**EB-2017-0049**

**ONTARIO ENERGY BOARD**

**IN THE MATTER OF** the *Ontario Energy Board Act*, *1998*, S.O. 1998, c.15, Schedule B;

**AND IN THE MATTER OF** an Application by Hydro One Networks Inc. for an order approving just and reasonable rates and other charges for electricity distribution to be effective January 1, 2018 to December 31, 2022.

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# COMPENDIUM OF THE SCHOOL ENERGY COALITION
## (Panel 1 - PSE)

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# ***School Energy Coalition Interrogatory # 10***

## ***Issue:***

Issue 10: Are the program-based cost, productivity and benchmarking studies filed by Hydro One appropriate?

## ***Reference:***

A-03-02-01

## ***Interrogatory:***

With respect to the retainer of Power System Engineering to carry out the TFP study:

a) Please provide the agreement between the Hydro One and the consultant, including all amendments.
b) Please provide the scope of work or other documents describing the initial instructions to the consultant, if they are not included in (a).
c) Please provide all written instructions to the consultant by the Hydro One or by counsel or others on other behalf, including but not limited to suggestions for edits to early drafts.

## ***Response:***

a) Please refer to Exhibit I-10-SEC-010, attachments.

b) Please refer to a) above.

c) In order to prepare its independent benchmarking study, Power System Engineering met regularly with Hydro One staff. Discussions included detailed aspects of the TFP. Throughout this process, Hydro One was afforded the opportunity to discuss and clarify preliminary observations made by Power System Engineering. These discussions and commentary occurred over a period of several months, took several formats (oral discussions, emails and telephone meetings). Hydro One had no decision-making role regarding the content or the conclusions that were reached by Power System Engineering. The underlying information that Power System Engineering has relied on for purposes of its reports is not a matter within Hydro One's domain or control. The requested compilation of all correspondence, exchanges, discussions that took place between Hydro One employees and Power System Engineering would take an inordinate effort and cost without any real or apparent purpose to the Board's consideration and review of the issues in this proceeding. Hydro One therefore declines to provide the requested information. Neither Hydro One nor

its counsel provided any instructions to Power System Engineering that would in any way impair or affect the objectivity and independence of the author's stated conclusions and findings. If SEC wishes to test the objectivity and independence of Power System Engineering and the conclusions that they have reached, this can occur through questions asked to Power System Engineering witnesses, and the testing of whether, or not, Power System Engineering's independence and objectivity was at any time impaired by the process which Power System Engineering used to prepare its reports.

1. Project kick-off phone conference
2. Prepare a draft study proposal for review by Hydro One.
3. Present and explain the proposed TFP study framework and methodology at a stakeholder session.
4. Meet with Hydro One to review suggested changes resulting from the stakeholder consultation.
5. Information and data requests to Hydro One requesting the identification of all possible additional "outputs" impacting TFP and historical and future data elements.
6. Hydro One completes information and data request.
7. Determine list of variables with Hydro One and PSE engineering experts that are theoretically plausible and available for data processing.
8. Gather and process cost, output, and potential service territory variables for an econometric model that may provide weights for the TFP outputs.
9. Estimate econometric model that quantifies the weights for possible outputs.
10. Determine comprehensive "outputs" for Hydro One TFP.
11. Determine appropriate weights for the TFP outputs to be included in the Hydro One TFP study.
12. Calculate Hydro One TFP trend from 2002-2022 (2015-2022 results will only be available once projected data is provided to PSE).
13. Prepare draft TFP study and preliminary study results.
14. Receive feedback from Hydro One.
15. Present a final TFP study.
16. Status update calls.
17. Defend the study during Part B of the project based on the requests of Hydro One.

## 3 Project Execution Approach

The project execution approach is flexible and will be customized to meet the needs of Hydro One. PSE suggests a kick-off call introducing PSE team members to Hydro One team members. The project manager, Mr. Fenrick of PSE, will also be the liaison between PSE and Hydro One. We recommend that Hydro One designate a contact person for the project as well. All data requests, data submissions, scheduling, and other communications should then be coordinated between the Mr. Fenrick and the Hydro One contact person(s).

PSE will provide project updates to Hydro One regularly, as project milestones approach and whenever requested by Hydro One. Project progress will be tracked and monitored to assure key project timelines are met.

## 4 Assumptions

The following are assumptions are assumed within this project proposal. They are:

- Stakeholder feedback, including that of Hydro One, will not significantly modify the overall scope of the project. The fixed price quote assumes the final project design will be similar to the proposed design in this SOW.

## 5 Project Schedule

Please refer to next page.

- A summary report on business performance and recommend measures that could be utilized by Hydro One.

2. Prepare a draft study proposal for review by Hydro One on or before beginning of August 2015.
3. Present and explain the proposed TFP study framework and methodology at a stakeholder session with the objective of gaining endorsement of the process and input on the same. Hydro One will retain the right to unilaterally decide any questions related to the study. A stakeholder session will include a one hour to two hour preparatory meeting with Hydro One and will be up to three hours in duration.
4. Meet with Hydro One to review suggested changes resulting from the stakeholder consultation.
5. Provide interim progress reports as requested by Hydro One.
6. Provide draft TFP study and preliminary study results by August 2016.
7. Present a final TFP study to Hydro One by October 2016 for submission to the OEB.

**Part B**

8. Participate fully, in cooperation with Hydro One, in the filing, discovery, hearing and argument phases of the Hydro One distribution rate application process as they pertain to the TFP study.
9. Defend the TFP study framework, methodology, findings and conclusions in the Hydro One distribution rates application proceeding in the normal phases of the regulatory application process as defined by the OEB. This includes the preparation of other related evidence as necessary to support the TFP study and expert witness testimony.

### 3.2 Consultant Requirements

The consultant required for this assignment must:

- Be able to provide all of the services outlined in Section 3.0;
- Have expertise and proven experience in preparing a TFP study and defending recommendations in a regulatory environment;
- Have in-depth knowledge and experience in applying general regulatory principles as they apply to the project scope;
- Have knowledge of specific practices and precedents within the regulated utility industry;
- Have significant experience in acting as an expert witness at rate hearings in the subject areas covered by this work scope;
- Be able to demonstrate that they have successfully completed similar work for other large clients, on time and on budget;

looking for. I'm looking at the list before you cut out all the stuff that you decided wasn't -- weren't appropriate variables. What's the menu that you chose from to get to the ones you ended up with?

MR. FENRICK: Subject to check, I'm not sure if an actual physical list exists of the variables. There was ongoing discussions, and frankly, in our benchmarking practice for other clients, we have ongoing discussions with the engineers at PSE, so I don't know if there is a physical variable list that exists --

MR. SHEPHERD: Well, so here's what I'm going to ask you to undertake, is to either look and see if there is a list or something that can help us to understand what you started with, or prepare one, if that's possible, of the variables that were considered, and if neither is possible just say so. Can you do that?

MR. FENRICK: Yes, we can do that.

MR. SIDLOFSKY: JT1.7.

**UNDERTAKING NO. JT1.7: TO PROVIDE, OR PREPARE AND PROVIDE, A LIST OF VARIABLES THAT WERE CONSIDERED, OR TO ADVISE IF NEITHER IS POSSIBLE.**

MR. SHEPHERD: Then number 13 here is prepare the draft TFP study and preliminary results. And that's not in the evidence, right?

MR. FENRICK: That's correct.

MR. SHEPHERD: And so I wonder if you could provide that then?

MR. NETTLETON: I'm going to ask that the witness not

answer or provide the undertaking on the basis that the evidence that Hydro One is relying on is the study, the final study. That is the application that's before the Board. And consistent with how Hydro One has responded to other requests of this nature of seeking draft reports, draft studies from third-party experts, we have declined to provide that information. And on that basis we are -- I am advising the witness to do the same and take the approach the same.

MR. SHEPHERD: Mr. Nettleton, our position in the hearing is going to be that Mr. Fenrick is not qualified as an expert because he is not independent. We're looking for -- and I was going to come to part C of this same interrogatory response, which was a refusal to provide the feedback that you gave to him. We're looking for that information because that will tell or help the Board understand whether Mr. Fenrick's evidence is in fact independent or not. And so if you refuse to --

MR. NETTLETON: I don't --

MR. SHEPHERD: I'm not finished.

MR. NETTLETON: Well, I am, and I'm telling you that this is a matter that we're wasting time on. There is an objection. It's not going to be resolved here, Mr. Shepherd. I would suggest that the matter be taken to the Board to have the Board decide.

MR. SHEPHERD: Fine. And so I assume that then item 14, receive feedback from Hydro One, that's also a refusal?

MR. NETTLETON: Yes.

