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M.H.P.U.C. Case No.	DE 12-116
Exhibit No.	#2
Witness	Michael D. Cannata, Jr.
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**STATE OF NEW HAMPSHIRE  
PUBLIC UTILITIES COMMISSION**

**DOCKET NO. DE 12-116**

**In The Matter of**

**PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE  
2011 ENERGY SERVICE AND STRANDED COST RECOVERY CHARGE  
RECONCILIATION**

**DIRECT TESTIMONY**

**of**

**Michael D. Cannata, Jr., P. E.  
Senior Consultant  
ACCION GROUP, INC.**

October 26, 2012

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1 **I. Introduction and Qualifications**

2 **Q. Mr. Cannata, please state your full name.**

3 A. My name is Michael D. Cannata, Jr.

4

5 **Q. Please state your employer and your business address.**

6 A. For this engagement, I am engaged by Accion Group, Inc. (“Accion Group” or  
7 “Accion”) to address the issues raised in this proceeding. My business address is 65A  
8 Ridge Road, Deerfield, New Hampshire 03037.

9

10 **Q. In what capacity are you employed?**

11 A. I am generally responsible for the review of energy utility engineering and operations  
12 management, practices, and procedures.

13

14 **Q. Please describe your educational background, work experience, and major  
15 accomplishments of your professional career?**

16 A. My educational background, work experience, and major career accomplishments are  
17 presented in Exhibit MDC-1.

18

19 **Q. To what professional organizations or industry groups do you belong or have  
20 you belonged?**

21 A. I am a member of the Institute of Electrical and Electronic Engineers and its Power  
22 Engineering Society, and am a Registered Professional Engineer in the State of New

1 Hampshire (#5618). I served as a member of virtually all of the former New England  
2 Power Pool (“NEPOOL”) Task Forces and Committees except for their executive  
3 Committee, where my role was supportive to an Executive Committee member. I  
4 also served as a member of the New England/Hydro Quebec DC Interconnection  
5 Task Force and the Hydro Quebec Phase Two Advisory Committee. These two  
6 groups designed the Hydro Quebec Phase One and Phase Two 450kV DC  
7 interconnections with New England. The various committees and groups that I have  
8 served on existed to address the functions now being performed by the Independent  
9 System Operator – New England (“ISO-NE”).

10 On national issues, I represented Public Service Company of New Hampshire  
11 (PSNH) at the Northeast Power Coordinating Council as its Joint Coordinating  
12 Committee member, at the Edison Electric Institute as its System Planning  
13 Committee member, and at the Electric Power Research Institute as a member of the  
14 Power Systems Planning and Operations Task Force.

15 While employed by the of the State of New Hampshire, I managed a professional  
16 staff engaged in investigations regarding safety, operations, reliability, emergency  
17 planning, and the implementation of public policy in the electric, gas,  
18 telecommunications, and water industries. I also served as a full member of the New  
19 Hampshire Site Evaluation Committee responsible for siting major energy facilities  
20 (Generating stations, gas transmission lines, electric transmission lines, and gas  
21 storage facilities). At the request of the New Hampshire Public Utilities  
22 Commission’s (“NHPUC” or “Commission”) Chairman, I sat on the State Emergency  
23 Response Commission as a designated member. I was also a member of the former

1 Staff Subcommittee on Engineering of the National Association of Regulatory Utility  
2 Commissioners.

3

4 **Q. Have you testified before regulatory bodies before?**

5 A. I have testified before the NHPUC in rate case, condemnation, least cost planning,  
6 fuel adjustment, electric industry restructuring, and unit outage reviews. I have  
7 testified before the Kentucky Public Service Commission and the Maine Public  
8 Utilities Commission in transmission siting proceedings, the Maryland Public Service  
9 Commission and the Massachusetts Department of Public Utilities with respect to  
10 system reliability/storm restoration proceedings, and have submitted testimony at  
11 proceedings at the Federal Energy Regulatory Commission (“FERC”). I have also  
12 testified at the request of the Commission before Committees of the New Hampshire  
13 Legislature on a variety of matters concerning regulated utilities.

14

15 **II. Summary of Testimony**

16 **Q. Please describe the areas that your testimony addresses today.**

17 A. My testimony addresses three main areas and other lesser issues. Accion was  
18 requested to review (1) the market-based capacity and energy transactions performed  
19 by Public Service Company of New Hampshire that augmented its own generation to  
20 supply 2011 Energy Service to PSNH customers, (2) the outages that occurred at all  
21 PSNH generating units during 2011 and recommend any specific disallowances  
22 and/or operational changes, and (3) the review of PSNH’s efforts to address the  
23 recommendations remaining in the settlement agreements in Docket DE 09-091,

1 Docket DE 10-121, and Docket DE 11-094, the 2008, 2009, and 2010 PSNH Energy  
2 Cost/Stranded Cost Recovery Charge (“ES/SCRC”) reconciliations, respectively. I  
3 also present my views regarding the unit availabilities and capacity factors, heat rates  
4 of PSNH generating units for 2011, and the adequacy of 2011 capital and O&M  
5 expenditures for reliable and efficient plant operations.

6 This testimony addresses the review areas either through the questions and answers  
7 presented below, or through a series of individual reports, which are attached as  
8 exhibits to my testimony and are organized as follows.

9 **Capacity/Energy Transactions:**

10 Exhibit MDC-2, 2011 Capacity/Energy Transactions

11 **Generating Unit Outages:**

12 Exhibit MDC-3, Merrimack Outages for 2011

13 Exhibit MDC-3A, Merrimack CAP Tie-in Outages for 2011

14 Exhibit MDC-4, Newington Outages For 2011

15 Exhibit MDC-5, Schiller Unit Outages For 2011

16 Exhibit MDC-6, Hydroelectric Unit Outages For 2011

17 Exhibit MDC-7, Combustion Turbine Outages For 2011

18 Exhibit MDC-8, W. F. Wyman-4 Outages for 2011

19 **Prior Stipulation Items**

20 Exhibit-MDC-9, Open Stipulation Items from Prior Years - Energy  
21 Service/Stranded Cost Recovery Charge reconciliation proceedings, Dockets  
22 DE 09-09, DE 10-121, and DE 11-094 respectively.

