is whether PSNH's management was imprudent by failing to promptly respond to changing conditions in late 2008/early 2009 by restudying and reassessing the Clean Air Project and Merrimack economic viability. Once an affirmative imprudence finding is reached, the next step is to quantify imprudence and consider appropriate remedies.

In Section V of my testimony, I further illustrate the imprudence concept with respect to an analogous coal plant development project taking place in about the same time frame as the Merrimack Clean Air Project. That was a case where an approved coal project was promptly and repeatedly restudied during late 2008/early 2009 when market conditions were changing, with updated study results and recommendations timely reported to regulators. That project ultimately was suspended and canceled, with essentially all project abandonment costs recovered by the utility. I believe this case is instructive and pertinent to the issues in this docket.

V. CANCELLATION OF THE LITTLE GYPSY PROJECT

Q. WHY IS A LOUISIANA COAL PLANT PROJECT RELEVANT TO THIS INVESTIGATION?

A. The Louisiana case is a very instructive example of a major utility facing circumstances concerning a major power plant investment at almost exactly the same time as the Merrimack Clean Air Project. In both cases, the economic support for the investment was dependent upon the projected outlook for the future price paths of natural gas versus coal. The Louisiana utility, Entergy Louisiana, LLC ("ELL"), continuously reevaluated project economics and effectively canceled its Project in early 2009. While this cancellation was less than a year after beginning construction, the utility incurred over $200 million in plant investment which became abandonment costs. The utility's actions in promptly revisiting project economics, reporting results to its regulator (i.e., the Louisiana Public Service Commission, "LPSC") and managing construction contracts to minimize cancellation costs, ultimately were determined to be prudent by the LPSC. The prompt and continuous reassessment was undertaken primarily due to rapidly changing gas market conditions in late 2008 and early to mid-2009.

Q. PLEASE DESCRIBE THE ELL COAL-FIRED PROJECT.

A. This has been referred to as the Little Gypsy Unit 3 Repowering Project ("LG3" or the "Repowering Project"). LG3 is a 1960s vintage gas-fired steam unit with a rated capacity of 547 MW. ELL is a large electric utility mostly serving southern Louisiana, and for many years ELL has been highly dependent on gas-fired generation and purchased power. In 2006, ELL proposed converting (i.e., "repowering") LG3 so that it instead

could burn coal or petroleum coke,[7] using fluidized bed combustion ("FBC") technology, thereby providing substantial energy cost savings and fuel diversity. The Repowering Project was selected as least cost in ELL's 2006 RFP for long-term resources. During the RFP process, the Repowering Project's capital cost estimate increased from less than $1 billion to more than $1.5 billion (with AFUDC). However, even at the higher capital cost, ELL continued to find the Repowering Project as least cost. This extreme and unexpected cost escalation parallels PSNH's experience with the Merrimack Clean Air Project.

In November 2007, the LPSC approved the Repowering Project and authorized ELL to proceed. A condition of approval was that ELL and the Commission Staff develop a construction monitoring plan to track progress on project status and development. The written Commission Order (Order No. U-30192), issued March 19, 2008, stated that if due to changed circumstances during project development that it no longer was appropriate to continue with the Repowering Project, this must be promptly reported to the Commission, with the supporting analysis. (Order, pp. 49-50.)

Q. HOW DID ELL SUPPORT THE DECISION TO PROCEED WITH AND/OR CONTINUE DEVELOPMENT OF THE PROJECT?

A. The Company conducted an NPV net benefits analysis that was more detailed but conceptually similar to PSNH's Merrimack Clean Air Project Summer 2008 study. The NPV revenue requirements for the capital and operating costs of the Repowering Project were calculated over an assumed 40-year useful life. This was compared to ELL's "next best alternative," assumed to be a replacement gas-fired combined cycle unit equal in size

[7] Petroleum coke is a very low cost refinery byproduct similar in price to, or even less expensive than, coal. For convenience, I refer to the LG3 Repowering Project as being coal-fired.

to LG3. That is, the NPV capital and operating revenue requirement stream for the replacement combined cycle unit were calculated.[8] The Repowering Project and the combined cycle case NPV results were then compared.

There was one important difference between the LG3 and the Merrimack studies. Once construction began, ELL removed from the study all construction costs incurred on or committed to the Repowering Project as of the date of the study. In other words, only the "to go" capital costs were included in the Repowering Project case. Costs that are committed (i.e., unavoidable) and "sunk" would not be relevant to the cancellation versus continued construction decision. Such costs therefore should be excluded from an economic viability study.