MR. SHEPHERD: Thank you. And I assume that in part C of I10-SEC-10, where it says "provide the proposals for edits to drafts" and stuff like that, which you've said, no, it's too hard, you're going to decline to provide that as well.

MR. NETTLETON: The answer as provided is not changing, sir.

MR. SHEPHERD: Well, sorry, you're refusing now for a different reason. You're saying you're not entitled to see this, you're only entitled to see our final report. In this interrogatory response you said that the reason we can't do it is because it's too hard, it's too much work. So which is your reason for refusal?

MR. NETTLETON: I think they're both.

MR. SHEPHERD: Okay. Thank you.

My next question is on attachment 3 of that interrogatory response on page 3 -- or actually, I have a question on page 2 first. When you say a repeatable TFP study, what are the criteria that you use to determine whether it's repeatable?

MR. FENRICK: Sorry, Mr. Shepherd, where does it say "repeatable"?

MR. SHEPHERD: I'm in the terms of reference on page 2, "design and complete a repeatable TFP study for Hydro One's distribution business", and I just want to know what criteria you use to determine whether your study is repeatable or not.

MR. NETTLETON: Sorry, we're still trying to find the document you're referring to, Mr. Shepherd. Just give us a minute.

MR. SHEPHERD: Attachment 3 --

MR. NETTLETON: It's on the screen?

MR. SHEPHERD: Yes, so go down, 2.1 -- no, sorry, attachment 3, page 2, and there you go. Part A1.

MR. NETTLETON: Part A --

MR. SHEPHERD: "Design and complete a repeatable TFP study for Hydro One's distribution business."

MR. NETTLETON: Sorry, you're under 3.1A now?

MR. SHEPHERD: I just read it off the screen.

MR. FENRICK: Mr. Shepherd, by "repeatable" we mean the formulas are transparent. We provided the Excel file that can be replicated by any knowledgeable consultant. It can be updated as we have in the IR responses to incorporate future years.

And so by "repeatable" we mean that it can be transparent, it can be repeatable by other consultants. It can also be updated as new data becomes available.

MR. SHEPHERD: So -- that's what I was getting at. So when you say "repeatable" you mean replicable in the scientific sense, right, another scientist could replicate it, and repeatable in the sense of being able to be updated and moved forward sort of by Hydro One or by new experts or even by yourself for Hydro One later?

MR. FENWICK: Correct.

MR. SHEPHERD: Okay. Thank you.

Now, on the next page we talked about the draft study proposal, which you're going to provide. The -- it says here "provide interim progress reports as requested by Hydro One." That's on item 5, and I'm going to ask for that. I assume you're going to refuse, but I'm going to ask that you provide that.

MR. NETTLETON: You are correct, we will be refusing to provide that information.

MR. SHEPHERD: And then item 6, the draft TFP study and preliminary study results, that's the same document that we talked about before in the statement of work, correct?

MR. NETTLETON: It is the same issue, sir.

MR. SHEPHERD: I'm asking whether it's the same document, then if it's the same document you've already refused to provide it.

MR. NETTLETON: Whether it's the same document or not, it's the same response that we're providing of, we're refusing to provide draft studies and preliminary studies.

MR. SHEPHERD: I'm asking a question; is that the same document. Are you refusing to say whether it's the same document?

MR. NETTLETON: Just trying to short-circuit your ultimate request, sir.

MR. SHEPHERD: So are you refusing to say whether it's the same document?

MR. NETTLETON: Mr. Fenrick, maybe you can help us out whether the -- the question, as I understand it from Mr.

3. **Deliver the Draft Report:** 120 hours (Hydro One role: Provide feedback during status updates, identification of service territory conditions and challenges, gather information and data as requested)
4. **Deliver the Final report:** 40 hours (Hydro One role: Provide a thorough review and feedback on the Draft Report)

There are no non-personnel resources required of Hydro One that PSE is currently aware of.

### 4.10 Intentionally Deleted

### 4.11 Intentionally Deleted

### 4.12 Intentionally Deleted

### 4.13 Assessment Methodology

Provide a description of the methods, processes and procedures and high level plan for conducting the Work as defined in this Request for Proposal (i.e., what and how it will be done). The Proponent should state the nature, and content, and the expected artifacts/deliverables that will be generated (i.e., what will be the product and what will Hydro One expect to receive).

*Answer below:*
**Please see Appendix 1**

### 4.14 Assumptions and Constraints

Identify below key assumptions and constraints governing your Proposal.

*Answer below:*
The proposal assumes the following assumptions and constraints: 1. Hydro One will provide feedback and data as it is available and requested. 2. Stakeholder feedback will not significantly modify the overall scope of the project. The fixed price quote assumes the final project design will be similar to the proposed design in this proposal.

### 4.15 Risks

Using the table provided below, provide an assessment of the potential risks that may impact a successful project completion and how these risks will be mitigated.

| Potential Risk | Risk Impact | Risk Mitigation |
|---|---|---|
| There are no obvious risks that PSE sees to the completion of a successful project. PSE is accustomed to gathering, processing, and using the data that will be necessary for this study. We have conducted TFP and benchmarking studies for rural electric cooperatives, IOUs, and within the Ontario industry. We regularly employ the techniques that will be used in this study, and we have the experts required to modify these techniques as is necessary for the successful completion of this project. | | |
| Click here to enter your answer | Click here to enter your answer | Click here to enter your answer |
| Click here to enter your answer | Click here to enter your answer | Click here to enter your answer |

## 4.13 Assessment Methodology

The project will significantly enhance the OEB's efficiency and TFP assessments as they relate to Hydro One. We will use methodology similar to that used by the OEB; however, it will be enhanced and customized to appropriately account for the uniqueness of Hydro One's service territory. The OEB methodology, while appropriate for the vast majority of Ontario distributors, requires modification and enhancement for it to be a fair and accurate depiction of Hydro One's distribution performance.

As did the OEB in its efficiency assessment, PSE will likely use the econometric benchmarking method as the foundation of the benchmarking research. The econometric approach estimates a cost model by calculating the correlations between a number of explanatory variables and an independent variable, which in this case is cost. This model provides a direct quantification of the effect of each variable on cost, and properly "weights" that variable based on its contribution to costs. Unlike the current OEB efficiency assessment (which ranks Hydro One 72nd out of 73 distributors), PSE will properly account for the service territory challenges encountered by Hydro One. These include the enormous area served, serving islands, extreme weather, Canadian Shield, and others.

The econometric approach is the preferred approach of the Ontario Energy Board in its regulation of electric distributors.[2] PSE is a leading expert of the approach, especially within Ontario regulation.[3]

The TFP trend assessment will also likely follow a similar method as that used by the OEB. However, the current OEB methodology is very limited in its focus on the true "outputs" being delivered by distributors. It also makes no adjustment for the differences in service territories. PSE will create a far more comprehensive TFP calculation by including other "outputs" such as regulatory, service quality, and environmental to provide the OEB with a comprehensive outlook at Hydro One's TFP. We will assess the reasonableness of that TFP by creating a "TFP-driver" model that examines the expected TFP for Hydro One based on the company's service territory conditions.

PSE has a great deal of experience working on TFP calculations. Mr. Fenrick was recognized as a TFP expert during the 4th Generation Incentive Regulation proceeding. We fully understand the OEB's current methodology, including its weaknesses and strengths.

[2] The Board's 4th Generation IR decision in 2013 uses the econometric method to determine stretch factors. The decision excluded the peer group approach in favor of only using the econometric method.

[3] From 2010 to 2013, PSE worked with Board Staff in annually updating the econometric and peer group results for all 70 Ontario distributors within the 3rd Generation IR. During the 4th Generation IR proceeding, PSE worked with the Coalition of Large Distributors in helping the Board determine how to move forward with benchmarking. PSE recommended using the econometric approach to determine stretch factors, which the Board decided was the proper course. In 2014, PSE filed an econometric study of total costs and reliability for Toronto Hydro in their Custom IR filing. In 2015, PSE filed a similar econometric study of total costs and reliability for Hydro Ottawa in their Custom IR filing.

At the sample mean, a 1% increase in the number of customers (N on the table) and maximum peak demand (D) are estimated to raise cost by 0.814% and 0.097%, respectively. The number of customers served is the dominant output-related cost driver, which is an expected result for an electric distribution total cost model. The business condition coefficients are also signed as our hypothesis would suggest. All business condition variables are plausibly signed and statistically significant at the required 90% confidence level.

The benchmark scores are derived by taking the logarithmic percentage difference from Hydro One's actual total costs and their model-predicted total costs. That is to say, a positive number implies that the company's actual costs are higher than the benchmark. The table below shows the scores for the most recent three years (2014 to 2016) and the average of that three-year period.