23

1 I present the data responses in this exhibit that I relied upon in my testimony as:

2 Exhibit- MDC-10, Data Responses

3

4 **III. Discussion of Capacity & Energy Transactions**

5 **Q. Please summarize your capacity and energy transaction testimony.**

6 A. With regard to capacity and energy transactions, Accion concluded that PSNH's  
7 filing is an accurate representation of the capacity and energy purchasing process that  
8 took place in 2011. Accion concluded that PSNH made sound and prudent  
9 management decisions with regard to its capacity and energy purchases in its market  
10 environment consistent with its 2010 Least Cost Plan. PSNH made progress in  
11 making short term sales of excess energy and capacity once energy or capacity was  
12 purchased. PSNH used its recently modified energy procurement procedures to  
13 govern all aspects of supplemental energy purchases and sales which limit exposure  
14 to market forces. PSNH's efforts in continuing to focus more on the short-term as  
15 recommended in Docket DE 11-094 has helped keep costs much lower than previous  
16 levels. The net cost of supplemental energy service decreased from \$217.0 million in  
17 2009 to \$81.8 million in 2010 and \$91.4 million in 2011.

18 Accion also reviewed the capacity and energy testimony filed by PSNH, conducted  
19 an on-site interview with knowledgeable personnel responsible for the capacity and  
20 energy transaction function at PSNH, requested follow-up information, and reviewed  
21 detailed, backup information of the summary results supplied by PSNH. Accion also  
22 concluded that the capacity factor projections for PSNH units used for 2011 market  
23 purchases were reasonable and included ongoing discussions with generating plant

1 personnel. Accion is satisfied with the manner in which PSNH is modeling short  
2 reliability outages in 2011 and the impact of economic reserve status on its forecasts  
3 in 2011. In addition, Accion concluded that while the volume of customer migration  
4 in 2011 was reasonably constant throughout the year, it still introduced some  
5 uncertainty into the supplemental energy procurement process due to the inability to  
6 adjust purchases in a timely manner for unknown customer decisions.

7 PSNH's focus in 2011 was on the short-term market. In fact, except for the two  
8 remaining long-term legacy contracts (both purchased in 2008 and expired at the end  
9 of 2011), no energy purchases were for longer than a month, and all purchase  
10 decisions were made within a week of the beginning of the energy transaction. In  
11 addition, PSNH has developed an in-depth understanding all of its units' operational  
12 requirements in a lower-priced short-term market such that it stands ready to reverse  
13 those practices and procedures when market prices increase.

14

15 **Q. Do you have recommendations regarding future capacity and energy transaction**  
16 **issues?**

17 A. No, I do not. This proceeding does not address those future issues.

18

19

20

21

22

23



1 **IV. Discussion on Outages**

2 **Q. Please state the results of your review of the PSNH unit outages that occurred**  
3 **during 2010.**

4 A. With regard to planned and forced unit outages, Accion found that the base-load  
5 units on the PSNH system ran well in 2011, but running times of the coal units were  
6 reduced due to reserve economic shutdowns in excess of those forecast by PSNH.

7 Accion reviewed outage information, conducted on-site interviews, and submitted  
8 follow-up requests for information as necessary. In each outage, except those noted  
9 below, Accion found the outages to be reasonable and not unexpected for the  
10 particular unit, its vintage, or that the outage was necessary for proper operation of  
11 the unit. Accion also concluded that PSNH conducted proper planning and  
12 management oversight regarding the aforementioned planned and forced unit outages,  
13 including the outages related to the Clean Air Project (CAP) and those related to  
14 transmission operational outages. Additionally, from its review of unit outages,  
15 Accion has recommendations it believes will support and elevate PSNH's efforts in  
16 achieving additional improvement in unit operation.

17

18 **Q. Which outages did you find unreasonable?**

19 A. Accion found a few of the PSNH unit outages to be unreasonable and they are noted  
20 below. Accion also lists outages below which were found reasonable, but the  
21 circumstances presented an opportunity for PSNH to improve its processes. Accion  
22 will first present its findings with regard to unreasonable outages.

1 The first outage Accion believes to be unreasonable is associated with Schiller 6C on  
2 5/5/11, as identified in Exhibit MDC-5. The unit tripped when an operator was  
3 cleaning the emergency electrical panel. The operator hit/bumped the DC breaker for  
4 the Burner Management System (“BMS”) and tripped the BMS. Loss of the BMS  
5 then tripped the unit.

6 PSNH attributes the tripping of the breakers to the fact that it was 10:00 PM and  
7 therefore it was dark in the area. Most breaker panels have breaker “on” positions that  
8 are from left and right towards the center of the panel. Dusting left to right is possible  
9 if it is performed lightly, but this method increases the chance of opening a breaker if  
10 performed with excessive force. Dusting breaker panels vertically will virtually  
11 eliminate the possibility of an inadvertent trip. An operator with a reasonable  
12 understanding of the breaker panel function in relation to his/her duties and a  
13 reasonable attention to duty level would recognize this. Accion attributes this outage  
14 to inattentive operator action. As such, PSNH should reinforce its expectations of  
15 attentiveness to its operators.

16 Accion recommends that the replacement power costs associated with this outage not  
17 be recovered from customers.

18 The next outage Accion believes to be unreasonable relates to Ayers Island on 2/3/11.  
19 This outage is identified as Ayers Island Outage 1B in Exhibit MDC-6. There was not  
20 enough water to run the unit since it returned from its annual overhaul in Outage 1A.  
21 Once operating, the unit tripped due to high oil level in the lower guide bearing

1 reservoir. Two and one half gallons of oil was removed from the lower guide bearing  
2 reservoir to return the oil to a normal operational level.

3 PSNH's procedures require that when oil is removed from the reservoir, it is  
4 measured and the same volume of oil is added back. Oil levels are monitored when  
5 the unit returns to service. PSNH's investigation found that during the annual  
6 inspection in Outage A, too much oil was added back due to inaccurate measurement.  
7 Accion believes that the inaccuracy of oil measurement is beyond that of  
8 reasonability.

9 Accion recommends that the replacement power costs associated with this outage not  
10 be recovered from customers.

11 The next outage Accion believes to be unreasonable relates to Eastman Falls on  
12 11/28/11. This outage is identified as Eastman Falls Outage 2M in Exhibit MDC-6.  
13 The unit was taken out of service because the operator, while preparing for the annual  
14 overhaul of Unit #1, switched out the Unit #2 control panel instead of the Unit #1  
15 control panel. This error did not trip Unit 2 but did require that the unit be taken out  
16 of service to reset the Programmable Logic Controller ("PLC") logic. The logic was  
17 reset and the unit returned to service.

