

Responses to Energy Probe Interrogatories

M1-EP-1

Reference: Exhibit M1 Page 6

Preamble: Hydro One Networks is expected to file a Custom IR proposal for its principal transmission operations in the near future. This proposal is likely to be supported by the same or similar (e.g., updated) transmission productivity and benchmarking research. In addition, the revenue cap index chosen in the proceeding may be used to escalate the Company's 2019 revenue requirement.

Question:

- a) Confirm this would be Hydro One Transmission's first IRM.
- b) Please explain if PEG agrees that Hydro One SSM a revenue cap is appropriate from the other options available in the RRFE.

Response to Energy Probe-1: The following response was provided by PEG.

- a) PEG confirms its understanding that this would be Hydro One Transmission's first multiyear IRM (or Custom IRM).
- b) PEG believes that price caps and revenue caps both warrant consideration for a power transmission IRM. However, it is not contesting HOSSM's proposal to use a revenue cap.

M1-EP-2

References: Exhibit M1 Page 10; Regie Decision- R-3897-2014A-0167 Dec-Dec-2018; D-2017-0143 Section 3.4.1

Preamble: “Our X factor recommendation (for HOSSM) is to combine a -0.34% base productivity trend drawn from our U.S. MFP research for the full sample period with a 0.30% stretch factor. With rounding this produces an X factor of 0.00%.

Question:

- a) Confirm PEG’ findings on Base productivity, Stretch Factor and X-factor for Quebec Hydro Transportation (HQT).
- b) Please summarize the data set used for HQT and the main differences to the Dataset for Hydro One SSM
- c) Please list and discuss the major considerations resulting in different Stretch and X Factor recommendation for HQT and Hydro One SSM
- d) Confirm that in its Decision regarding HQT, the Regie determined that a Stretch Factor was appropriate resulting in an X Factor of 0.3%.
- e) Please provide an opinion if the judgemental factors leading to the Regie Decision regarding Stretch Factor are/are not applicable to HO SSM, including, First Generation IRM, Revenue Cap RCI, treatment of Capital etc.

Response to Energy Probe-2: The following response was provided by PEG.

- a) In the Quebec proceeding to develop an IRM for Hydro-Québec Transmission, PEG has undertaken research and testimony for the Association Québécoise de Consommateurs Industriels d’Electricité. PEG recommend a 0.20% base productivity trend and a 0.20% stretch factor, which combine to create a 0.40% X factor. However, this is in the context of an index that escalates allowed *OM&A* revenue, not *total* base rate revenue. The Régie had previously decided to continue cost of service regulation for capital revenue.
- b) PEG was able in that proceeding only to undertake a preliminary study of transmission *OM&A* productivity using US transmission data. The dataset was an early version of that later used for the Hydro One SSM work.
- c) In the Hydro One SSM proceeding the *multifactor* productivity (encompassing both capital and *OM&A* inputs) trend of transmission utilities rather than the *OM&A* productivity trend is the key issue. Also, no statistical benchmarking study was available on the cost performance of Hydro-Québec Transmission whereas in this proceeding there is such a study for Hydro One.

- d) Not confirmed. In the proceeding to develop an IRM for Hydro Québec Distribution a 0.30% X factor was chosen by the Regie. No stretch factor was itemized in this decision.
- e) PEG does not agree with the Regie's decision not to specify a stretch factor, especially inasmuch as this was a first generation IRM and there was no convincing evidence of Hydro-Quebec's superior cost performance.

M1-EP-3

Reference: EB-2018-0218, Exhibit A Tab 4 Schedule 1 and Table 1.

Preamble: The proposed weighting of 14% labour and 86% non-labour is supported by the recommendation provided by PSE in the study provided in EB-2018-0218.

Hydro One (also) believes that it is appropriate to apply the same input price indices that are used to set the¹⁶ Inflation Factor for electricity distributors in Ontario to its transmission business.

Question:

- a) Please provide a summary of work done on the Inflation Index (I) for IRM by PEG in Quebec and Ontario. Specifically include the recommended weightings.
- b) Comment on the weightings proposed for HO SSM.

Response to Energy Probe-3: The following response was provided by PEG.

PEG is comfortable with Canadian-style inflation measures which take a weighted average of macroeconomic and labor price inflation. The weight should reflect the share of labor OM&A expenses in total cost or OM&A expenses, whichever is applicable. PEG believes that the weightings on labor proposed by HQT and Hydro One HOSSM are in the ballpark of reasonable.