Q. HOW DID ELL PROCEED?

A. At the end of 2007 and in early 2008, ELL proceeded expeditiously with project contracting, selecting an EPC contractor along with other major equipment supply contractors (i.e., for the boiler, chimney, and high pressure piping). On-site construction could not start immediately due to a delay and complication with the air permit. This delay increased the estimated total project cost by about $200 million to $1.76 billion, and the Project was then reevaluated at that higher cost. The Project was able to resume construction in July 2008.

In the meantime, the Company and Staff had developed a formal Project Monitoring process, which was approved by the Commission. This Monitoring Plan required quarterly reports to be submitted to the Commission, inclusive of ongoing economic viability studies using ELL's standard methodology.

[8] In both cases, fuel costs were calculated using the Company's ProSym production costing model.

Q. WHEN WAS THE FIRST SUCH QUARTERLY MONITORING REPORT SUBMITTED?

A. It was submitted in July 2008, which is approximately the same timing as PSNH's Merrimack scrubber Summer 2008 study and the September 2, 2008 status report filing. ELL's July 2008 report showed the Repowering Project to be highly cost-effective with the customer net benefits increasing relative to those in its 2007 study, despite the air permit delay and additional cost escalation. This increased benefits in July 2008 is what one would expect given the escalation in natural gas prices between 2007 and mid-2008.

Q. DID YOU PARTICIPATE IN THE LG3 MONITORING PROCESS?

A. Yes. I participated as Staff's lead consultant. I helped to author the Monitoring Plan approved by the Commission, reviewed the quarterly reports prepared by ELL, and maintained close contact with the ELL project team.

Q. HOW DID ELL CONTINUE TO MONITOR DEVELOPMENTS DURING THE REMAINDER OF 2008?

A. After the financial crisis of September 2008, ELL and Staff held discussions in order to determine whether the momentous market changes taking place could threaten the viability of the Repowering Project. Both ELL and Staff, aware of these changes, were concerned that it might not be appropriate to continue with such a large and uncertain investment given the very uncertain changes taking place. However, in the fourth quarter of 2008, ELL had not completed a revised viability study because its updated long-term gas price forecast was not scheduled for completion until approximately year-end 2008. In addition to conference calls, ELL requested an in-person meeting with Staff in December 2008 to discuss the Repowering Project and possible management decisions.

Although ELL was not prepared in December 2008 to make a decision on the fate of the Project (in part because its updated study was not complete), Staff and the Company developed an outline of possible suspension and/or cancellation scenarios for the Repowering Project that should be studied as soon as possible. In other words, it is fair to say that by the fourth quarter of 2008, ELL management began to consider suspension or cancellation as a strong possibility.

Q. WHEN DID ELL CONDUCT ITS UPDATED STUDY?

A. At the end of 2008, ELL was conducting a detailed reassessment of the natural gas market and other major developments (such as expected CO_2 costs), and this was completed in January 2009. ELL completed and filed its updated Repowering Project economic viability study in February 2009, based on new forecasts for natural gas prices and CO_2 costs. This new study reversed the earlier 2007 and 2008 study findings, indicating that the Repowering Project no longer was considered to be cost-effective as compared to a gas-fired combined cycle unit. The main driver of this reversal was a significant reduction in the long-term gas price forecast.

Q. AFTER FILING THE FEBRUARY 2009 UPDATE, WHAT WERE THE NEXT STEPS?

A. ELL provided Staff and other parties an opportunity to review and discuss study findings. At that time, ELL was incurring substantial Project costs internally, under its EPC contract and from the various major equipment contracts. Staff therefore urged ELL to act quickly and reach a decision, preferably by the end of the first quarter of 2009. In light of updated study findings, the observed dramatic changes in market conditions over the previous six months, and the spending rate on the Project, ELL in March 2009

recommended a temporary suspension. This recommendation was supported by Staff and approved by the Commission in an order issued March 13, 2009 (Order No. U-30192-B). The suspension was intended to be temporary pending ELL conducting and filing a much more complete analysis.

The temporary suspension dramatically slowed expenditures on the Project, although it was not possible to stop spending completely. ELL had the right under its contracts to suspend work on the Project for a short period of time (e.g., several weeks), but it was not practical to suspend construction contracts at the negotiated contract prices and other contract terms for an extended period (i.e., several months).