18 PSNH states that the panels were marked, that the event was due to operator  
19 oversight, and that the operator has been counseled. Accion attributes this outage to  
20 operator inattention.

1 Accion recommends that replacement power costs associated with this outage not be  
2 recovered from customers.

3 The next outage Accion believes to be unreasonable relates to Jackman on 12/8/11.  
4 This outage is identified as Jackman Outage 1D in Exhibit MDC-6.

5 A tree from outside of the right-of-way fell on the L-163 115 kV line between the  
6 Keene and Jackman Substations. When this event occurred, the A-164 terminal at the  
7 Weare substation and the F-162 terminal at Greggs substation over tripped. The unit  
8 also over tripped for this fault. PSNH investigation found that there was a setting  
9 error on a relay associated with the F-162 and A-164 lines at Greggs.

10 PSNH states that this type of relay is checked on a 6-year schedule and was installed  
11 in 2009/2010, thus it had not yet reached its first maintenance cycle. The incorrect  
12 setting was associated with the original installation of the Weare Substation. With  
13 respect to the tree that caused the trip, PSNH also states that it has not addressed  
14 danger trees that were off the right-of-way.

15 The over trip of the relay at Greggs Substation associated with the A-164 115 kV  
16 terminal at Weare Substation and the F-162 115 kV terminal at Greggs Substation  
17 occurred for a single system design event. Good utility practice for the system design  
18 would lead to the conclusion that this event should have been considered in the design  
19 of the new Weare Substation. Either PSNH did not consider this single design event,  
20 or PSNH considered this design event and did not implement the required changes. In  
21 either case, PSNH did not exercise due care in the design of the Weare Substation.

1 Accion recommends that PSNH not recover replacement power costs for this outage  
2 from customers.

3 The last outage that Accion believes to be unreasonable relates to Garvins Falls on  
4 5/29/11 and 5/30/11. This was really a series of outages which are identified as  
5 Garvins Falls Outage 4F, 4G, and 4H in Exhibit MDC-6. In each outage, the unit  
6 tripped off-line due to low oil level in the lower guide bearing oil reservoir. The  
7 system reset itself because the oil level returned to normal and the unit restarted 35  
8 minutes later because the unit was required for generation. PSNH initially determined  
9 that due to the number of previous intermittent shutdowns, the Mercoid switches were  
10 not functioning properly and consequently ordered new Reed switches to replace  
11 them. Further investigation attributed the cause of the outage to low oil level in the  
12 lower guide bearing oil reservoir requiring manual oil flow valve adjustments.

13 PSNH had been having trouble in maintaining proper oil level in the lower guide  
14 bearing reservoir as reported in Outages 4C, 4D, and 4E on 5/27/11, the Friday before  
15 a long holiday weekend. Over the weekend, on 5/29/11 and 5/30/11, the outages  
16 related to this problem continued as reported in Outage 4F, 4G, and 4H above. In  
17 each of these outages, the generator restarted in 35 minutes because the pond level  
18 was such that the unit was required to generate, but PSNH did not dispatch an  
19 operator under those conditions. Accion believes that PSNH either did not fully  
20 understand the reasons for the continued unit trips and did not dispatch an operator to  
21 investigate the repetitive problem or that PSNH understood the problem and let it  
22 continue into normal business hours on Monday. Accion believes that good utility  
23 practice in either case would be to dispatch an operator.

1 Accion recommends that PSNH not recover the replacement power costs for these  
2 outages from customers.

3

4 **Q. Is that the extent of the outages that you find to be unreasonable?**

5 A. Yes, it is.

6

7 **Q. How should the replacement power costs of the outages you believe to be  
8 unreasonable be quantified?**

9 A. PSNH has consistently used a method to quantify replacement power costs in recent  
10 Energy Service/Stranded Cost Recovery Charge reviews. I recommend they continue  
11 to use that methodology for these outages and provide such quantification for review  
12 prior to the hearing in this proceeding.

13

14 **V. Unit Operation Recommendations**

15 **Q. In addition to your recommendations regarding the recovery of outage costs, you  
16 mentioned that you have recommendations that you believe will support and  
17 elevate PSNH's efforts in achieving additional improvement in unit operation.**

18 **Please present those recommendations.**

19 A. Certainly. First, let me clarify that while Accion found all the following referenced  
20 outages reasonable and recommends the recovery of all costs related to those outages,  
21 the outages present circumstances from which PSNH may be able to improve  
22 operating proficiency and, thus, lower costs to customers.

1 The first recommendation does not relate to a specific outage, but to the addition of  
2 the scrubber at Merrimack Station.

3 Accion believes that due to the installation of the scrubber at Merrimack Station, new  
4 situations exist that can result in common mode failures of both Merrimack units.  
5 Accion recommends that PSNH review the interaction of the scrubber to each unit at  
6 Merrimack or the scrubber itself to identify those conditions to determine the  
7 necessity of spare parts or additional redundancy to maximize operational efficiency  
8 if it does not already have plans to do so.

9 The next recommendation relates to planned outages at Merrimack Station,  
10 specifically the Unit 2 outage for the tie-in of the CAP on 10/12/11. Accion  
11 recognizes that each planned outage is unique for one reason or another and that  
12 many decisions regarding assumptions must be made when developing an outage  
13 schedule. In the case of the Unit 2 tie-in outage, assumptions of conducting start-up of  
14 both units in parallel, scaffolding distance, and normal start-up procedures required  
15 refinement during the outage, resulting in abrupt schedule planning and changes.  
16 Although the situations mentioned did not extend the subject outage length, they had  
17 the opportunity to do so. Accion recommends that PSNH review all its planned  
18 outage schedules prior to the outage to detect assumptions that need to be verified.

19 The next recommendation relates to Schiller Station, specifically Outages 4E and 4F.  
20 In these events, PSNH experienced a reverse relay problem with Unit 4. PSNH  
21 secured and installed a used relay from its electrical contractor. The problem  
22 persisted. Investigation found that although the relay was functionally tested, full

1 testing was not performed. Accion believes that PSNH more than likely will be using  
2 increased amounts of used or refurbished equipment replacements as its unit fleet  
3 ages. Accion recommends that PSNH add the testing performed on used or  
4 refurbished parts to the part's history documentation. Such nomenclature could be  
5 "functional, manufacturer, etc." and should also include any new parts. This  
6 recommendation should be implemented at all stations, and the hydro group and  
7 PSNH should make its expectations clear to vendors.