M1-EP-4

Reference: Exhibit M1, p.18

Preamble: “We calculated indexes of the transmission OM&A, capital, and multifactor productivity of Hydro One Networks and each U.S. utility in our sample.” (p.18)

- a) Having regard to the data requested by Energy Probe that PEG provided on Monday February 25, please confirm that PEG’s sample of U.S. utilities consists of 48 such utilities.
- b) Please confirm/disconfirm that PEG sought to calculate annual total-factor productivity (“TFP”) growth rates for each utility in its U.S. sample for the years 1996-2016 inclusive.
- c) Please confirm/disconfirm that PEG was not able to calculate 21 years of annual TFP growth rates for five utilities in its U.S. sample, with the result that full TFP results are available for only 43 of those utilities.
- d) Please confirm/disconfirm that the following table correctly shows PEG’s annual TFP growth rates for those 43 utilities for which full data are available.
- e) Please confirm that the table contains 903 observations of the annual TFP growth rate.
- f) Please confirm/disconfirm that PEG’s TFP growth rates as shown in the table are logarithmic growth rates.
- g) As shown in the right-hand column of the table, Energy Probe has calculated the average annual TFP growth rate for each of the 43 utilities for which full data are available for the period 1996-2016. Please confirm/disconfirm that these row averages are correctly calculated and that the average of the row averages is -0.216% as shown.
- h) As shown in the final row of the table, Energy Probe has calculated the average of the annual TFP growth rates for each year of the period 1996-2016. Please confirm/disconfirm that these column averages are correctly calculated and that the average of the column averages is -0.216%.