Q. IN LIGHT OF THE TIME PRESSURES, DID ELL RESPOND PROMPTLY TO THE COMMISSION'S DIRECTIVE FOR A MORE DEFINITIVE ANALYSIS?

A. Yes. In a filing on April 1, 2009, ELL submitted its revised report and study of the Repowering Project. This report recommended a three-year suspension which, as a practical matter, was little different from outright Project cancellation. ELL, on its initiative, decided to cancel and unwind the Project construction contracts. This was a very complicated process because it involved negotiation of termination arrangements, preservation of work completed, and determining how to maximize any salvage value. At the time, ELL estimated the cancellation costs to be on the order of $300 million, although this was later revised down to about $200 million after savings opportunities and salvage value were identified.

Q. DID THE COMMISSION APPROVE THE REQUEST FOR A THREE-YEAR SUSPENSION?

A. Yes, it issued an order on May 22, 2009 approving the long-term suspension. It directed ELL to submit a filing by September 1, 2009 concerning recoverable abandonment costs and by December 15, 2009 on any plans to restart the Project.

On November 16, 2009, ELL filed a request for Project cancellation and rate recovery of $209 million of net abandonment costs. At this time, the Repowering Project and all contracts effectively had been canceled.

Q. DID ANY PARTY OBJECT TO ELL'S SHORT-TERM OR LONG-TERM PROJECT SUSPENSION OR FINAL CANCELLATION?

A. There were a number of active parties in these dockets, but none challenged the actions taken by ELL, and no party questioned the prudence of ELL's decision-making or management.

Q. WHAT WAS THE OUTCOME OF ELL'S COST RECOVERY REQUEST?

A. The parties reached a settlement in April 2010 which permitted ELL to obtain $200 million of cost recovery from customers of the abandonment costs (substantially all of the actual costs incurred) through securitization.

Q. DID ELL ITSELF ATTRIBUTE ITS SUSPENSION/CANCELLATION DECISION TO CHANGES IN NATURAL GAS MARKETS?

A. Yes. This explanation was highlighted in ELL's November 2009 Application:

> Between the time of the first Quarterly Monitoring Report ("July 2008 Report") and the February 2009 Report, long-term natural gas projections declined materially. (Application, page 12.)

Over that time period, the revised studies showed a change in Project value of over $600 million NPV for the 40-year study period.

The Application goes on to explain that the market change was far more than merely observing spot market price trends or even NYMEX futures, as important and unmistakable that these indicators were. It also reflected a careful review of changing gas market fundamentals. As explained in page 12 of the Application:

> Expectations regarding future natural gas prices declined, in large part, as a result of an increased realization that the supply of natural gas would be greater than had been previously known. This increase in expected supply is the result of a structural change in the natural gas market driven by the increased production of domestic gas through unconventional technologies. The recent success of unconventional gas production technologies (e.g., hydraulic fracturing and horizontal drilling) has altered the supply-side fundamentals such that there now exists an expectation of much greater supplies of economically priced natural gas in the long-run. In addition, the drop in projected long-term natural gas prices reflects expectations of reduced demand for natural gas as a result of the U.S. and global economic downturns.

The Application emphasized that the important changes were both those associated with gas supply technology as well as the upheavals in the U.S. and global economy from the Fall 2008 financial crisis. Moreover, these changes were readily identifiable in early 2009.

Q. DID ELL PROVIDE ANY GAS MARKET ANALYSES?

A. As discussed by its economic viability witness,[9] the sharp declines in late 2008 of the NYMEX gas price futures were a general indication of important fundamental market shifts that required closer scrutiny. He states:

> During 2008, there occurred a seismic shift in the North American gas market. "Non-conventional gas" – so called because it

[9] *Direct testimony of Anthony P. Walz,* Docket No. U-30192, Phase III.

> involves the extraction of gas resources that previously were non-economic or technically difficult to extract – emerged as an economic source of long-term supply. (Testimony, pages 23-24.)
>
> The changes in natural gas markets resulting from the emergence of non-conventional natural gas supplies are notable for the speed at which these developments occurred and the magnitude of their effect. Both dimensions were confirmed in June 2009 when the Potential Gas Committee ("PGC") announced the results of its year-end 2008 assessment of U.S. natural gas resources...the most recent report concluded that the total potential resources had increased from 1,320.9 trillion cubic feet ("TCF") to 1,836.4 TCF, an increase of 39% in two years. (Testimony, pages 24-25, footnote omitted.)