8 The next recommendation also relates to an outage at Schiller Station and took place  
9 on 7/11/11, specifically Outage 6H. The unit was in cold-start mode (available in  
10 eight hours). ISO-NE had called for the unit at 10:30 PM the prior evening for an  
11 online time of 5:00 AM. Even though the start-up notice was only 6.5 hours, PSNH  
12 accepted the bid. PSNH was not able to phase the unit until 6:00 am resulting in a  
13 delayed start, but still made its 8-hour start time designation. PSNH states that the  
14 ISO-NE often calls for unit start-ups shorter than the eight-hour requirement and that  
15 PSNH always does its best to satisfy the pool needs by phasing as soon as possible.  
16 Accion recommends that PSNH make clear to the ISO-NE that all unit starts are made  
17 on a best efforts basis only and is not responsible if the start-up time is less than the  
18 committed start-up time.

19 The next recommendation relates to the host of over trip outages PSNH is  
20 experiencing with its units connected to the lower voltage system. PSNH is in the  
21 process of addressing this issue by conducting coordination studies that also require  
22 transient stability analysis. Accion understands that the PSNH system reliability  
23 design of its distribution system incorporates the loss of a system element with one



1 unit out of service. If the over trip outages are found to be systemic upon conclusion  
2 of the PSNH analysis of this issue, Accion recommends that the system reliability  
3 design incorporate the unit over trips into the system design criteria on a local basis  
4 only if other economic remedies are not available.

5 The next recommendation is related to Smith Outage 1C. In that event, a fault  
6 occurred on the short tap directly off the East Side 115 kV bus in Berlin that did not  
7 have its own breaker. In order to provide protection, the clearing of the fault must be  
8 delayed. In its repairs for this outage, and in conjunction with the installation of new  
9 generation in Berlin, PSNH is installing a breaker specifically on the Smith Hydro tap  
10 for both reliability and protection reasons. PSNH also recognized that this  
11 phenomenon existed at Merrimack Station with the two combustion turbines located  
12 at that station. In that case, PSNH also installed a separate breaker for the two  
13 combustion turbines. Accion recommends that PSNH review all of its generation tie-  
14 in configurations, assess the risk of similar failures at those locations, and  
15 appropriately and economically address the risks found.

16 The next recommendation is related to the hydro units in various outages. PSNH is  
17 experiencing more unit interruptions due to misoperations of the multitude of  
18 Mercoid switches employed across its hydro system. PSNH can no longer purchase  
19 new Mercoid switches as it has been prohibited since 2008 by NH law. PSNH has  
20 identified a replacement for these switches identified as the “Reed” switch and  
21 replaces the Mercoid switches with Reed switches on a case-by-case basis. Given the  
22 legislative mercury mandate, and the identification of a suitable replacement, Accion  
23 recommends that PSNH develop a program approach with a finite time frame (to be

1 determined) for replacement of Mercoid switches at its hydro stations and all other  
2 generating facilities with identified opportunities, such as annual maintenance  
3 outages.

4 The next recommendation is related to Garvins Falls Outage 4D. The early arrival of  
5 warm weather caused the unit to trip on low lower guide bearing oil flow. Extreme  
6 temperatures at earlier (or later) times during the year are causing outages because  
7 ventilation fans or louvers have not been put into, or have been taken off, summer  
8 temperature settings. Accion recommends that PSNH review and modify the times of  
9 year it changes to summer temperature settings in its hydro station buildings so that  
10 such early (or late) season events are within the summer time band width, or  
11 eliminate the winter temperature period all together.

12 The next recommendation relates to White Lake, Outage CT-1F. In that outage, a  
13 leaking air valve was replaced with a valve of improper pressure. The error occurred  
14 due to incorrect original manufacturer's drawings. Accion recommends that PSNH  
15 place a "hold" on work and question the replacement when an engineer, operator, or  
16 mechanic is replacing equipment that is not "in kind" until the replacement is well  
17 understood. This recommendation would fit well with a training program that trains  
18 the employee to have a questioning attitude.

19 The last recommendation relates to issues with the installations of gaskets and other  
20 interface mediums such as the O ring in Outage Merrimack CT-1C and the hydrogen  
21 coolers at Schiller Station that were problematic in both 2010 and 2011. In 2010,  
22 Accion recommended that PSNH set up a system in which installers of gasket

1 materials bring gasket-related issues to management’s attention during the outage to  
2 prevent down time while returning the unit to service. PSNH addressed that concern,  
3 yet issues with gaskets persist. Accion believes that PSNH needs to both review the  
4 changes in compatibility of materials used in interface connections and to strengthen  
5 its training of proper installation of the various interface sealing mechanisms. Accion  
6 also recommends that PSNH do so at all of its stations, including hydro operations.

7

8 **VI. Open Stipulation Items from Prior ES/SCRC Reviews**

9 **Q. Commission Staff also requested that you review PSNH’s efforts with regard to**  
10 **the remaining stipulation items agreed to in Docket No. DE 09-091, Docket No.**  
11 **DE 10-121, and Docket No. DE 11-094. Please present the results of your review.**

12 A. Certainly. The details of my review are contained in Exhibit MDC-9. Exhibit  
13 MDC-9 describes the issue in each remaining stipulated item, PSNH’s actions,  
14 Accion Group’s view regarding whether PSNH’s effort was appropriate and  
15 complete, and Accion Group’s recommendation as to the disposition of the item. A  
16 summary of Exhibit MDC-9 appears directly below.

17

18 **Items from Previous ES/SCRC Reviews**

19

20 **2009-1 – Mitigation of Customer Costs Regarding Certain 2008 Generation Unit**  
21 **Outages**

22 PSNH presented an accounting of all replacement power costs related to the 2008  
23 Merrimack Turbine outage. In the initial claim, PSNH put in a property claim of

1           \$21.0 million, and a replacement power cost of \$13.9 million. The replacement power  
2           cost claim resulted in a mutually agreed upon amount of \$12.5 million and the \$21.0  
3           million claim was reduced by its deductible of \$1.0 million to \$20.0 million. PSNH  
4           customers received \$32.5 million and PSNH credited that amount to customers. As  
5           noted below in Item 2010-1, PSNH is also pursuing reimbursement of the \$1.0  
6           million property damage deductible. This information is detailed in the PSNH  
7           response to STAFF-01, Q-STAFF-005 in Docket No. DE 12-116.