Logarithmic growth rates																					
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	AVERAGE
2.48%	4.47%	-2.67%	4.75%	2.19%	4.16%	-4.29%	-4.16%	-2.11%	-1.34%	-0.22%	3.17%	-5.00%	2.57%	-6.30%	7.69%	1.41%	0.83%	-1.87%	-1.50%	-3.84%	0.02%
4.77%	-1.26%	7.38%	6.96%	-3.51%	3.86%	4.59%	2.28%	0.08%	-6.21%	5.71%	-0.57%	-0.04%	-1.06%	1.67%	1.10%	-0.59%	3.79%	-3.92%	-4.02%	0.64%	1.03%
4.31%	-3.13%	6.35%	0.48%	5.39%	3.44%	-3.49%	2.31%	-7.50%	2.14%	7.54%	1.80%	-5.11%	-2.02%	-2.29%	-10.00%	-2.92%	0.82%	-0.22%	2.38%	-3.99%	-0.18%
6.19%	1.04%	-1.08%	2.37%	0.51%	1.98%	2.83%	0.11%	-1.41%	-1.34%	-5.66%	-3.86%	-4.89%	-0.15%	0.39%	-3.43%	-1.82%	2.82%	0.06%	-1.18%	-3.58%	-0.48%
1.67%	4.96%	1.04%	4.65%	2.87%	0.83%	-0.95%	1.72%	-31.56%	-18.95%	16.81%	1.75%	-4.95%	7.29%	0.71%	-8.91%	1.49%	2.30%	3.70%	-0.50%	6.86%	-0.34%
0.67%	-0.12%	3.96%	-0.15%	2.82%	1.54%	4.23%	1.12%	0.08%	3.17%	1.55%	-6.41%	-2.02%	-5.94%	-0.23%	-1.33%	-9.58%	-8.81%	4.48%	12.78%	-4.19%	-0.11%
2.62%	-1.78%	5.91%	2.22%	0.70%	4.34%	3.77%	2.31%	-5.19%	5.45%	-4.64%	2.62%	3.10%	-3.35%	5.33%	7.61%	-13.54%	-7.20%	-2.85%	11.57%	-2.24%	0.80%
-2.53%	3.47%	8.05%	4.31%	0.04%	3.16%	-0.61%	5.87%	-1.91%	-4.61%	6.95%	-2.73%	11.04%	-15.50%	7.50%	2.76%	0.87%	1.74%	-2.50%	-2.51%	-2.07%	0.99%
0.63%	6.84%	1.37%	7.18%	-0.39%	2.62%	2.13%	-3.90%	-4.70%	-3.66%	13.95%	7.41%	1.03%	3.26%	3.07%	-0.85%	-4.30%	-3.25%	0.20%	3.94%	-1.54%	1.48%
0.42%	-2.75%	4.95%	-3.63%	-1.73%	-8.27%	7.33%	2.42%	2.92%	0.01%	9.58%	-8.94%	4.94%	-4.27%	3.54%	2.29%	-3.22%	3.53%	0.94%	-5.39%	-3.71%	0.05%
-2.48%	6.78%	4.89%	9.08%	2.27%	6.49%	-7.43%	-0.62%	-7.59%	-1.18%	-8.81%	-19.13%	-8.47%	-31.79%	-1.03%	1.37%	1.50%	1.78%	-5.08%	1.72%	-7.91%	-3.13%
0.59%	0.90%	-0.75%	3.55%	-1.13%	4.73%	-2.78%	3.01%	5.59%	0.97%	-4.14%	-3.70%	-3.44%	-1.52%	-4.85%	3.35%	-2.11%	8.66%	2.11%	-2.81%	-0.33%	0.28%
-1.16%	7.38%	-0.04%	2.38%	1.78%	-2.63%	13.57%	0.22%	-2.37%	4.76%	5.10%	-4.37%	-10.05%	8.75%	-3.95%	0.16%	-2.08%	0.19%	0.34%	0.21%	-0.07%	0.86%
0.76%	3.04%	7.30%	3.23%	-0.38%	1.20%	3.03%	2.30%	-7.38%	0.74%	-5.45%	5.14%	1.95%	-0.11%	6.36%	6.21%	-2.75%	0.66%	-3.65%	1.66%	0.48%	1.16%
0.87%	4.75%	-5.98%	7.57%	5.40%	-8.54%	2.58%	1.78%	-2.36%	1.20%	8.91%	-5.70%	-8.70%	2.17%	-1.55%	-1.69%	-0.10%	-5.28%	-2.61%	-3.95%	-4.09%	-0.73%
7.41%	-2.16%	0.02%	3.77%	1.43%	3.39%	0.12%	4.64%	-0.88%	2.40%	-1.20%	0.66%	0.87%	0.39%	0.89%	0.10%	-2.07%	1.99%	1.98%	-3.59%	-1.56%	0.89%
6.18%	2.15%	-8.02%	9.49%	3.63%	-4.72%	2.74%	-10.67%	-0.02%	-0.56%	4.75%	-1.15%	11.38%	2.22%	-4.67%	-7.15%	0.66%	-6.54%	-6.26%	-0.47%	-21.38%	-1.35%
2.55%	-0.27%	5.67%	2.82%	-2.87%	-0.81%	-0.14%	-1.70%	-5.53%	1.10%	-1.87%	3.15%	-5.31%	-0.84%	0.52%	-5.97%	-2.93%	4.23%	-0.81%	0.08%	4.59%	-0.21%
1.56%	-0.42%	3.88%	5.71%	7.70%	2.35%	4.56%	3.24%	-0.31%	10.77%	-0.55%	0.37%	-4.38%	7.71%	1.54%	1.45%	4.28%	-2.53%	-0.39%	4.51%	-6.94%	2.10%
0.51%	2.94%	3.44%	2.28%	1.27%	2.10%	1.23%	3.08%	-13.56%	-0.34%	0.72%	20.19%	0.63%	0.24%	-3.20%	0.44%	0.53%	4.11%	2.98%	1.05%	0.57%	1.49%
9.41%	7.78%	0.07%	0.92%	2.71%	-2.44%	6.60%	2.00%	-0.57%	-0.49%	-3.21%	-4.73%	4.70%	-10.13%	6.67%	-5.04%	-0.26%	-13.53%	-8.21%	0.82%	-9.54%	-0.78%
2.44%	2.89%	2.58%	5.17%	4.24%	-4.41%	4.24%	4.98%	1.72%	1.44%	0.40%	4.47%	-1.59%	1.91%	-2.16%	-9.30%	-0.70%	-2.11%	2.02%	-0.43%	0.41%	0.87%