**Table 3-2 Hydro One's Cost Performance 2014-2016**

| Year | % Difference from Benchmark Total Cost |
|---|---|
| **2014** | +29.3 |
| **2015** | +23.2 |
| **2016** | +21.6 |
| **Average 2014-2016** | +24.7 |

In the most recent three-year period, Hydro One's total costs are 24.7% above benchmark expectations. In the latest available year, 2016, we find Hydro One's costs to be 21.6% above benchmark expectations. The table below shows the projected scores for 2017 to 2022 and the average of that six-year period (22.0% above benchmark). The average score of the 2018 test year is 21.4% above benchmark.

**Table 3-3 Hydro One's Cost Performance 2017-2022**

| Year | % Difference from Benchmark Total Cost |
|---|---|
| 2017 | +21.3% |
| 2018 | +21.4% |
| 2019 | +22.0% |
| 2020 | +22.4% |
| 2021 | +22.4% |
| 2022 | +22.7% |
| **Average 2017-2022** | **+22.0%** |

# ***UNDERTAKING – JT 1.3***

***Undertaking***

To provide partial factor productivities for Hydro One's cost forecast through 2022.

***Response***

Below are the unadjusted PFP and TFP indexes. The adjusted indexes are not possible to forecast to 2022 due to a lack of safety and reliability forecasts.

| Year | PFP (OM&A) | PFP (Capital) | **TFP** |
|---|---|---|---|
| | | | |
| 2002 | 1.00 | 1.00 | **1.00** |
| 2003 | 1.03 | 0.99 | **1.00** |
| 2004 | 1.10 | 0.98 | **1.02** |
| 2005 | 1.06 | 0.98 | **1.01** |
| 2006 | 0.95 | 0.96 | **0.96** |
| 2007 | 0.82 | 0.94 | **0.89** |
| 2008 | 0.86 | 0.93 | **0.90** |
| 2009 | 0.80 | 0.90 | **0.86** |
| 2010 | 0.77 | 0.89 | **0.84** |
| 2011 | 0.78 | 0.88 | **0.84** |
| 2012 | 0.82 | 0.87 | **0.85** |
| 2013 | 0.76 | 0.85 | **0.81** |
| 2014 | 0.73 | 0.84 | **0.80** |
| 2015 | 0.85 | 0.82 | **0.83** |
| 2016 | 0.88 | 0.82 | **0.84** |
| 2017 | 0.86 | 0.83 | **0.84** |
| 2018 | 0.86 | 0.83 | **0.83** |
| 2019 | 0.87 | 0.82 | **0.83** |
| 2020 | 0.88 | 0.82 | **0.83** |
| 2021 | 0.88 | 0.81 | **0.83** |
| 2022 | 0.89 | 0.81 | **0.83** |
| | | | |
| | | | |
| 2002-2015 | **-1.2%** | **-1.5%** | **-1.4%** |
| 2002-2010 | **-3.2%** | **-1.5%** | **-2.1%** |
| 2010-2015 | **2.0%** | **-1.5%** | **-0.4%** |
| | | | |
| 2015-2022 | 0.7% | -0.3% | 0.0% |
| 2017-2022 | 0.7% | -0.5% | -0.1% |
| 2018-2022 | 0.8% | -0.5% | -0.2% |

fulfilling the Board's directive for Hydro One to "be able to demonstrate improvement in productivity to its customers and the OEB."[6]

The Hydro One TFP trends and performance adjustments are meant to provide information about the performance trends over time of Hydro One. The performance adjustments further inform stakeholders on the performance trend of the utility after adjusting for reliability and safety performance.

The purpose of calculating an adjusted TFP for Hydro One, in addition to the unadjusted TFP, is to make the performance trends more comprehensive than only including the number of customers, kWh deliveries, and peak demand. Connecting customers to the distribution grid and investing in the system capacity to deliver energy at peak demands is a highly valued service to customers. However, enhancing the reliability of the grid and assuring a safe work environment are also valuable services both to Hydro One's customers and to the OEB. While these activities do not increase revenue for Hydro One, for the most part, they do bring externalized benefits to customers or employees.[7]

The adjusted TFP does not correct for and incorporate all factors that may influence TFP trends. While reliability and safety are prominent functions of a utility, there are other causes, outputs, and reasons for TFP trends to increase or decrease. For more discussion, please see Section 3.2.

### 2.1.4 The Hydro One TFP Results Should Not Be Used for Calculating the Productivity Component

The TFP results specific to Hydro One should not be used as the basis of a productivity parameter within an incentive regulation plan. However, the updated Ontario TFP trend we calculated can be used as the basis for a productivity component within an incentive regulation plan. Incentive regulation parameters (input price inflation and productivity factor) should be external to the utility that they are being applied to. The 4th Generation Incentive Regulation proceeding followed this incentive regulation principle when estimating industry-wide TFP and uses that external benchmark as the basis for the productivity factor.

The 3rd Generation Incentive Regulation report from the Board also emphasized the need for an "external benchmark" for the productivity factor. On page 12 it states,

> The productivity component of the X-factor is intended to be the external benchmark which all distributors are expected to achieve. It should be derived from objective, data-based

[6] March 12, 2015 OEB Decision in EB-2013-0416, page 17.

[7] Reducing outages will increase revenue, however, this revenue increase is small relative to the externalized value of reducing outages to customers. The same can be said for employee safety. The utility will likely have some increased productivity if employee injuries are reduced, however, this increased productivity is small compared to the value to employees of experiencing fewer on-job injuries. Said another way, PSE is assuming that typical utilities spend far more money on reliability and employee safety than they would if there were no externalized benefit of increasing reliability or safety.

**Figure 7 Ontario Industry Historical TFP**

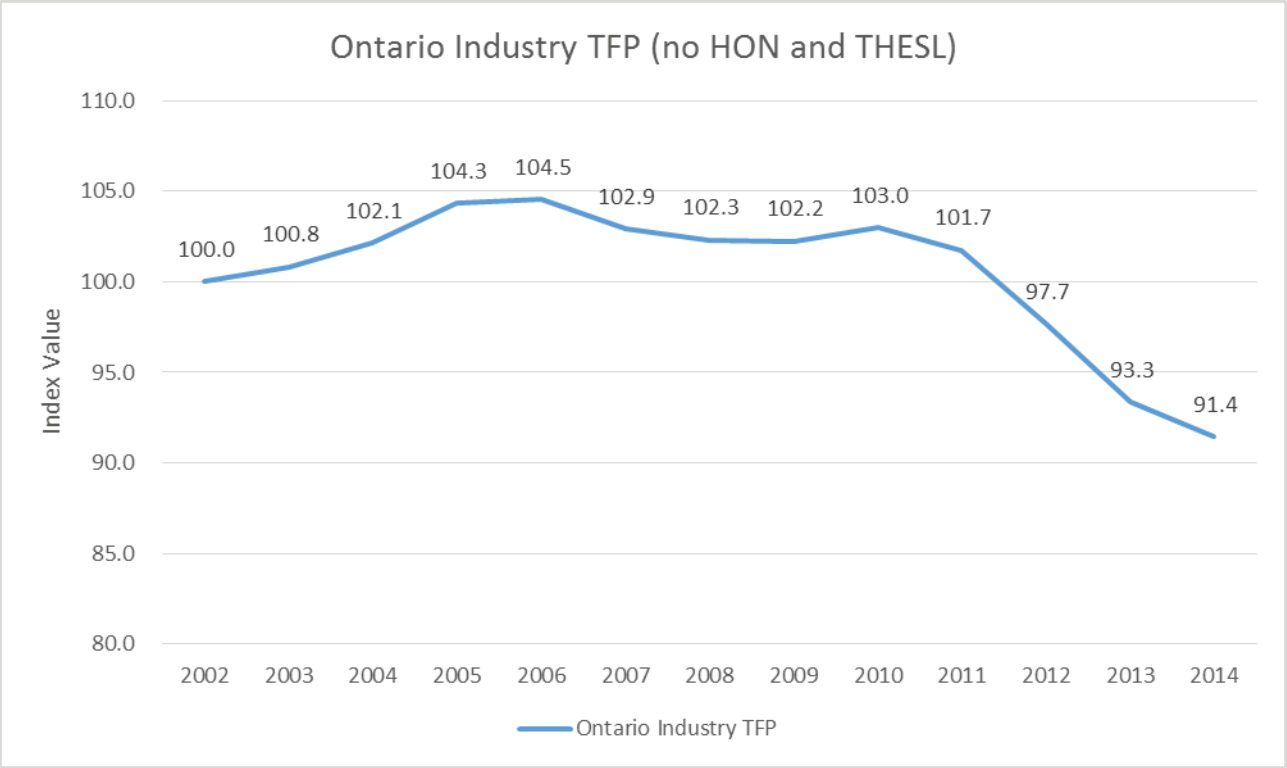



**Table 21 Ontario Industry TFP**

| Ontario Industry TFP | Average Annual Growth Rate |
|---|---|
| **2002-2012** | -0.3% |
| **2002-2015** | -0.9% |