8           **Recommendation**

9           Staff is satisfied with PSNH's accounting in this matter and advises Accion that it  
10          recommends the item be closed.

11

12          **2009-2 – Schiller Warranty Items**

13          PSNH booked the final two Schiller warranty settlement amounts of \$750,000, each  
14          in January and June of 2011. Of these credits, \$1.0 million was booked to capital  
15          accounts and \$500,000 was booked to O&M. This information is detailed in the  
16          PSNH response to TECH-01, Q-TECH-001 in Docket No. DE 12-116.

17          **Recommendation**

18          Staff is satisfied with PSNH's accounting in this matter and advises Accion that it  
19          recommends the item be closed.

20

21

1           **2009-5 - Interconnection of PSNH Generating Units to the PSNH Distribution**  
2           **System**

3           During its analysis of this item, PSNH found issues relating to protection  
4           coordination in the areas near the hydro units. However, solutions were not identified  
5           and implemented until late 2010, so inadvertent trips still appear in quantity in the  
6           2010 ES/SCRC review in 2011. PSNH stated that the coordination review will be  
7           completed in 2011. PSNH agreed to report on this issue as part of its filing for the  
8           2011 ES/SCRC review in May 2012 (DE 11-094 Stipulation [2011 Stipulation]  
9           Section IV.E).

10          PSNH filed a progress report with the Commission on May 2, 2012 as part of its 2011  
11          ES/SCRC review. The progress report was attached to the testimony of William H.  
12          Smagula at Appendix A, Recommendation 5. Prior to continuing with the  
13          coordination studies at the hydro stations, PSNH needs to obtain the ability to analyze  
14          its distribution power system from a transient stability viewpoint. That item took on a  
15          separate action item apart from the coordination and is discussed in Item 2011-6  
16          below. There it is stated that the transient stability studies must be completed before  
17          the coordination studies can be completed.

18          **Recommendation**

19          Accion recommends that this item remain open while transient stability analyses are  
20          completed and incorporated into the overall coordination analysis.

21

22

1           **2010-1 - Tracking Insurance payments from the 2008 MK-2 Turbine Outage**

2           PSNH reported on this issue as part of its May 2011 filing for the 2010 SCRC review.  
3           Where replacement power costs of this outage were settled in Docket DE 11-094, the  
4           Commission assigned a new stipulation number (2010-1) for tracking the \$1.0 million  
5           machinery insurance deductible recovery payments from the lawsuit (DE 11-094  
6           Stipulation, Item III.E) and required PSNH to report its progress as part of its May 1,  
7           2012 filing for the 2011 ES/SCRC review (Docket DE 11-094). PSNH reported on  
8           this issue in its May 2, 2012 filing in Appendix A of the testimony of William H.  
9           Smagula as Recommendation No. 7.

10          According to PSNH, its insurance carrier performed an independent analysis  
11          regarding the root cause of the foreign material that damaged the MK-2 turbine. The  
12          insurance carrier believes it has sufficient documentation to show that Babcock &  
13          Wilcox (B&W) was the source of the foreign material intrusion and has initiated legal  
14          action against B&W to try to recoup its loss. PSNH stated that it has joined in the  
15          insurance carrier's suit. If recovery is made, PSNH would receive the first \$1,000,000  
16          of recovery representing its deductible for its boiler and machinery claims policy.  
17          Any recovery made by PSNH would be credited to customers. PSNH states that the  
18          legal action is in the discovery stage and a conclusion date is undetermined at this  
19          time.

20          **Recommendation**

21          Where litigation relating to this issue is still ongoing, Accion recommends that this  
22          issue remain open and further recommends that PSNH file an update of its progress as  
23          part of its 2012 ES/SCRC review filing in May 2013.

1           **Stipulation Items from the 2010 ES/SCRC Review in Docket DE 11-094**

2           During the 2010 ES/SCRC review conducted in 2011 in Docket DE 11-094, PSNH  
3           and the parties stipulated to a number of items to resolve outstanding issues in the  
4           case (2011 Stipulation). The 2011 Stipulation was filed on November 22, 2011 and  
5           approved in Order No. 25,321 (January 26, 2012). The stipulated items were  
6           reviewed by Accion in 2012 as part of the 2011 ES/SCRC reconciliation in Docket  
7           DE 12-116.

8

9           **2011-1 – Preparing Units for Longer than Previous Normal Shut Down Times**

10          In the 2011 Stipulation, PSNH agreed to review start-up procedures for all its major  
11          units (Merrimack, Schiller, and Newington) to determine if changes needed to be  
12          made to start-up (or shut-down) procedures when coming on line after longer than  
13          normal downtimes (2011 Stipulation, Section IV.D.1).

14          PSNH reported on this item in its May 2, 2012 filing in the testimony of William H.  
15          Smagula, Appendix A, Recommendation 1. PSNH states that the management teams  
16          of Merrimack and Schiller Stations discussed this issue with the management team of  
17          Newington Station who has been addressing this issue for the past two years, the  
18          equipment manufacturers, and PSNH’s Generation Maintenance rotating equipment  
19          specialists. While the changes in procedures may vary from station to station because  
20          of fuel, capacity factor, etc., PSNH used the Newington procedures and findings as a  
21          starting point and then adapted the logic specifically to the other stations. The primary  
22          focus of PSNH’s assessment was to use a more proactive approach to confirm that

1 critical equipment is in a ready-to-run state and functional when a unit is called for in  
2 the dispatch with minimal adjustments to existing ISO-NE start-up times.

3 A short summary of PSNH's procedure changes that have been made to date follows:

4 **Merrimack Station**

5 **Turbine** – Keep the rotor on turning gear, keep the turbine oil system in  
6 service, install a temporary heating source to the exciter, and cycle the turbine  
7 throttle valves.

8 **Bulk Material Handling Systems** – Routinely run system belts of the clean  
9 coal, limestone, and gypsum feed systems of the units and scrubber to avoid  
10 hardening or agglomeration. Prepare bunkers for extended layup by managing  
11 the level of coal (running them down on shutdown).

12 **Scrubber** – Rotate ball mills, ensure motor heaters are in service, routinely  
13 operate mill pumps, and manage the limestone silo level.

14 **Boiler** – PSNH currently lays up its boilers at Merrimack with the “dry”  
15 method where the boilers are drained and inert gas is added to prevent  
16 corrosion. A boiler may also be layed up with the “wet” method where the  
17 boiler is not drained and chemicals are added to prevent corrosion. PSNH is  
18 currently analyzing the pros and cons of each method.