1.50%	5.39%	1.76%	5.45%	2.99%	-0.20%	1.88%	-2.07%	1.36%	1.77%	1.48%	1.92%	-5.59%	0.96%	3.16%	-9.48%	0.90%	-2.54%	-1.19%	-2.98%	-5.61%	0.04%
0.45%	2.88%	3.45%	-1.96%	4.68%	-1.50%	-3.51%	-3.14%	4.30%	-0.97%	3.54%	3.76%	-7.39%	18.92%	-33.22%	-1.81%	1.02%	-3.16%	-6.82%	-3.84%	-5.05%	-1.40%
-6.66%	7.07%	1.55%	2.29%	7.29%	8.20%	-6.74%	0.54%	-0.53%	-0.02%	19.27%	0.71%	-13.53%	1.16%	3.73%	1.26%	0.30%	-10.63%	-6.18%	1.51%	-6.56%	0.19%
1.05%	-0.31%	6.67%	-2.68%	-3.39%	2.55%	14.29%	0.79%	-1.97%	6.01%	1.35%	3.45%	6.10%	-4.86%	6.16%	3.27%	-11.74%	16.90%	-25.01%	15.12%	3.94%	1.79%
-4.61%	16.50%	0.15%	-12.24%	-12.42%	-0.59%	-7.61%	-1.05%	-7.89%	3.10%	5.39%	2.71%	-5.49%	-2.38%	-4.37%	1.98%	6.24%	-0.42%	-7.03%	2.49%	8.04%	-0.93%
4.84%	0.43%	-1.59%	3.24%	-1.20%	19.55%	2.48%	1.23%	-0.69%	-1.02%	-3.53%	-3.55%	-5.99%	-6.80%	-3.76%	-0.83%	-4.05%	-3.23%	2.16%	-11.04%	-10.37%	-1.13%
9.14%	2.97%	3.68%	6.01%	-0.04%	2.17%	3.82%	-9.36%	-8.64%	-0.65%	21.68%	8.44%	-5.77%	5.12%	2.95%	-9.65%	-2.35%	-15.35%	-5.75%	-19.28%	1.28%	-0.46%
3.04%	-1.38%	4.90%	7.20%	-0.98%	-0.15%	2.89%	6.13%	1.75%	0.29%	-0.70%	6.37%	-2.66%	-0.02%	-0.33%	-14.89%	0.60%	5.35%	-1.63%	2.07%	-3.98%	0.66%
1.32%	1.26%	3.99%	5.40%	2.46%	4.15%	4.37%	3.59%	2.77%	6.83%	6.10%	-1.33%	-2.00%	-3.16%	0.77%	-3.69%	-1.42%	-3.97%	-2.42%	-4.21%	-3.86%	0.81%
2.21%	-1.25%	5.90%	3.06%	5.11%	-0.09%	49.64%	0.52%	-7.59%	-1.66%	-0.70%	2.05%	5.99%	-7.82%	-7.89%	-2.37%	-14.30%	-3.54%	-5.23%	-18.43%	-24.16%	-0.98%
2.63%	6.51%	2.99%	-0.09%	7.50%	4.25%	-4.59%	2.74%	-1.04%	0.09%	-3.61%	7.02%	-4.66%	-3.15%	-6.52%	-2.78%	3.07%	-19.94%	-4.19%	0.13%	0.10%	-0.64%
3.68%	2.86%	7.31%	8.15%	-3.09%	8.40%	5.54%	3.26%	-36.36%	8.61%	-0.14%	-7.45%	-3.97%	-15.84%	-6.12%	0.07%	-4.79%	1.89%	-7.22%	-1.56%	-13.69%	-2.40%
1.75%	6.09%	1.76%	-0.42%	-8.34%	8.24%	1.32%	2.11%	-17.73%	5.44%	9.68%	-10.86%	1.84%	-7.31%	0.64%	7.66%	-0.30%	-6.10%	-15.30%	0.02%	5.71%	-0.67%
1.21%	7.74%	2.51%	1.73%	-2.10%	-0.16%	-3.38%	-5.79%	0.02%	-6.56%	-9.03%	-5.53%	-0.84%	-5.41%	-5.80%	-3.18%	-0.09%	-60.34%	4.24%	-6.07%	-3.97%	-4.80%
-3.43%	-4.78%	3.09%	4.67%	1.66%	2.57%	3.85%	1.35%	-0.39%	-6.90%	-4.82%	6.64%	-4.66%	-2.52%	-3.32%	1.17%	-3.82%	-1.40%	1.11%	-5.63%	-3.16%	-0.89%
2.65%	4.47%	3.70%	4.38%	0.13%	3.88%	-4.59%	0.18%	2.34%	-1.60%	-4.05%	1.96%	-1.02%	-5.80%	-6.91%	1.37%	-0.73%	-10.43%	-15.26%	-5.45%	-7.22%	-1.81%
1.81%	3.61%	4.40%	0.24%	-0.89%	2.01%	12.27%	1.59%	4.80%	-14.16%	1.63%	-14.04%	-14.77%	1.92%	-5.14%	-15.08%	2.37%	-9.62%	0.92%	-1.90%	-0.50%	-1.83%
-1.80%	-1.10%	5.50%	1.26%	-3.53%	-3.10%	0.97%	4.56%	2.76%	0.06%	-0.69%	0.29%	5.93%	-3.51%	-8.71%	0.61%	-7.03%	-9.26%	-5.09%	-21.76%	-10.76%	-2.59%
11.35%	-1.85%	-1.65%	5.35%	1.88%	7.50%	5.29%	5.41%	-9.25%	1.02%	-11.55%	5.45%	1.27%	-0.93%	-4.70%	-1.49%	-3.35%	-0.83%	0.49%	-0.32%	-3.28%	0.28%
3.91%	3.38%	4.49%	2.96%	5.74%	0.80%	3.63%	5.75%	0.03%	9.52%	-1.83%	-5.63%	9.64%	-9.01%	4.26%	-1.12%	-4.93%	-0.67%	-0.35%	-5.25%	-8.13%	0.82%
-21.78%	31.86%	-0.47%	-2.05%	-1.34%	11.83%	-0.65%	5.76%	0.61%	6.71%	3.53%	-0.59%	8.62%	-3.65%	6.70%	5.05%	-2.35%	-1.63%	-1.47%	1.06%	-4.51%	1.96%
1.49%	3.25%	2.61%	2.95%	0.86%	2.20%	2.91%	1.08%	-3.62%	0.27%	1.84%	-0.20%	-1.47%	-2.19%	-1.41%	-1.47%	-1.98%	-3.51%	-2.81%	-1.65%	-3.70%	-0.2161%