**Table 6 Hydro One OM&A Unadjusted Input Components and OM&A Quantity Calculation**

| Year | OM&A Distribution Expenses | GDPIPI-Canada | AWE-All Employees-Ontario | OM&A Price Index | OM&A Input Quantity Index |
|---|---|---|---|---|---|
| **2002** | 314,638 | 90.3 | 711.29 | 1.00 | **314,638** |
| **2003** | 318,186 | 91.8 | 728.7 | 1.02 | **311,303** |
| **2004** | 305,724 | 93.4 | 748.98 | 1.05 | **291,901** |
| **2005** | 333,219 | 95.4 | 776.33 | 1.08 | **308,298** |
| **2006** | 377,591 | 97.6 | 788.78 | 1.10 | **343,128** |
| **2007** | 459,664 | 100.0 | 819.18 | 1.14 | **403,845** |
| **2008** | 452,127 | 102.6 | 838.34 | 1.17 | **387,848** |
| **2009** | 489,371 | 103.7 | 849.07 | 1.18 | **414,747** |
| **2010** | 525,571 | 104.8 | 881.44 | 1.22 | **432,541** |
| **2011** | 528,786 | 107.3 | 893.44 | 1.24 | **428,049** |
| **2012** | 515,527 | 109.1 | 906.15 | 1.25 | **411,153** |
| **2013** | 569,253 | 111.0 | 920.24 | 1.27 | **446,803** |
| **2014** | 601,149 | 113.4 | 938.27 | 1.30 | **462,496** |
| **2015** | 531,571 | 115.3 | 962.73 | 1.33 | **399,667** |
| **Average Annual Growth Rates** | | | | | |
| **2002-2015** | 4.0% | 1.9% | 2.3% | 2.2% | **1.8%** |
| **2002-2010** | 6.4% | 1.9% | 2.7% | 2.4% | **4.0%** |
| **2010-2015** | 0.2% | 1.9% | 1.8% | 1.8% | **-1.6%** |

### 4.2.2 Capital Quantity: Perpetual Inventory Capital Method

PSE's measure of capital quantity is based on the perpetual inventory capital method. This approach has a solid basis in economic theory, and is the same method chosen by PEG in their 4th Generation IR research.[14] The approach also has ample precedent in government-sponsored cost research. It is used by the Bureau of Labor Statistics of the U.S. Department of Labor in computing multi-factor productivity indexes for the U.S. private business sector and for several subsectors, including the utility services industry.

Based on this approach, the cost of capital in each period *t* is the product of indices of the capital service price and capital quantity in place at the end of the prior period. The formula for this is given by:

$$CK_t = WKS_t \cdot XK_{t-1}$$

In each period *t*:

- $CK_t$ is the cost of capital,

[14] See Hall and Jorgensen (1967) for a seminal discussion of the use of service price methods for measuring capital cost.

# ***School Energy Coalition Interrogatory # 18***

## ***Issue:***

Issue 10: Are the program-based cost, productivity and benchmarking studies filed by Hydro One appropriate?

## ***Reference:***

A-03-02-01 Page: 34

## ***Interrogatory:***

Please confirm that Table 15 means that 38.5% of the inputs of the adjusted TFP model are assumed to be used to deliver reliability outputs. If this is not correct, please describe more fully the quantitative impact of the reliability weights on the resulting TFP.

## ***Response:***

Confirmed.

MR. SHEPHERD: And so -- and that weight is in fact 38.5 percent, right?

MR. FENRICK: The combined weight with the SAIFI and CAIDI is 38.5 percent --

MR. SHEPHERD: All of the reliability component is 38.5 percent.

MR. FENRICK: Correct.

MR. SHEPHERD: Okay. And the Board's approach assigns a value to reliability outputs of zero, implicitly.

MR. FENRICK: Because they're not included?

MR. SHEPHERD: Yes.

MR. FENRICK: Yes.

MR. SHEPHERD: And so the only outputs are -- the common outputs in the two studies are load and demand, load and customer count, right?

MR. FENRICK: There's three components in the study: number of customers, kilowatt-hour deliveries, and then demand, maximum peak demand variable.

MR. SHEPHERD: And so what you've done in your study is you've reduced the weight of those other three by 30 -- the inverse of 38.5 percent in order to put in reliability. Reliability is actually the biggest weight in your study, right?

MR. FENRICK: This gets into a fairly complex discussion. So the weights for the cost components aren't actually reduced. We're talking -- we're now doing a three-dimensional study, if you will. And so if you think about a utility, if they're serving 1,000 customers with a

given reliability level, if they then double to 2,000 customers with that same reliability level, they actually still doubled. You know, they didn't -- just because the SAIFI or CAIDI didn't improve by double, they still doubled in size. And so that's how our study accounts for this. So it's -- and we're getting the two-dimensional cost variables of number of customers, kilowatt-hour deliveries, and maximum demand. They still get the same weights that they've always gotten. Now we're adding this third dimension of reliability into the study.

And so it wouldn't be fair to say we're reducing the weights of those three other outputs. They're still being weighted the same way, but now we're adding this third dimension into the total factor productivity, the adjusted total factor productivity.

MR. SHEPHERD: I always thought that when you used percentages if you add something with another percentage you either change your fraction or you reduce the effective weight of the other things. How is that not possible -- not the case here?

MR. FENRICK: Because of the third dimension that we're referencing, in that, in the example, if you have 1,000 -- say we're only using one output, number of customers. Even if the reliability doesn't change, in our TFP, the adjusted TFP, if those number of customers doubles, our output measure would still double. We're just adding that extra dimension of reliability and adjusting based on those weights one way or the other. In our

inconvenience (e.g., re-setting clocks), to life-threatening situations where electricity is needed to run medical equipment.

CAIDI measures the economic costs to customers that occur subsequent to the immediate costs. CAIDI costs grow as the outage gets longer. For example, for businesses, loss of manufacturing production, customers leaving the building, spoiled products, and spoiled food all increase as the duration of an electricity outage lengthens.

To incorporate Hydro One's SAIFI and CAIDI performance into the reliability adjustments, we needed to develop weights for each one. However, assigning a specific dollar amount to customer interruption costs is a challenging task. To PSE's knowledge, a direct study from Hydro One has not been conducted to quantify interruption costs.

To estimate the SAIFI and CAIDI costs and weights, PSE used interruption estimates from a publically-available paper published in June 2009 by the Ernest Orlando Lawrence Berkeley National Laboratory and prepared for the U.S. Department of Energy. The title of the paper is *Estimated Value of Service Reliability for Electric Utility Customers in the United States*.

PSE used the following table found in the Executive Summary of the LBNL report (page xxvi). The table reveals the estimated customer interruption costs (in U.S. 2008$) for various rate classes for outages with varying interruption duration times.

**Table 12 LBNL Interruption Costs**

**Table ES- 5. Estimated Average Electric Customer Interruption Costs US 2008$ Anytime By Duration and Customer Type**

| | Interruption Duration | | | | |
|---|---|---|---|---|---|
| Interruption Cost | Momentary | 30 minutes | 1 hour | 4 hours | 8 hours |
| **Medium and Large C&I** | | | | | |
| Cost Per Event | $6,558 | $9,217 | $12,487 | $42,506 | $69,284 |
| Cost Per Average kW | $8.0 | $11.3 | $15.3 | $52.1 | $85.0 |
| Cost Per Un-served kWh | $96.5 | $22.6 | $15.3 | $13.0 | $10.6 |
| Cost Per Annual kWh | 9.18E-04 | 1.29E-03 | 1.75E-03 | 5.95E-03 | 9.70E-03 |
| **Small C&I** | | | | | |
| Cost Per Event | $293 | $435 | $619 | $2,623 | $5,195 |
| Cost Per Average kW | $133.7 | $198.1 | $282.0 | $1,195.8 | $2,368.6 |
| Cost Per Un-served kWh | $1,604.1 | $396.3 | $282.0 | $298.9 | $296.1 |
| Cost Per Annual kWh | 1.53E-02 | 2.26E-02 | 3.22E-02 | $0.137 | $0.270 |
| **Residential** | | | | | |
| Cost Per Event | $2.1 | $2.7 | $3.3 | $7.4 | $10.6 |
| Cost Per Average kW | $1.4 | $1.8 | $2.2 | $4.9 | $6.9 |
| Cost Per Un-served kWh | $16.8 | $3.5 | $2.2 | $1.2 | $0.9 |
| Cost Per Annual kWh | 1.60E-04 | 2.01E-04 | 2.46E-04 | 5.58E-04 | 7.92E-04 |

PSE examined Hydro One's RRR data in 2008 to determine the number of residential, small C&I, and Medium and Large C&I customers that correspond with the preceding table. To determine

the SAIFI-related interruption costs per outage in 2008, we used the "Momentary" cost per event estimate for each rate class. To determine the CAIDI-related interruption costs per outage in 2008, we took the "1 hour" cost per event for each rate class and then subtracted out the momentary costs. For all of the estimates we also translated the U.S. dollar figure into Canadian dollars using the 2008 Canadian Purchasing Price Parity (PPP) ratio. We then multiplied by the number of customers in that rate class and by the SAIFI to ascertain the SAIFI-related costs.