The 2009 PGC report indicated this to be the largest resource evaluation increase in its 44-year history.

Q. PLEASE SUMMARIZE ELL'S ACTIONS IN 2008/2009.

A. In mid-2008, ELL found itself in a circumstance very similar to PSNH. It was about to move forward with a major coal-fired related investment after experiencing a very large increase in the projected construction costs. Mid-2008 study results for both ELL and PSNH, while uncertain, did support proceeding and committing investment funds. This was a time when both actual and projected gas prices were at their high points and the evidence of economic viability was therefore strongest.

As ELL entered the fall of 2008, both spot and futures gas prices fell sharply, and the U.S. was experiencing a severe financial crisis and profound economic slump. These trends were extremely sudden and not immediately understood. Nonetheless, by the fourth quarter of 2008, the changes were so strong that ELL began to question the Repowering Project's economic viability, despite a favorable study only months earlier and over $1 billion in executed contracts. ELL engaged in discussions with Staff to study suspension or cancellation scenarios and to conduct a careful update prepared in the

beginning of 2009 incorporating a revised assessment of gas markets and other important drivers.

ELL's February 2009 study confirmed that the Project economics had reversed. This finding was discussed extensively with Staff and presented to the Commission. ELL concluded, after careful assessment, that this was not merely a short-term market fluctuation but rather a reflection of changing market fundamentals, including rapidly changing gas supply technology and economics. Within three months, the utility requested and obtained approval for short-term and long-term Project suspension, and, on its own initiative, it canceled the EPC and equipment contracts.

As these contracts were in place since about the end of 2007, this resulted in substantial cancellation costs. ELL carefully tracked these costs so that they could be properly recognized in the periodic economic viability studies. Despite being a very large corporation, ELL was able to move very quickly to make the critical decisions and minimize its cancellation costs.[10] ELL ultimately has been able to recover those costs, and there has been a consensus that its management conduct pertaining to the Project was prudent.

Q. HOW DOES THIS EXPERIENCE COMPARE TO THAT OF PSNH?

A. PSNH's behavior has been quite different. As was the case with ELL, it presented a Summer 2008 study arguably showing the Clean Air Project to be economically viable. However, for the crucial nine-month period from fourth quarter 2008 through second quarter 2009 there is no indication of a careful and prompt reassessment of market conditions and economic viability similar to that conducted by ELL. (See Long

[10] ELL is a wholly-owned subsidiary of Entergy Corporation.

Deposition at page 114). In contrast to ELL, PSNH takes the position that the Clean Air Project was effectively a legal mandate. However, that viewpoint should not have stopped the Company from updating its study, reevaluating market conditions, and presenting updated findings and recommendations to policymakers.

In comparison with ELL, where an uneconomic $1.5 billion investment was avoided, PSNH's management conduct cannot be considered to be prudent.

VI. CONCLUSIONS AND RECOMMENDATIONS

Q. PLEASE SUMMARIZE THE SCOPE OF YOUR PRUDENCE REVIEW.

A. My review covers the planning process undertaken by PSNH management and the reasonableness of management decisions for the Merrimack Clean Air Project, focusing primarily on the 2008/2009 time frame. This includes a review of the Company's Summer 2008 economic viability study and how that study likely would have changed had it been updated.

Notably, my review does not evaluate the scrubber technology selection and design, the Company's procurement and contracting process, or cost control effectiveness in completing the Project. Those issues are addressed in the due diligence report prepared by Jacobs, the consultant retained by the Commission. In addition, my testimony does not address the Company's legal arguments, i.e., that it was compelled by statute to construct the scrubber.

Q. WHAT ARE YOUR PRINCIPAL FINDINGS PERTAINING TO PRUDENCE?

A. Based on my review, I have reached the following findings:

- The Company's original Project cost estimate was reported as $250 million but later updated to $457 million in May 2008 after more careful

study by contractors and receiving bid information. This extreme budget increase (over 80 percent) was partly due to the incompleteness of the original estimate and partly due to industry-wide construction cost escalation trends. The budget increase is not by itself an indication of management imprudence.