Response to Energy Probe-4: The following response was provided by PEG.

Response:

- a. Confirmed
- b. Confirmed
- c. Several observations were unintentionally dropped from the calculation of final results due to several missing values that were not corrected in the productivity database. PEG confirms that they did not calculate these values due to an error on their part. PEG does not confirm that they were unable to do so. Please see their response to part i of the Hydro One SSM IR 6 for revised productivity results that include the cited missing observations. PEG has additionally updated the analysis presented in the remaining questions with their updated results so that Energy Probe will not have to repeat this work.
- d. PEG confirms that the numbers presented are consistent with what they provided. Corrected results are provided below.
- e. Confirmed.
- f. Confirmed. Corrected growth rates are provided below.
- g. Confirmed. Corrected results are provided below.
- h. Confirmed. Corrected results are provided below.

Logarithmic Growth Rates																					
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
2.48%	4.48%	-2.68%	4.71%	2.17%	4.17%	-4.28%	-4.15%	-2.11%	-1.35%	-0.33%	3.06%	-4.89%	2.46%	-6.32%	7.61%	1.40%	0.83%	-1.92%	-1.49%	-3.82%	0.00%
4.77%	-1.26%	7.35%	6.95%	-3.51%	3.87%	4.59%	2.28%	0.08%	-6.31%	5.72%	-0.58%	-0.03%	-1.06%	1.67%	1.11%	-0.59%	3.79%	-4.41%	-3.77%	0.34%	1.00%
4.60%	-2.60%	6.47%	0.70%	5.52%	3.58%	-2.92%	2.64%	-6.85%	2.42%	7.54%	1.89%	-4.77%	-1.79%	-2.04%	-9.53%	-2.72%	0.90%	-0.11%	2.46%	-3.77%	0.08%
6.09%	1.04%	-1.08%	2.37%	0.52%	2.00%	2.83%	0.11%	-1.41%	-1.34%	-5.66%	-3.86%	-4.88%	-0.15%	0.38%	-3.42%	-1.82%	2.82%	0.05%	-1.18%	-3.58%	-0.48%
1.69%	4.82%	1.04%	4.63%	2.85%	0.80%	-0.97%	1.72%	-31.75%	-19.26%	16.79%	1.73%	-4.95%	7.35%	0.79%	-8.94%	1.49%	2.29%	3.70%	-0.50%	6.94%	-0.37%
0.67%	-0.15%	3.95%	-0.18%	2.81%	1.52%	4.20%	1.12%	0.07%	3.14%	1.47%	-6.40%	-2.11%	-5.85%	-0.24%	-1.33%	-9.58%	-8.81%	4.20%	12.74%	-4.25%	-0.14%
2.62%	-1.79%	5.91%	2.16%	0.70%	4.31%	3.72%	2.31%	-5.18%	5.41%	-5.75%	2.23%	3.19%	-3.63%	5.17%	7.82%	-13.56%	-7.48%	-2.80%	11.82%	-2.34%	0.71%
-2.53%	3.47%	8.03%	4.26%	0.03%	3.16%	-0.63%	5.87%	-1.91%	-4.60%	6.96%	-2.73%	10.69%	-15.84%	7.46%	2.72%	0.70%	1.97%	-2.68%	-2.93%	-1.60%	0.95%
0.63%	6.81%	1.32%	7.15%	-0.42%	2.63%	2.13%	-3.91%	-4.70%	-3.66%	12.29%	7.92%	0.97%	3.23%	3.21%	-0.81%	-4.23%	-3.32%	0.19%	4.03%	-1.49%	1.43%
0.42%	-2.75%	4.95%	-3.81%	-1.73%	-8.26%	7.33%	2.47%	2.93%	0.02%	9.34%	-9.22%	4.95%	-4.21%	3.58%	2.25%	-3.22%	3.52%	0.94%	-5.39%	-3.76%	0.02%
-2.48%	6.76%	4.89%	9.03%	2.27%	6.46%	-7.43%	-0.62%	-7.60%	-1.21%	-9.14%	-20.04%	-8.52%	-31.59%	-1.26%	1.65%	1.52%	1.78%	-4.82%	1.92%	-7.91%	-3.16%