For the CAIDI-related costs, we multiplied by the number of customers in each rate class and by the CAIDI value. This gives us an estimate of the cost for each outage at the average duration. We then multiplied that value by the average number of outages (i.e., the SAIFI value) to give us the total CAIDI-related costs for each rate class.

The equation to determine the 2008 SAIFI-related customer interruption costs is:

$$SAIFI\ Costs_j = Momentary\ Costs_j * PPP * Customers_j * SAIFI$$

The equation to determine the 2008 CAIDI-related customer interruption costs is:

$$CAIDI\ Costs_j = \left(1\ Hour\ Costs_j - Momentary\ Costs_j\right) * PPP * Customers_j * CAIDI * SAIFI$$

The table below provides the SAIFI-related costs by rate class and the total estimated interruption costs related to SAIFI.

**Table 13 SAIFI Costs**

| Rate Class | Momentary Interruption Costs (US$ 2008) | 2008 PPP | Number of Hydro One Customers in 2008 | 2008 SAIFI (no MEDs, no power supply) | Total SAIFI Customer Interruption Costs (US$ 2008) |
|---|---|---|---|---|---|
| **Residential** | 2.10 | 1.23 | 1,077,500 | 3.01 | $8,377,379 |
| **Small C&I** | 293 | 1.23 | 109,722 | 3.01 | $119,023,562 |
| **Medium & Large C&I** | 6,558 | 1.23 | 31 | 3.01 | $752,670 |
| **Sum of All Classes** | | | | | **$128,153,611** |

The table below provides the CAIDI-related costs by rate class and the total estimated interruption costs related to CAIDI.

**Table 14 CAIDI Costs**

| Rate Class | 1 hour - Momentary Interruption Costs (US$ 2008) | 2008 PPP | Number of Hydro One Customers in 2008 | 2008 CAIDI (no MEDs, no power supply) | 2008 SAIFI (no MEDs, no power supply) | Total CAIDI Customer Interruption Costs (US$ 2008) |
|---|---|---|---|---|---|---|
| **Residential** | 1.20 | 1.23 | 1,077,500 | 2.69 | 3.01 | $12,877,228 |
| **Small C&I** | 326 | 1.23 | 109,722 | 2.69 | 3.01 | $356,233,864 |
| **Medium & Large C&I** | 5,929 | 1.23 | 31 | 2.69 | 3.01 | $1,830,489 |
| **Sum of All Classes** | | | | | | **$370,941,582** |

The total SAIFI and CAIDI costs are weighted based on their proportion to Hydro One's distribution total costs in 2008 calculated in the TFP study. The 2008 weights are applied for all years of the study. This leads to the following weights for each reliability component:

**Table 15 Reliability Weights**

| Reliability Performance Component | Weight |
|---|---|
| **SAIFI** | 9.9% |
| **CAIDI** | 28.6% |

There are a number of assumptions embedded in the calculation of the weights. One key assumption is that the system-wide SAIFI and CAIDI metrics are applicable to each of the rate classes. That is to say, all customers experience the same reliability levels. A second assumption is that Hydro One customers are similar to the U.S. customers that formulate the interruption costs in the 2009 LBNL reliability study (i.e. the 2009 study adequately reflects the true interruption costs of Hydro One customers). Another assumption is that interruption costs have not changed since the 2009 LBNL study. Given these and other uncertainties with determining the value of service (VOS), PSE views these weights as a "first approximation" proposal. We are certainly open to suggestions on how to best formulate the weights when making these reliability adjustments.

# 6 Hydro One TFP and Performance Assessment Results

This Chapter provides the Hydro One TFP trend from 2002 to 2015, both without and with the performance adjustments discussed in previous chapters. These results are Hydro One's own TFP and performance trend. The Ontario industry TFP results are provided in the following chapter.

## 6.1 Hydro One Unadjusted TFP

Hydro One's TFP trend absent the performance adjustments declined by an average annual growth rate of 1.4% from 2002 to 2015. Much of the decline in TFP occurred in the earlier years of this time period. From 2002-2010, Hydro One's TFP declined by 2.1%. Since 2010, Hydro One's unadjusted TFP has declined by 0.4%.

**Table 16 Hydro One Unadjusted 2002-2015 TFP Trend**

| Year | Output Quantity Index | Input Quantity Index | TFP Index |
|---|---|---|---|
| **2002** | 1.00 | 1.00 | **1.00** |
| **2003** | 1.02 | 1.01 | **1.00** |
| **2004** | 1.02 | 1.00 | **1.02** |
| **2005** | 1.04 | 1.03 | **1.01** |
| **2006** | 1.04 | 1.08 | **0.96** |
| **2007** | 1.05 | 1.17 | **0.89** |
| **2008** | 1.06 | 1.17 | **0.90** |
| **2009** | 1.06 | 1.22 | **0.86** |
| **2010** | 1.06 | 1.26 | **0.84** |
| **2011** | 1.07 | 1.26 | **0.84** |
| **2012** | 1.07 | 1.26 | **0.85** |
| **2013** | 1.07 | 1.32 | **0.81** |
| **2014** | 1.07 | 1.35 | **0.80** |
| **2015** | 1.08 | 1.30 | **0.83** |
| **Average Annual Growth Rates** | | | |
| **2002-2015** | 0.6% | 2.0% | **-1.4%** |
| **2002-2010** | 0.7% | 2.9% | **-2.1%** |
| **2010-2015** | 0.4% | 0.7% | **-0.4%** |

As discussed in Section 3.2 negative TFP does not necessarily imply worsening efficiency. It simply means that measured input quantity growth is outpacing measured output quantity growth. Possibilities for causes, other than worsening efficiency, include: the economic downturn, slowing output growth even absent the downturn, aging infrastructure requiring large capital replacement

and increased maintenance costs, and an increase in unmeasured outputs (e.g., safety, reliability, customer service, regulatory, public safety, and environmental concerns).

## 6.2 Hydro One Adjusted TFP

PSE made two adjustments to the Hydro One TFP index to incorporate the impacts of changing reliability and employee safety performance. This makes the TFP index more comprehensive and indicative of performance' however, we caution that it does not include all possible performance metrics and other possible influencers of TFP trends.

### 6.2.1 TFP After Safety Adjustment

Due to Hydro One not having employee safety data prior to 2004 and PSE using a 3-year rolling average of the employee safety metric, the TFP index is not affected by the safety performance adjustment until 2007. For the years 2002-2006, we assume employee safety was constant and does not impact the TFP trend for those years.

The following table displays the unadjusted TFP and then the adjustment for employee safety.

**Table 17 Hydro One TFP Adjusted for Safety**

| Year | TFP (unadjusted) | TFP with Safety Adjustment |
|---|---|---|
| **2002** | 1.00 | **1.00** |
| **2003** | 1.00 | **1.00** |
| **2004** | 1.02 | **1.02** |
| **2005** | 1.01 | **1.01** |
| **2006** | 0.96 | **0.96** |
| **2007** | 0.89 | **0.90** |
| **2008** | 0.90 | **0.90** |
| **2009** | 0.86 | **0.86** |
| **2010** | 0.84 | **0.85** |
| **2011** | 0.84 | **0.85** |
| **2012** | 0.85 | **0.88** |
| **2013** | 0.81 | **0.84** |
| **2014** | 0.80 | **0.84** |
| **2015** | 0.83 | **0.88** |
| **Average Annual Growth Rate** | | |
| **2002-2015** | -1.4% | **-1.0%** |
| **2002-2010** | -2.1% | **-2.0%** |
| **2010-2015** | -0.4% | **0.6%** |

Incorporating employee safety changes the measured TFP trend from -1.4% to -1.0% over the entire sample period. Recall, however, that for the earliest years (2002 to 2006) no adjustment

was able to be made due to a lack of available data and we assumed constant employee safety. For the latter years, incorporating safety performance improves Hydro One's TFP indexes. From 2010 to 2015, Hydro One's safety-adjusted TFP trend is a positive 0.6%.