- In the summer of 2008, apparently in response to the increased Project budget estimate, the Company conducted an economic viability study which validated the cost-effectiveness of the Project as compared with Merrimack retirement. A number of aspects of this study could be challenged, and it was based on a rather extreme gas price assumption of $11 per MMBtu in 2011. However, this was arguably supported by the very unusual market conditions prevailing at the time. While I do not completely agree with the study, neither do I find it or the Company's conclusion to be imprudent.

- The study summary was provided to the Commission as part of the September 2, 2008 status report requested by the Commission. Study results, along with additional detail, also were presented to NU management that authorized the Project (including the RaCC). Market conditions drastically and suddenly changed after September 2008, but it appears that in the context of this Project, PSNH and/or NU management failed to recognize or respond to the profound changes. The Summer 2008 study does not appear to have been updated in any complete way over the ensuing year. This is unreasonable and should be considered imprudent management conduct.

- The following six to nine months following September 2008 was a crucial period. A careful reassessment of the Project would likely have shown that it was no longer economically viable. PSNH was the only party in a position to respond quickly, reevaluate the Project in light of changing conditions (a historically sharp recession, dramatic changes in the gas price outlook) and report its findings to the Commission and/or New Hampshire legislature. It did not do so, and this can be considered to be imprudent management behavior.

- The sheer size of the Project, i.e., $457 million out of a 2008 capitalization of about $1.1 billion means that the Project was of immense importance to the Company and its customers. For that reason alone it merited close management scrutiny and continual analysis.

- Spending on the Project began to ramp up in 2009, but by early to mid-2009, only a small percentage of the $457 million budget would have been expended. By comparison, by the end of 2010, the vast majority of construction spending had occurred.

- The New Hampshire legislature's compliance deadline of July 1, 2013 provided the Company with substantial construction scheduling flexibility. The Company responded by expediting completion, nearly two years in advance of the compliance date, in the face of sharply falling gas prices and default service demand.

Setting aside the legal question of PSNH's unilateral authority to cancel the Project when markets began to turn against it, the Project should have been continually reevaluated

during the early part of the construction period with results provided to the Commission and/or legislature, along with Company recommendations. This was the process followed at the same time by another major utility, ELL, which ultimately incurred $200 million in abandonment costs, but in the process avoided an incremental uneconomic investment of $1.5 billion.

Q. SETTING ASIDE THE ARGUMENTS CONCERNING LEGAL AUTHORITY, WHAT WERE THE POSSIBLE 2008/2009 ALTERNATIVES FOR THE MERRIMACK PLANT?

A. This issue has been partly addressed in Commission orders on the scope of this docket. Potential actions in the 2008/2009 time frame might have included:

- Outright cancellation of the Clean Air Project, with the associated retirement of the two coal units by the July 1, 2013 compliance deadline.
- Divestiture of the Merrimack Plant, which might require the new buyer to complete the scrubber. (It is conceivable that a new buyer could pursue other options such as retirement or repowering as a gas-fired plant.)
- Long-term Project suspension and potentially mothballing of the Merrimack coal units (after July 2013). This would have permitted a future reassessment of the Merrimack plant and scrubber investment.

These may not have been options that PSNH could have undertaken as unilateral decisions (any more than ELL could have for its Repowering Project). But the Company could have submitted its analysis and recommendations to policymakers. It did not do so.

Q. HAVE YOU CALCULATED HARM TO RATEPAYERS FROM THIS IMPRUDENCE?

A. No, not at this time. It would appear that some portion of the $422 million scrubber investment is imprudent, but it is difficult to determine how much. In particular, had a cancellation decision been made in mid-2009 (as supported by the evidence), there would have been a significant amount of prudently-incurred cancellation costs. Whether that amount is $75 million, $100 million, or $150 million is simply not known at this time because the cancellation cost analysis (i.e., unavoidable costs incurred) has not been performed. The Commission could direct the Company to prepare such an analysis for the relevant cancellation dates (presumably in 2009).

Q. WHAT DOES THIS IMPLY REGARDING POSSIBLE REMEDIES?

A. This may depend on the future role of the Merrimack plant in providing default service, as discussed in the Staff Report on default service of June 2013. For example, if current arrangements continue, the Commission could recognize imprudence and mitigate cost by permitting a debt-only return on investment as part of the Merrimack revenue requirements. In the case of a plant retirement or divestiture, with stranded costs securitized, the Commission could require a write down of some of the Merrimack net book value that otherwise would be securitized.

The Commission has a number of options, but remedies and their quantification require further study and consideration.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.