0.59%	0.89%	-0.74%	3.49%	-1.13%	4.71%	-2.78%	3.01%	5.59%	0.92%	-5.00%	-4.32%	-3.39%	-1.72%	-5.10%	4.75%	-2.11%	8.66%	1.42%	-2.13%	-0.31%	0.25%
-1.16%	7.38%	-0.03%	2.35%	1.77%	-2.63%	13.58%	0.22%	-2.36%	4.74%	5.10%	-4.38%	-10.05%	8.75%	-4.68%	0.27%	-2.23%	0.42%	0.41%	0.15%	0.06%	0.84%
3.53%	3.31%	-1.27%	0.50%	8.89%	-10.03%	11.35%	6.37%	-5.38%	-0.77%	-1.28%	7.25%	-14.16%	2.81%	5.17%	-11.41%	-2.68%	-4.53%	-2.98%	1.89%	6.19%	0.16%
0.75%	3.01%	7.38%	3.23%	-0.38%	1.20%	3.03%	2.30%	-7.46%	0.73%	-5.45%	5.12%	1.94%	-0.12%	6.34%	6.17%	-2.74%	0.65%	-3.66%	1.67%	0.05%	1.15%
0.85%	4.73%	-6.00%	7.53%	5.39%	-8.55%	2.59%	1.76%	-2.36%	1.17%	8.87%	-5.70%	-8.69%	2.17%	-1.56%	-1.69%	-8.07%	-5.28%	-1.67%	-3.97%	-4.48%	-0.74%
7.36%	-2.16%	0.02%	3.78%	1.43%	3.38%	0.11%	4.62%	-0.88%	2.35%	-1.67%	0.58%	1.13%	0.19%	0.82%	0.03%	-2.15%	1.97%	2.15%	-3.54%	-1.59%	0.85%
6.15%	2.15%	-8.02%	9.48%	3.59%	-4.71%	2.70%	-10.68%	-0.02%	-0.57%	4.43%	-1.12%	11.47%	2.07%	-4.74%	-7.13%	0.17%	-6.56%	-6.32%	-0.42%	-21.35%	-1.38%
2.48%	-0.27%	5.65%	2.80%	-2.89%	-0.82%	-0.14%	-1.70%	-5.52%	1.10%	-2.11%	2.82%	-5.30%	-0.71%	0.52%	-5.96%	-3.11%	4.22%	-0.96%	0.14%	4.58%	-0.25%
1.56%	-0.42%	3.87%	5.70%	7.70%	2.34%	4.54%	3.24%	-0.31%	10.75%	-0.58%	0.25%	-4.42%	7.76%	1.58%	1.47%	4.28%	-2.53%	-0.39%	4.51%	-6.92%	2.09%
0.49%	2.93%	3.41%	2.27%	1.24%	2.10%	1.23%	3.05%	-13.56%	-0.33%	0.70%	20.20%	0.63%	0.25%	-3.20%	0.45%	0.52%	4.11%	2.98%	1.05%	0.57%	1.48%
9.35%	7.65%	0.07%	0.92%	2.71%	-2.44%	6.60%	2.01%	-0.57%	-0.49%	-3.21%	-5.07%	5.00%	-10.14%	6.68%	-5.04%	-0.28%	-13.56%	-8.22%	0.82%	-9.55%	-0.80%
2.43%	2.87%	2.57%	5.13%	4.24%	-4.41%	4.22%	4.98%	1.72%	1.38%	0.38%	4.45%	-1.61%	1.89%	-2.15%	-9.30%	-0.70%	-2.11%	1.96%	-0.43%	0.41%	0.85%
1.50%	5.38%	1.75%	5.40%	2.99%	-0.20%	1.90%	-2.08%	1.36%	1.74%	1.47%	1.90%	-5.59%	0.96%	3.16%	-9.48%	0.90%	-2.54%	-1.19%	-2.98%	-5.61%	0.04%
0.43%	2.87%	3.45%	-1.96%	4.68%	-1.48%	-3.60%	-3.13%	4.29%	-0.96%	1.20%	3.21%	-8.47%	19.87%	-32.87%	-2.36%	0.54%	-2.42%	-6.76%	-3.58%	-4.95%	-1.52%
-6.66%	7.06%	1.50%	2.26%	7.25%	8.20%	-6.74%	0.54%	-0.52%	-0.01%	19.26%	0.22%	-12.99%	1.05%	3.63%	1.20%	0.25%	-10.61%	-6.35%	1.43%	-6.54%	0.16%
1.05%	-0.31%	6.67%	-2.70%	-3.39%	2.53%	14.26%	0.79%	-1.97%	5.98%	1.09%	3.58%	6.19%	-4.84%	5.91%	3.37%	-11.69%	16.99%	-24.96%	15.04%	3.92%	1.79%
-4.65%	16.52%	0.06%	-12.23%	-12.49%	-0.59%	-7.72%	-1.03%	-7.91%	3.03%	5.05%	2.59%	-4.95%	-2.41%	-4.36%	1.97%	6.23%	-0.42%	-7.03%	2.49%	8.02%	-0.94%
2.23%	0.12%	1.99%	1.27%	5.85%	2.80%	2.48%	2.95%	2.91%	8.08%	5.01%	1.40%	-6.17%	-4.75%	5.08%	-5.38%	2.53%	-3.05%	7.33%	-3.70%	0.70%	1.41%
4.84%	0.42%	-1.59%	3.21%	-1.21%	19.39%	2.48%	1.25%	-0.69%	-1.02%	-3.55%	-3.54%	-5.98%	-6.79%	-3.76%	-0.83%	-4.03%	-3.23%	2.21%	-11.01%	-10.36%	-1.13%