19

20 **Schiller Station**

21 **Turbine** - Keep the turbine oil system in service, install a temporary heating  
22 source to the exciter, and cycle the turbine throttle valves.



1                   **Bulk Material Handling Systems** – Routinely run fuel system belts. Prepare  
2 bunkers for extended layup by managing the level of coal (running them down  
3 on shutdown) and clean coal feed system to reduce the chance of pluggage.

4                   **Boiler** – Because the boilers at Schiller are different than at other stations,  
5 auxiliary steam is required for the oil tank farm temperature so the boilers are  
6 left full and under auxiliary steam pressure. Units #4, #5, and #6 have a  
7 common auxiliary steam system which can be keep pressurized by any unit,  
8 the wood unit if the coal units are in reserve shutdown, or by oil if all units are  
9 out of service.

10                   PSNH states that it continues to explore this issue looking forward.

11                   **Recommendation**

12                   Accion believes that PSNH has adequately addressed the concern presented in Docket  
13 DE 11-094. In addition, conversations with PSNH indicate that they have a full  
14 knowledge of the topic and understand what changes need to be made to procedures if  
15 the energy situation reverses and the units are called upon to supply more energy to  
16 the market place. Accion recommends closure of this item.

17

18                   **2011-2 – Addressing Potential Gasket Problems within the Confines of the**  
19 **Existing Outage**

20                   In the 2011 Stipulation, PSNH agreed that when any contractor or company personnel  
21 suspects that gasket installations are problematic, that PSNH management should be  
22 notified of such problems to evaluate the need for rework at that time within the

1 confines of the existing outage schedule rather than potentially impede the  
2 maintenance schedule at the conclusion of the outage. This issue was to be addressed  
3 at all plants (2011 Stipulation, Section IV.D.2).

4 PSNH responded to this item in its filing on May 2, 2012 in the testimony of William  
5 H. Smagula, Appendix A, Recommendation 2. PSNH states that its current practices  
6 reinforce the importance of quality work and that during any outage; PSNH assigns a  
7 liaison to oversee the work and to facilitate communication between the contractor  
8 and station management on safety, work quality, and productivity.

9 PSNH states that in an effort to reinforce the importance of quality workmanship and  
10 proper communication, it has instituted additional specific actions to discuss this issue  
11 with contractors at pre-planning outage meetings and to discuss these issues at the  
12 daily outage meetings during the outage. This practice has been implemented at all  
13 plants and hydro as appropriate.

14 **Recommendation**

15 Accion believes that PSNH actions addresses the concern put forth in its  
16 recommendation during Docket DE 11-094 and recommends that this item be closed.

17 Accion also notes that there are other issues with gasket installations and addresses  
18 those issues in another module of its review.

19

20 **2011-3 – Vegetation Outages along the 355 and 355X10 34.5 kV Circuits**

21 In the 2011 Stipulation, PSNH agreed to conduct a vegetation inspection of the 355  
22 and 355X10 34.5 kV circuits that are connected to the Canaan Hydro Station.

1 Multiple outages had occurred due to vegetation. Accion had further recommended  
2 that recovery of the replacement power costs for Outages Canaan 1C, 1D, 1E, 1F,  
3 1G, 1K, and 1M be deferred until this issue was reviewed in the 2011 ES/SCRC  
4 review, the instant docket DE 12-116 (2011 Stipulation, Section IV.D.3).

5 PSNH responded to this item in its filing on May 2, 2012 in the testimony of William  
6 H. Smagula, Appendix A, Recommendation 3.

7 **355 34.5 kV Line**

8 Outages 1C, 1D, and 1E are directly a result of vegetation events. Outage 1F  
9 could not be confirmed as a tree related outage, but is suspected that the cause  
10 was tree. PSNH states that its vegetation management practices include  
11 removal of hazard trees for circuits in rights-of-way. In phase one of the  
12 Reliability Enhancement Program (REP)/Vegetation Management Program  
13 (VMP), PSNH reduced the trim cycle for rights-of-way to 5 years and  
14 increased hazard tree removal. In addition, and beginning on July, 1, 2010,  
15 PSNH introduced phase 2 into the REP/VMP which included the reclamation  
16 of rights-of-way to full width. With respect to the subject outages, PSNH  
17 identified most of the trees causing the outages as being from outside of the  
18 trim zone. PSNH's inspection in 2010 identified 36 hazard trees in and outside  
19 of the right-of-way. Trees that posed an imminent danger of causing an outage  
20 were immediately removed and the remaining danger trees were scheduled for  
21 removal.

1 Scheduled right-of-way maintenance was to take place in 2012. PSNH  
2 deferred this maintenance trimming to 2013 but also scheduled another  
3 vegetation management patrol in late 2012 to pick up additional vegetation  
4 problems so they could all be addressed at that time.

5  
6 **355X10 34.5 kV Distribution Circuit**

7 PSNH identified Outages 1G, 1K, and 1M as tree related events, mostly from  
8 outside of the trim zone. PSNH states that its vegetation management  
9 practices include scheduled tree trimming, enhanced tree trimming,  
10 maintenance enhanced tree trimming, mid-cycle tree trimming, and hazard  
11 tree removal. PSNH states that regularly scheduled tree trimming for this  
12 circuit is scheduled for 2012.

13 Accion notes that no specifics were supplied by PSNH pertaining to what  
14 parts of their vegetation management programs were applied to this  
15 distribution circuit nor were a number of danger trees found. Accion believes  
16 that record-keeping practices is the cause for the lack of information.

17 **Recommendation**

18 Accion refers the reader to 2011 Stipulation Item 2011-4 discussed directly below as  
19 it is similar to the instant issue and Accion presents its overall recommendation for  
20 both Item #3 and Item #4 there.

1           **2011-4 – Vegetation Outages along the 335/332 34.5 kV Circuits**

2           In the 2011 Stipulation, PSNH agreed to conduct a vegetation inspection of the  
3           335/332 34.5 kV circuits that are connected to the Hooksett and Garvins Hydro  
4           Stations. Multiple outages had occurred due to vegetation. Accion had further  
5           recommended that recovery of the replacement power costs for Outages Hooksett 1A,  
6           1B, and 1C plus Garvins Outage M-A be deferred until this issue was reviewed in the  
7           2011 ES/SCRC review, the instant docket DE 12-116 (Stipulation, Section IV.D.4).