### 6.2.2 TFP After Reliability Adjustment

The reliability adjustment incorporates the two primary aspects of reliability: the number of outages experienced (i.e., SAIFI) and the duration of those outages (i.e., CAIDI). PSE is using a 3-year rolling average to smooth out annual fluctuations and excluding MEDs and power supply outages. The data provided to PSE prior to 2006 cannot be fully verified by Hydro One. However, given the consistency with the more recent years, we have included the estimates of the 2002 to 2005 reliability data.

The following table provides the unadjusted TFP findings for Hydro One along with the reliability performance adjustment index.

**Table 18 Hydro One TFP Adjusted for Reliability**

| Year | TFP (unadjusted) | TFP with Reliability Adjustment |
|---|---|---|
| **2002** | 1.00 | **1.00** |
| **2003** | 1.00 | **1.00** |
| **2004** | 1.02 | **1.02** |
| **2005** | 1.01 | **1.02** |
| **2006** | 0.96 | **0.99** |
| **2007** | 0.89 | **0.91** |
| **2008** | 0.90 | **0.92** |
| **2009** | 0.86 | **0.88** |
| **2010** | 0.84 | **0.86** |
| **2011** | 0.84 | **0.86** |
| **2012** | 0.85 | **0.87** |
| **2013** | 0.81 | **0.83** |
| **2014** | 0.80 | **0.81** |
| **2015** | 0.83 | **0.84** |
| **Average Annual Growth Rates** | | |
| **2002-2015** | -1.4% | **-1.4%** |
| **2002-2010** | -2.1% | **-1.9%** |
| **2010-2015** | -0.4% | **-0.5%** |

As is evident in the table above, incorporating the reliability adjustment does not alter the TFP trends in a meaningful way. The 2002 to 2015 TFP trend remains unchanged, the 2002 to 2010 trend improves slightly, and the 2010 to 2015 worsens slightly. These minor differences are due to the fact that Hydro One's reliability indexes have remained relatively stable since 2002.

### 6.2.3 TFP After Safety and Reliability Adjustment

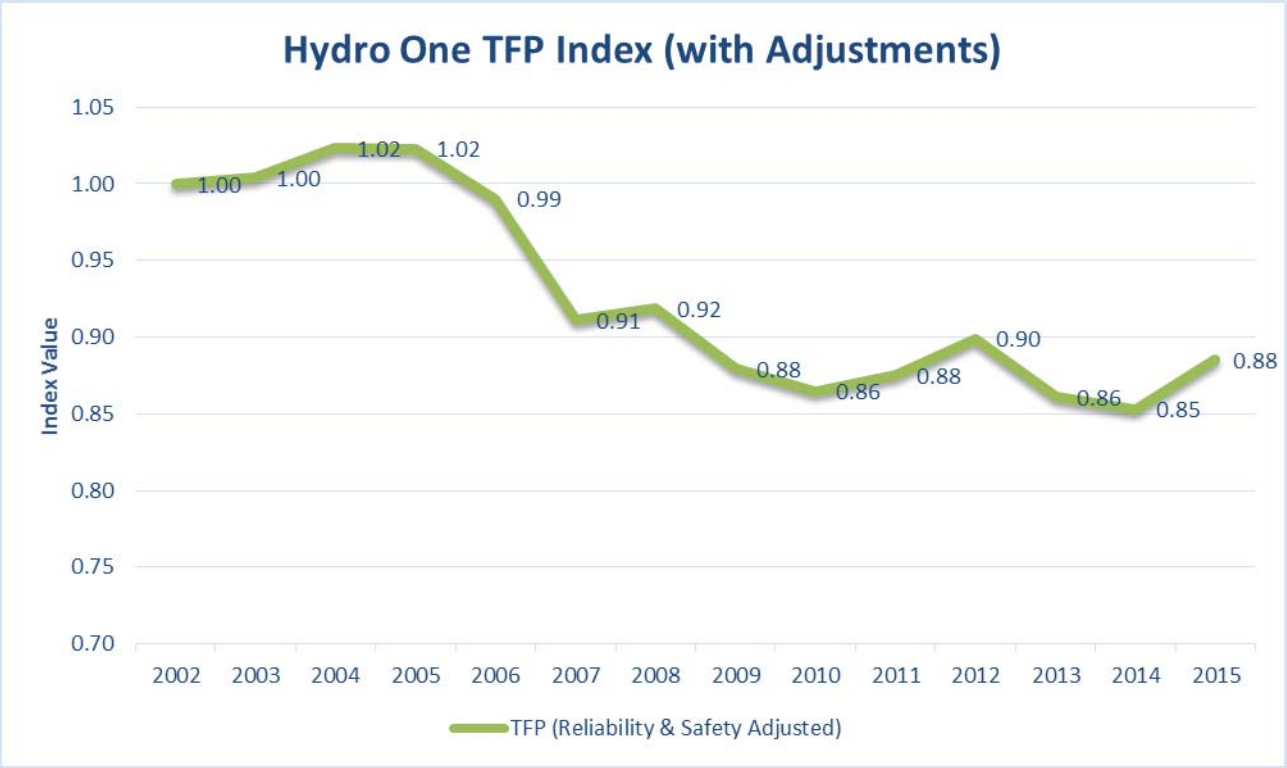
The following table incorporates both the safety and the reliability adjustments together into one index. This adjusted index provides a more comprehensive performance picture relative to the unadjusted index.

**Table 19 Hydro One TFP Adjusted for Safety and Reliability**

| Year | TFP (unadjusted) | TFP with Safety Adjustment | TFP with Reliability Adjustment | TFP with Safety and Reliability Adjustment |
|---|---|---|---|---|
| **2002** | 1.00 | 1.00 | 1.00 | **1.00** |
| **2003** | 1.00 | 1.00 | 1.00 | **1.00** |
| **2004** | 1.02 | 1.02 | 1.02 | **1.02** |
| **2005** | 1.01 | 1.01 | 1.02 | **1.02** |
| **2006** | 0.96 | 0.96 | 0.99 | **0.99** |
| **2007** | 0.89 | 0.90 | 0.91 | **0.91** |
| **2008** | 0.90 | 0.90 | 0.92 | **0.92** |
| **2009** | 0.86 | 0.86 | 0.88 | **0.88** |
| **2010** | 0.84 | 0.85 | 0.86 | **0.86** |
| **2011** | 0.84 | 0.85 | 0.86 | **0.88** |
| **2012** | 0.85 | 0.88 | 0.87 | **0.90** |
| **2013** | 0.81 | 0.84 | 0.83 | **0.86** |
| **2014** | 0.80 | 0.84 | 0.81 | **0.85** |
| **2015** | 0.83 | 0.88 | 0.84 | **0.88** |
| **Average Annual Growth Rate** | | | | |
| **2002-2015** | -1.4% | -1.0% | -1.4% | **-0.9%** |
| **2002-2010** | -2.1% | -2.0% | -1.9% | **-1.8%** |
| **2010-2015** | -0.4% | 0.6% | -0.5% | **0.5%** |

After incorporating the safety and reliability adjustments into the TFP trend, Hydro One's 2002-2015 TFP index average annual growth rate is -0.9%. The earlier years, 2002 to 2010, saw a larger decline of -1.8%. From 2010 to 2015, Hydro One has produced modest positive TFP growth (after adjustments are made) of +0.5%.

**Figure 6 Hydro One TFP Adjusted for Safety and Reliability**



# HYDRO ONE NETWORKS IR #20

**20. Reference: Exhibit M1, page 21**

In a separate table (or in a new column in Table 2), please add PSE's reliability and safety adjustments to Table 2 for both the PEG-calculated TFP and the PSE-calculated TFP for Hydro One. How does including PSE's reliability and safety adjustments affect Hydro One's productivity results?

**Response to HONI-20**: The following response was provided by PEG.

Please see Tables HONI-20a and 20b below for the requested calculations.