9.13%	2.95%	3.64%	5.97%	-0.04%	2.17%	3.82%	-9.37%	-8.63%	-0.70%	21.65%	8.23%	-5.64%	4.96%	2.81%	-9.58%	-2.23%	-15.35%	-5.74%	-19.24%	1.33%	-0.47%
2.99%	-1.38%	4.87%	7.20%	-0.99%	-0.15%	2.88%	6.14%	1.74%	0.29%	-1.18%	6.17%	-2.77%	0.06%	-0.30%	-14.82%	0.57%	5.35%	-1.56%	2.08%	-3.98%	0.63%
5.74%	-3.59%	9.45%	9.93%	-3.39%	1.21%	8.73%	4.34%	-5.33%	-5.42%	6.57%	-2.46%	1.10%	-2.07%	0.05%	-0.64%	7.40%	-6.95%	3.68%	-0.35%	2.67%	1.46%
1.25%	1.17%	3.97%	5.40%	2.42%	4.07%	4.30%	3.59%	2.74%	6.79%	5.35%	-1.90%	-1.82%	-3.51%	0.74%	-4.06%	-1.51%	-3.88%	-2.38%	-4.35%	-3.98%	0.69%
2.20%	-1.25%	5.90%	3.05%	5.08%	-0.09%	50.39%	0.52%	-7.62%	-1.66%	-1.23%	2.17%	5.99%	-7.78%	-7.78%	-2.37%	-14.28%	-4.46%	-5.32%	-18.66%	-23.97%	-0.96%
-2.26%	6.38%	1.40%	4.77%	0.71%	0.19%	-0.49%	-2.35%	1.17%	22.58%	-10.37%	-5.72%	-0.95%	6.22%	-6.31%	6.38%	0.04%	-4.58%	1.96%	-3.53%	-2.39%	0.61%
2.62%	6.48%	2.95%	-0.10%	7.43%	4.24%	-4.62%	2.70%	-1.03%	0.08%	-3.61%	7.04%	-4.66%	-3.12%	-6.51%	-2.73%	3.20%	-20.08%	-4.19%	0.13%	0.10%	-0.65%
3.68%	2.86%	7.28%	8.11%	-3.09%	8.39%	5.51%	3.27%	-36.69%	8.56%	-0.57%	-8.61%	-3.87%	-15.87%	-6.38%	0.32%	-4.86%	1.89%	-6.86%	-1.02%	-13.68%	-2.46%
1.76%	6.09%	1.77%	-0.42%	-8.33%	8.20%	1.30%	2.17%	-17.73%	5.41%	9.64%	-10.85%	1.84%	-7.31%	0.64%	7.36%	-0.37%	-6.09%	-15.36%	0.17%	5.81%	-0.68%
1.22%	7.67%	2.46%	1.73%	-2.14%	-0.16%	-3.38%	-5.79%	0.00%	-6.56%	-9.63%	-5.69%	-1.01%	-5.22%	-6.14%	-3.21%	-0.06%	-60.35%	4.30%	-6.08%	-3.73%	-4.85%
-3.42%	-4.79%	3.06%	4.64%	1.65%	2.57%	3.82%	1.34%	-0.39%	-6.94%	-5.00%	6.57%	-4.28%	-2.70%	-3.40%	1.16%	-3.81%	-1.39%	1.11%	-5.54%	-3.16%	-0.90%
2.64%	4.44%	3.67%	4.38%	0.13%	3.93%	-4.64%	0.18%	2.32%	-1.64%	-4.48%	1.98%	-1.05%	6.57%	-7.02%	1.36%	-0.94%	-10.69%	-15.55%	-5.62%	-7.46%	-1.94%
1.82%	3.61%	4.39%	0.20%	-0.89%	2.00%	12.24%	1.58%	4.80%	-14.18%	1.43%	-14.20%	-14.55%	0.85%	-5.11%	-14.96%	2.44%	-9.56%	0.79%	-1.94%	-0.88%	-1.91%
-1.80%	-1.10%	5.47%	1.26%	-3.57%	-3.18%	1.08%	4.52%	2.76%	0.06%	-0.73%	0.29%	5.93%	-3.53%	-8.71%	0.63%	-7.01%	-9.27%	-5.05%	-21.74%	-10.75%	-2.59%
11.33%	-1.85%	-1.65%	5.34%	1.87%	7.43%	5.30%	5.41%	-9.25%	0.99%	-14.49%	5.05%	1.47%	-0.76%	-4.65%	-1.42%	-3.25%	-0.39%	0.07%	-0.70%	-3.03%	0.13%
3.91%	3.38%	4.47%	2.96%	5.74%	0.83%	3.61%	5.72%	0.05%	9.45%	-2.06%	-5.56%	9.66%	-8.93%	4.33%	-1.08%	-4.90%	-0.65%	-0.32%	-5.20%	-8.09%	0.82%
-21.79%	31.86%	-0.47%	-2.06%	-1.37%	11.77%	-0.65%	5.76%	0.61%	6.70%	3.03%	-0.36%	8.79%	-3.54%	6.46%	5.10%	-2.33%	-1.45%	-1.49%	1.03%	-4.55%	1.95%
1.56%	3.10%	2.63%	3.04%	1.04%	1.88%	3.15%	1.23%	-3.46%	0.75%	1.35%	-0.31%	-1.74%	-1.99%	-1.24%	-1.54%	-1.67%	-3.58%	-2.39%	-1.60%	-3.22%	-0.14141%