8           PSNH responded to this item in its filing on May 2, 2012 in the testimony of William  
9           H. Smagula, Appendix A, Recommendation 4. PSNH identified these outages as tree  
10          related events with most of the trees located outside of the right-of-way. PSNH states  
11          that it conducted a patrol in late 2011 for this line consistent with current vegetation  
12          management practices and found 22 danger trees within the right-of-way.

13          Accion notes that normal scheduled vegetation management practices generally do  
14          not address vegetation issues that are outside of the right-of-way.

15          **Recommendation**

16          Tree related outages are numerous with most instances caused by trees that are  
17          outside of the maintained right-of-way. PSNH has obtained rights as part of its  
18          easements to remove trees that are out of the right-of-way if they pose a danger to  
19          operation of the power system for most of its transmission lines and an unknown  
20          amount of its 34.5 kV lines. These trees are identified as danger trees could cause the  
21          following operational problems:

- 22                 • Potential interruption of service to PSNH generation

- 1 • Potential interruption to the multitude of market generators connected to the
- 2 PSNH system (most bought by PSNH)
- 3 • Potential interruption to customers during severe weather events.

4 PSNH addresses what they call hazard trees (danger trees within the right-of-way)

5 during the vegetation management process but generally does not address danger

6 trees outside of the right-of-way even though in many cases it has the easement rights

7 to do so. PSNH is aware of the operational danger to the T & D system from trees

8 outside of the right-of-way. The NU transmission vegetation management budget for

9 2013 proposes (not yet approved) to spend \$800,000 on danger trees that are outside

10 the right-of-way and the distribution vegetation management program has begun to

11 identify easements that allow PSNH to address danger trees outside of the right-of-

12 way.

13 Accion recommends that PSNH initiate a 5-year program that continuously addresses

14 danger trees that are outside of the right-of-way as part of its regular vegetation T and

15 D maintenance cycles. As Accion understands the jurisdictional differences, the cost

16 of addressing danger trees on the transmission system would flow through

17 transmission charges, while PSNH would be responsible for funding the program on

18 the distribution side.

19 **2011-5 – Planning for Emergent Issues at Small Hydro Stations**

20 In the 2011 Stipulation, PSNH agreed to focus its non-destructive examinations

21 (NDE) on major hydro components (runners, draft tubes, etc.) and develop a

22 comprehensive plan to address the results of the NDE examinations. To be more

1 specific, it was expected that items such as exciters, runners, step-up transformers,  
2 rotors, stators, and draft tubes be explicitly addressed (2011 Stipulation, Section  
3 IV.D.5).

4 PSNH responded to this item in its filing on May 2, 2012 in the testimony of William  
5 H. Smagula, Appendix A, Recommendation 6. PSNH stated that it has created a  
6 Project Plan that incorporates NDE examinations of the equipment specifically  
7 mentioned into its maintenance planning process with the intention of creating a  
8 comprehensive NDE plan. PSNH has completed an assessment of the equipment that  
9 is listed above and has identified the proper NDE practices based on industry  
10 standards for each piece of equipment. PSNH is reviewing the appropriate NDE  
11 schedule for each piece of equipment, determining proper schedule placement that  
12 aligns with unit overhaul schedules, and will incorporate its findings into the unit  
13 maintenance schedules.

14 **Recommendation**

15 PSNH has implemented an ongoing process which directly addresses the concerns set  
16 forth in Docket DE 11-094. Accion recommends that this issue be closed.

17

18 **2011-6 – PSNH In-House Transient Stability Analysis (Unresolved Issue)**

19 In the 2011 Stipulation, Accion recommended with the support of Staff that PSNH  
20 obtain the in-house ability to perform transient stability analysis to aid the resolution  
21 of inadvertent generator over trips caused by faults on the distribution system, and to

1 aid in the determination of proper time delays of under voltage relays to maintain  
2 stability for properly cleared faults (2011 Stipulation, Section IV.G).

3 The issue was presented to the Commission at the hearing on the merits held on  
4 November 29, 2011. At the hearing, PSNH requested that it be given time to review  
5 the resource requirements of acquiring the ability to perform the studies and the  
6 resource requirements to perform the analyses. In its order in Docket DE 11-094, the  
7 Commission granted the ability to address this issue in a post hearing forum (Order  
8 No. 25,321 dated January 26, 2012, P17-P18).

9 Post hearing, on December 8, 2011, PSNH and Accion participated in a conference  
10 call on this subject. During that conference call, PSNH agreed to acquire the  
11 capability to perform in-house transient stability analyses. PSNH responded to this  
12 item in its filing on May 2, 2012 in the testimony of William H. Smagula, Appendix  
13 A, Recommendation 5. PSNH informed Staff that it could utilize the in-house  
14 transient stability program currently used by its transmission engineers for such  
15 purposes. Transmission planners use the Power System Simulator for Engineers  
16 (PSS/E) software that is supported by Siemens Power Technologies Inc. This  
17 program is considered as state-of-the-art by the power industry.

18 PSNH is in the process of training in-house personnel. PSNH is sending technical  
19 personnel to attend courses at the Siemens Power Academy TD in Schenectady, NY.  
20 Topics studied include modeling and building tools, data development and software  
21 operation, and analysis and mitigation of power system voltage and stability  
22 problems. PSNH is currently gathering data to construct models to analyze the



1 Canaan and Jackman hydro areas. Accion agrees that these two areas are the highest  
2 priority for analysis.

3 **Recommendation**

4 Where analyses are not complete, Accion recommends that this issue remain open  
5 and further recommends that PSNH file an update of its progress as part of its 2012  
6 ES/SCRC filing in May 2013.

7

8 **Q. Are there any other operational performance improvement recommendations**  
9 **that you wish to discuss?**

10 A. No, there are not.

11

12 **VII. Unit Availabilities and Capacity Factors**

13 **Q. What was the result of your review of the unit availability factors and capacity**  
14 **factors of the PSNH units?**

15 A. From a capacity factor basis, PSNH coal units performed at a lower level than  
16 expected. PSNH had forecast that economic reserve shutdowns were expected in the  
17 months of May and October when preparing and updating its ES rates, but actual  
18 market conditions resulted in a reduction of coal unit capacity factors of  
19 approximately 11% to 53% with the lowest reduction occurring on Merrimack-1 and  
20 the highest reduction occurring on Schiller-6. Without reserve shut downs, the units'  
21 capacity factors would have been much closer to historic values. This phenomenon is  
22 expected to continue into 2012. Capacity factors at Schiller 5 and Newington  
23 remained essentially unchanged from 2010 values.