Table HONI-20a

## Input and Output Indexes

| | Input Quantity (PEG Upgrade) | | | Output | Output Quantity w/ Safety |
|---|---|---|---|---|---|
| **Year** | **Summary** | **OM&A** | **Capital** | **Quantity[fn]** | |
| 2002 | | | | | |
| **2003** | 1.5% | -1.2% | 3.2% | 1.6% | 1.6% |
| **2004** | -0.8% | -6.3% | 2.4% | 0.7% | 0.7% |
| **2005** | 3.4% | 5.8% | 2.0% | 1.2% | 1.2% |
| **2006** | 6.1% | 10.2% | 3.6% | 0.3% | 0.3% |
| **2007** | 9.9% | 16.2% | 5.6% | 1.0% | 1.2% |
| **2008** | 0.6% | -4.6% | 4.2% | 0.6% | 0.5% |
| **2009** | 5.0% | 5.6% | 4.6% | 0.0% | 0.0% |
| **2010** | 4.0% | 4.2% | 3.8% | 0.4% | 1.1% |
| **2011** | 1.4% | -1.2% | 3.2% | 0.5% | 1.2% |
| **2012** | 0.2% | -4.0% | 2.9% | 0.5% | 2.2% |
| **2013** | 6.3% | 8.4% | 4.8% | 0.2% | 0.3% |
| **2014** | 3.2% | 3.7% | 2.9% | 0.0% | 1.6% |
| **2015** | -2.9% | -14.6% | 4.0% | 0.7% | 1.3% |
| **2003-2015** | **2.9%** | **1.7%** | **3.6%** | **0.6%** | **1.0%** |
| **2003-2010** | **3.7%** | **3.7%** | **3.7%** | **0.7%** | **0.8%** |
| **2011-2015** | **1.6%** | **-1.6%** | **3.6%** | **0.4%** | **1.3%** |

fn The output measure for these calculations was the multidimensional elasticity-weighted output index developed by PEG for the OEB in 4th GIRM.

Table HONI-20b

# Alternative Productivity Results for Hydro One

## Productivity

| | PEG Upgrade | | | PSE Methodology | | |
|---|---|---|---|---|---|---|
| Year | TFP | OM&A | Capital | TFP | OM&A | Capital |
| 2002 | | | | | | |
| **2003** | 0.1% | 2.8% | -1.6% | 0.4% | 2.7% | -1.0% |
| **2004** | 1.5% | 7.0% | -1.6% | 1.9% | 7.2% | -0.9% |
| **2005** | -2.2% | -4.6% | -0.8% | -1.5% | -4.3% | 0.0% |
| **2006** | -5.8% | -9.9% | -3.2% | -4.8% | -10.4% | -1.8% |
| **2007** | -9.0% | -15.3% | -4.6% | -7.2% | -15.3% | -2.4% |
| **2008** | 0.0% | 5.2% | -3.6% | 0.7% | 4.6% | -1.6% |
| **2009** | -5.0% | -5.6% | -4.6% | -4.1% | -6.7% | -2.8% |
| **2010** | -3.5% | -3.7% | -3.4% | -2.3% | -3.8% | -1.6% |
| **2011** | -1.0% | 1.7% | -2.7% | -0.1% | 1.5% | -1.0% |
| **2012** | 0.3% | 4.5% | -2.4% | 1.1% | 4.5% | -0.7% |
| **2013** | -6.1% | -8.2% | -4.6% | -4.6% | -8.1% | -2.7% |
| **2014** | -3.2% | -3.7% | -2.9% | -2.1% | -3.5% | -1.4% |
| **2015** | 3.6% | 15.4% | -3.3% | 3.9% | 15.3% | -1.6% |
| **2003-2015** | **-2.31%** | **-1.11%** | **-3.03%** | **-1.45%** | **-1.25%** | **-1.49%** |
| **2003-2010** | **-2.97%** | **-3.00%** | **-2.93%** | **-2.12%** | **-3.25%** | **-1.51%** |
| **2011-2015** | **-1.26%** | **1.93%** | **-3.20%** | **-0.36%** | **1.95%** | **-1.47%** |

## Productivity with PSE Safety Adjustments

| | PEG Upgrade + Safety | | | PSE Methodology | | |
|---|---|---|---|---|---|---|
| Year | TFP | OM&A | Capital | TFP | OM&A | Capital |
| 2002 | | | | | | |
| **2003** | 0.1% | 2.8% | -1.6% | 0.4% | 2.7% | -1.0% |
| **2004** | 1.5% | 7.0% | -1.6% | 1.9% | 7.2% | -0.9% |
| **2005** | -2.2% | -4.6% | -0.8% | -1.5% | -4.3% | 0.0% |
| **2006** | -5.8% | -9.9% | -3.2% | -4.8% | -10.4% | -1.8% |
| **2007** | -8.7% | -15.1% | -4.4% | -7.0% | -15.1% | -2.2% |
| **2008** | -0.1% | 5.0% | -3.7% | 0.6% | 4.5% | -1.7% |
| **2009** | -5.0% | -5.6% | -4.6% | -4.2% | -6.7% | -2.8% |
| **2010** | -2.9% | -3.1% | -2.8% | -1.7% | -3.1% | -1.0% |
| **2011** | -0.3% | 2.4% | -2.0% | 0.6% | 2.2% | -0.2% |
| **2012** | 2.0% | 6.2% | -0.8% | 2.8% | 6.2% | 1.0% |
| **2013** | -6.0% | -8.1% | -4.5% | -4.5% | -8.0% | -2.6% |
| **2014** | -1.5% | -2.0% | -1.2% | -0.4% | -1.8% | 0.3% |
| **2015** | 4.2% | 16.0% | -2.7% | 4.5% | 15.9% | -1.0% |
| **2003-2015** | **-1.89%** | **-0.69%** | **-2.61%** | **-1.03%** | **-0.83%** | **-1.08%** |
| **2003-2010** | **-2.88%** | **-2.92%** | **-2.84%** | **-2.04%** | **-3.16%** | **-1.43%** |
| **2011-2015** | **-0.31%** | **2.88%** | **-2.25%** | **0.59%** | **2.90%** | **-0.52%** |

## Productivity with PSE Reliability Adjustments

| | PEG Upgrade + Reliability | | | PSE Methodology | | |
|---|---|---|---|---|---|---|
| Year | TFP | OM&A | Capital | TFP | OM&A | Capital |
| 2002 | | | | | | |
| **2003** | 0.1% | 2.8% | -1.6% | 0.4% | 2.7% | -1.0% |
| **2004** | 1.5% | 7.0% | -1.6% | 1.9% | 7.2% | -0.9% |
| **2005** | -0.8% | -3.2% | 0.6% | -0.1% | -2.9% | 1.4% |
| **2006** | -4.1% | -8.3% | -1.6% | -3.2% | -8.7% | -0.2% |
| **2007** | -10.3% | -16.6% | -5.9% | -8.5% | -16.7% | -3.8% |
| **2008** | 0.3% | 5.4% | -3.3% | 1.0% | 4.9% | -1.3% |
| **2009** | -5.2% | -5.8% | -4.8% | -4.4% | -6.9% | -3.0% |
| **2010** | -3.5% | -3.7% | -3.3% | -2.3% | -3.7% | -1.5% |
| **2011** | -0.4% | 2.3% | -2.2% | 0.5% | 2.1% | -0.4% |
| **2012** | 0.2% | 4.4% | -2.5% | 1.0% | 4.4% | -0.8% |
| **2013** | -5.9% | -8.0% | -4.4% | -4.4% | -7.9% | -2.5% |
| **2014** | -3.7% | -4.2% | -3.4% | -2.6% | -4.0% | -1.9% |
| **2015** | 2.8% | 14.5% | -4.1% | 3.1% | 14.5% | -2.4% |
| **2003-2015** | **-2.22%** | **-1.02%** | **-2.94%** | **-1.36%** | **-1.16%** | **-1.41%** |
| **2003-2010** | **-2.74%** | **-2.78%** | **-2.70%** | **-1.90%** | **-3.02%** | **-1.29%** |
| **2011-2015** | **-1.39%** | **1.80%** | **-3.33%** | **-0.49%** | **1.83%** | **-1.59%** |

## Productivity with PSE Safety and Reliability Adjustments

| | PEG Upgrade + Safety and | | | PSE Methodology | | |
|---|---|---|---|---|---|---|
| Year | TFP | OM&A | Capital | TFP | OM&A | Capital |
| 2002 | | | | | | |
| **2003** | 0.1% | 2.8% | -1.6% | 0.4% | 2.7% | -1.0% |
| **2004** | 1.5% | 7.0% | -1.6% | 1.9% | 7.2% | -0.9% |
| **2005** | -0.8% | -3.2% | 0.6% | -0.1% | -2.9% | 1.4% |
| **2006** | -4.1% | -8.3% | -1.6% | -3.2% | -8.7% | -0.2% |
| **2007** | -10.1% | -16.4% | -5.7% | -8.3% | -16.5% | -3.6% |
| **2008** | 0.2% | 5.3% | -3.4% | 0.9% | 4.8% | -1.4% |
| **2009** | -5.2% | -5.8% | -4.8% | -4.4% | -6.9% | -3.0% |
| **2010** | -2.9% | -3.1% | -2.7% | -1.7% | -3.1% | -0.9% |
| **2011** | 0.3% | 3.0% | -1.4% | 1.2% | 2.8% | 0.4% |
| **2012** | 1.9% | 6.1% | -0.8% | 2.7% | 6.1% | 0.9% |
| **2013** | -5.8% | -8.0% | -4.4% | -4.3% | -7.8% | -2.5% |
| **2014** | -2.0% | -2.5% | -1.7% | -0.9% | -2.3% | -0.2% |
| **2015** | 3.4% | 15.1% | -3.5% | 3.7% | 15.1% | -1.8% |
| **2003-2015** | **-1.81%** | **-0.60%** | **-2.52%** | **-0.94%** | **-0.74%** | **-0.99%** |
| **2003-2010** | **-2.66%** | **-2.70%** | **-2.62%** | **-1.82%** | **-2.94%** | **-1.20%** |
| **2011-2015** | **-0.44%** | **2.75%** | **-2.38%** | **0.46%** | **2.77%** | **-0.64%** |