1 PSNH units generally performed as well or better than forecasted from an availability  
2 perspective and with very high availability on the 30 highest priced energy days  
3 during 2011 (90% to 100%) with a fleet availability of 95% for those same days. The  
4 fleet availability was approximately 1% higher in 2011 than 2010.

5 Accion Group made the following observations regarding 2011 unit availability  
6 factors:

- 7 • Schiller 4 and Schiller 6 availabilities have historically been about 95 percent.  
8 In 2011, availabilities remained at approximately 95% and increased slightly.
- 9 • In 2011, the availability at Schiller 5 increased from approximately 95% to  
10 approximately 100%. Accion attributes this increase to unit maturity and  
11 continued progress in the operational learning curve.
- 12 • Newington maintained an availability of near 100% in 2011.
- 13 • Historically, availability factors for Merrimack-1 have been approximately 90  
14 to 95% since it went to its two-year major maintenance schedule in 2002. In  
15 2011, the availability factor for this unit increased to approximately 97%.
- 16 • The availability factor for Merrimack 2 has historically been approximately 90  
17 to 95% (except during 2008 as a result of the problems experienced with the  
18 HP turbine replacement). In 2010, the unit availability factor was  
19 approximately 95% and that availability factor was maintained in 2011.

20

21 **Q. Are there other observations you made with regard to the availabilities and**  
22 **capacity factors of PSNH generating units?**

23 A. No, there are not.

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**VIII. Unit Heat Rates**

**Q. What are your observations regarding the heat rates of the PSNH major generating units?**

A. The full load heat rates of the PSNH units have remained relatively constant over the last six years and remained at those levels in 2011. Actual heat rates for the unit have changed. Accion comments on each major unit below:

- The actual heat rates for Merrimack-1 and Merrimack-2 remained approximately at the same level in 2011 as they were in 2010 even though there was a reduction in operation due to economic reserve status in 2011. The reasoning is that when called upon to run, the units ran at high load levels and for reasonable periods of time. Such operation does not significantly impact unit heat rates.
- The Newington heat rate in 2011 remained relatively constant in 2011 from 2010. As the operation of the unit did not materially change in 2011, stable heat rates would be expected. The value of the units' heat rate indicates continued low unit operating levels and operation for relatively short periods of time.
- Heat rates for Schiller-4 and Schiller-6 increased markedly for 2011 from 2010 levels. Such an increase in heat rates indicates that the units operated at less than full-load and for short periods of time.

- The heat rate for Schiller-5 dropped markedly in 2011 compared to historical values. Accion attributes the drop to both increased availability and capacity factors that indicate both higher levels of operation and longer run times.

**IX. Capital and O&M Expenditures**

**Q. What did you form as a conclusion when you reviewed the 2011 spending for capital projects and O&M at PSNH generating stations?**

A. Accion reviewed the 2011 capital and O&M budgets (business plan) for Merrimack Station, Newington Station, and Schiller Station. Accion also reviewed the 2011 business plan for the Hydro group. In addition, Accion reviewed the hydro ten-year conceptual budget plan. Accion Group made the following general observations, and drew the following conclusions.

**Capital**

- PSNH's capital expenditures at the coal units are being reduced from historic levels when adjusted for major unit overhauls and other large planned capital expenditures.
- The reduced operation of the coal units due to increased economic reserve status requires a downward adjustment of capital expenditures because most capital expenditures are based on run-time. This is the same process that PSNH used at Newington to align capital expenditures with actual operation. Some in the industry refer to this

1 as the “snowplow effect” where major maintenance items are pushed  
2 into the future.<sup>1</sup>

- 3 • In addition, Schiller 6 is being moved to a 2-year maintenance cycle.
- 4 • PSNH has included FERC licensing requirements, dam repairs, and  
5 general capital project replacements in its budget projections at all  
6 stations.
- 7 • Newington and other non-coal units capital spending remained  
8 relatively constant.
- 9 • Capital spending adequately addresses upcoming maintenance issues  
10 as necessary.

11

## 12 O&M

- 13 • PSNH’s O&M expenditures at the coal units are being reduced from  
14 historic levels. The reduced operation of the coal units due to  
15 increased economic reserve status requires a downward adjustment of  
16 O&M expenditures because most O&M expenditures are based on  
17 run-time. This is the same process that PSNH used at Newington to  
18 align O&M expenditures with actual operation.
- 19 • PSNH’s O&M expenditures at non-coal units remain relatively  
20 constant at present levels into the future, when adjusted for major unit  
21 overhauls and other large planned capital expenditures.

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<sup>1</sup> Accion notes that if unit operation is increased because of increasing market prices that maintenance items would then be brought into closer time frames and could be coined as a “tsunami effect”.

- 1                   • O&M spending adequately addresses upcoming maintenance issues as  
2                   necessary.

3                   Accion Group concluded that PSNH is currently spending sufficient funds for capital  
4                   replacement/improvement and maintenance projects and sufficient money for  
5                   adequate maintenance to assure continued high performance operation of its units  
6                   consistent with good utility practice, consistent with its long-range plans for  
7                   continued operation of the units, and with recognition of unit age and operational duty  
8                   cycle as required.

9

10 **Q. Are there any other items you wish to discuss?**

11 A. I only wish to present the data responses relied upon by Accion Group in preparation  
12 of its testimony in addition to the materials filed by PSNH so they may be officially  
13 admitted into the record. Those data responses appear as Exhibit MDC-10 and are  
14 identified as:

15 **Staff Set 01**

16                   Data Responses 1, 5, and 9 through 21.

17 **Staff Set 02**

18                   Data Responses 1 through 28 and 30.

19 **Office of Consumer Advocate Set 01**

20                   Data Responses 10, 11, and 13.

21 **Office of Consumer Advocate Set 02**

22                   Data Responses 2, 5, and 6.

23 **Trans Canada Set 01**

1 Data Responses 3, 7, 9, 10 through 14, 16 through 24, 26 through 35, and 37.

2 **Trans Canada Set 02**

3 Data Responses 1, 2, 6 through 8, 10, and 11.

4 **TECH Set 01**

5 Data Responses 1, 5 through 8.

6

7 **Q. Does that conclude your testimony?**

8 **A.** Yes, it does.