# HYDRO ONE NETWORKS IR #61

**61. Reference: Exhibit M1, page 18**

PEG describes the approach it used to adjust for the transition to MIFRS.

a) On p. 15 and 16 of the report, PEG mentions that a 10.1% markdown is the result of a 12.5% reported cost increase, and the fact that 81% of OM&A costs were affected by the issue.
   i. Is PEG saying the transition to IFRS standards caused a 10.1% increase in OM&A costs? If not, please clarify the claim being made.
   ii. Is PEG asserting that the 12.5% increase in OM&A would have been 2.4% without the transition to IFRS?
   iii. Was a similar calculation conducted for capex costs? If yes, please provide.
   iv. In PEG's opinion, would the transition to IFRS standards likely decrease capex costs (as opposed to increasing OM&A costs)?

b) Please describe the OM&A IFRS adjustment in full, including all data and calculations used. Please provide a list of the 14 distributors mentioned along with the derivation of the 12.5% increase to OM&A under MIFRS.

c) Please identify the utilities that had not adopted MIFRS or indicated that they had previously changed their capitalization policy and show how PEG determined that 81% of OM&A costs were impacted by change.

d) The increase in OM&A expenses due a change in capitalization policy would have had a corresponding reduction in Capital costs that are no longer capitalized. What offsetting adjustments did PEG make in its analysis for the capital costs of utilities that transitioned to MIFRS? If no adjustments were made for capital costs, please explain why.

e) Given that a change in capitalization policy involves an offset in costs between capital and OM&A, please explain why it is reasonable that the overall TFP trend for the industry would be materially impacted by such a change?

**Response to HONI-61**: The following response was provided by PEG.

a. Our research suggests that on average, there is a 12.5% increase in OM&A cost for companies adopting IFRS for the first time. This is due to expensing as opposed to capitalizing overheads

and is persistent. The lower 10.1% value reflected some doubt on the part of PEG that all distributors had made the transition by 2015 and therefore an adjustment factor of 12.5% would overstate the cost impact of IFRS. The 10.1% adjustment factor is 81% of 12.5% and implicitly assumes that 19% had no IFRS impact. Because this a one-time adjustment, the impact on the trend is diluted over the number of years in the period considered. We do not confirm the premise of part ii of the question. A similar adjustment was not done for capex because in theory the impact on capital cost will be much lower in the short run. The impact of capitalization policy on O&M expenses was described by several distributors in COS filings which provided the source data for the estimate. These can be found on the OEB website.

b. Please see the working papers provided in response to HONI-9 for the data and calculations. The adjustment modifies the OM&A cost in 2015 for the impact of changed capitalization policy that most distributors implemented between 2011 and 2015. The adjustment is to lower the aggregate industry 2015 OM&A cost by the adjustment factor described above. Because the formerly capitalized overheads are correlated with regular capital spending, the OM&A impact will not be a self-correcting "blip" in the series but rather an increase in one year to a higher level that will persist. Modifying the endpoint provides a straightforward method to estimate the impact on the OM&A cost trend that feeds into the remaining calculations. Had perfect information been readily available for all distributors on this topic, an improved estimate of the impact would individually adjust each distributor's data in the year in which the change occurred and adjust subsequent OM&A cost levels. PEG believes that the method used provides a reasonable estimate of the direction and magnitude of the short-run impact of the change in capitalization policy on productivity.

c. Please see the working papers provided in response to HONI-9.

d. Dr. Lowry believes that the upcoming 5th Generation IRM proceeding is the appropriate venue to finalize calculation of the productivity trends of Ontario power distributors. PEG's goal in this proceeding has been to make sufficient progress down this road to show convincingly that PSE's -0.9% estimate of the TFP trend is likely far off the mark and that the OEB's 0.0% base TFP trend from the 4th Generation IRM proceeding is still serviceable for determining a base TFP growth target for Hydro One's X factor. The main impact of the transition to IFRS accounting in the short run should be on OM&A productivity. Accordingly, it was appropriate for PEG to focus on the OM&A impact.

e. Please see our responses to HONI-25 and to part d) of this question.

# HYDRO ONE NETWORKS IR #24

**24. Reference: Exhibit M1, page 18**

Please update Table 1 that provides the Ontario TFP trend estimates for the more recent 2011 to 2015 period.

**Response to HONI-24**: The following response was provided by PEG.

The requested results are provided in Table HONI-24 below.

Table HONI-24

## Analysis of PSE's Ontario Productivity Study

| | | | | | | |
|---|---|---|---|---|---|---|
| **PSE Productivity Trend (2011-2015)** | | **-3.58%** | | **-2.59%** | | **-2.96%** |
| | **OM&A** | | **Capital** | | **TFP** | |
| | Incremental Impact | Revised Trend | Incremental Impact | Revised Trend | Incremental Impact | Revised Trend |
| **Adjustments and Corrections** | | | | | | |
| Data Comparability Issues | | | | | | |
| CIAC | na | -3.58% | 0.43% | -2.16% | 0.25% | -2.71% |
| Smart Meter OM&A | 0.55% | -3.03% | na | -2.16% | 0.23% | -2.48% |
| Smart Meter Capital | na | -3.03% | 0.22% | -1.94% | 0.13% | -2.36% |
| Transition to IFRS Accounting Changes | 2.13% | -0.90% | na | -1.94% | 0.90% | -1.46% |
| Sample and Merger Issues | 0.02% | -0.89% | 0.02% | -1.93% | 0.02% | -1.44% |
| Exclude Norfolk | 0.00% | -0.90% | 0.00% | -1.94% | 0.00% | -1.46% |
| Include Lakeland/Parry | 0.02% | -0.89% | 0.02% | -1.93% | 0.02% | -1.44% |
| **Total Impact of Adjustments and Corrections [A]** | **2.70%** | **-0.89%** | **0.66%** | **-1.93%** | **1.52%** | **-1.44%** |
| **Methodological Upgrades** | | | | | | |
| Labor Price Index [B] | -0.03% | -0.92% | na | -1.93% | -0.02% | -1.45% |
| Asset Price Index: Replace EUCPI | na | -0.92% | 0.36% | -1.56% | 0.17% | -1.29% |
| Use Utility Sector Capital Stock Deflator [D] | na | -0.92% | 0.36% | -1.56% | 0.17% | -1.29% |
| Use Northeast HW index adjusted for PPP | na | -0.92% | 1.85% | -0.07% | 1.12% | -0.34% |
| Output Quantity Adjustment | 0.37% | -0.55% | 0.37% | -1.19% | 0.37% | -0.92% |
| Conservation adjustments to volumes and peaks | 1.29% | 0.37% | 1.29% | -0.28% | 1.29% | 0.00% |
| Customer only index [C] | 0.37% | -0.55% | 0.37% | -1.19% | 0.37% | -0.92% |
| **Total Impact of Proposed Upgrades [E]=[B+C+D]** | **0.34%** | | **0.73%** | | **0.52%** | |
| **Total Impact of All Adjustments and Upgrades [A+E]** | **3.03%** | **-0.55%** | **1.40%** | **-1.19%** | **2.05%** | **-0.92%** |

financial costs embedded in the index. Given that the -- and there on that same page, we reference that they used financing costs from the Bank of Canada in construction of the indexes.

We did look into this issue and frankly, it was unclear whether financing costs were included or not included. If you had a reference that clearly denotes that financing costs were not included, we would certainly take that under consideration. However, looking into the issue, it was unclear. And also given that the EUCPI index grows much less rapidly than the Handy Whitman indexes in the U.S. for construction costs gave us pause. That along with the fact that it was discontinued for -- on page 25 of our report, it says the program will be reviewed to ensure the models used in the future take into account current practices and construction. You know, for these reasons we were reluctant to use that index because it's just unclear what that index is actually measuring, and it's discontinued for further review, which is another reason for pause.

MR. HOVDE: In terms of which index you would use to update the discontinued EUCPI, I believe you used the Handy Whitman index for the U.S. I'm wondering, did you consider any other alternatives, in particular Canadian alternatives?

MR. FENRICK: We did not. We used the Handy Whitman index. It's a standard index. It's been around for decades. So that was the one we used. We did not consider