M1-EP-5

Reference: Exhibit M1, Page 11/55

Preamble: A January 2017 staff report on productivity from the U.S. Bureau of Labor Statistics¹ calls the period 2007-2009 (“the Great Recession”) the worst American recession since the Great Depression and states that the U.S. economy has been recovering from this historic decline for 7 years and is now in the midst of one of the longest business cycles of the post-World War II era.²

That report also states:

“During the current business cycle, which started in the fourth quarter of 2007, labor productivity has grown at an annualized rate of 1.1 percent. This growth rate is notably low compared with the rates of the 10 completed business cycles since 1947—only a brief six-quarter cycle in the early 1980’s posted a cyclical growth rate that low.”³

“Also noteworthy is the output growth rate of the current cycle: at 1.4 percent, it is the second-lowest output growth rate of the historical period and well below the average-cycle output growth rate of 3.4 percent.”⁴

The report further states:

“Now let us look at the productivity growth data of the current business cycle. Why are we looking at business cycles, you may be wondering? This is because, being based on the highly cyclical output and hours data, productivity data tend to possess a cyclical element... Thus, it makes sense to compare periods that take this feature of the data into account and that each contain one recession and one expansion. This approach allows for consistent and standardized comparisons of productivity trends through time.”⁵

Question:

- a) Does PEG agree with the final paragraph above that productivity data possess a cyclical element due to the influence of highly cyclical output data?

¹ U.S. Bureau of Labor Statistics. “Below trend: the U.S. productivity slowdown since the Great Recession”, Beyond the Numbers, Vol. 6, No.2, January 2017.

² *ibid*, p.1

³ *ibid*, p.3

⁴ *ibid*, p.3

⁵ *ibid*, p.2

- b) Does PEG expect that PSE's productivity results for its sample of U.S. utilities in its sample period 2004-2016 would reflect the severe but short downturn in 2008-9 and the very slow recovery in U.S. output growth and labour productivity thereafter?
- c) In PEG's view, does PSE's study period 2004-2016 contains a sufficient number of periods, each containing one recession and one expansion, to permit "consistent and standardized comparisons of productivity" as suggested in the U.S. BLS article?
- d) The above-cited U.S. Bureau of Labor Statistics study identifies twelve business cycles of varying length since 1947.⁶ Does PEG believe that its study period 1995-2016 contains a sufficient number of periods, each containing one recession and one expansion, to permit "consistent and standardized comparisons of productivity" as suggested in the U.S. BLS article?

Response to Energy Probe-5: The following response was provided by PEG.

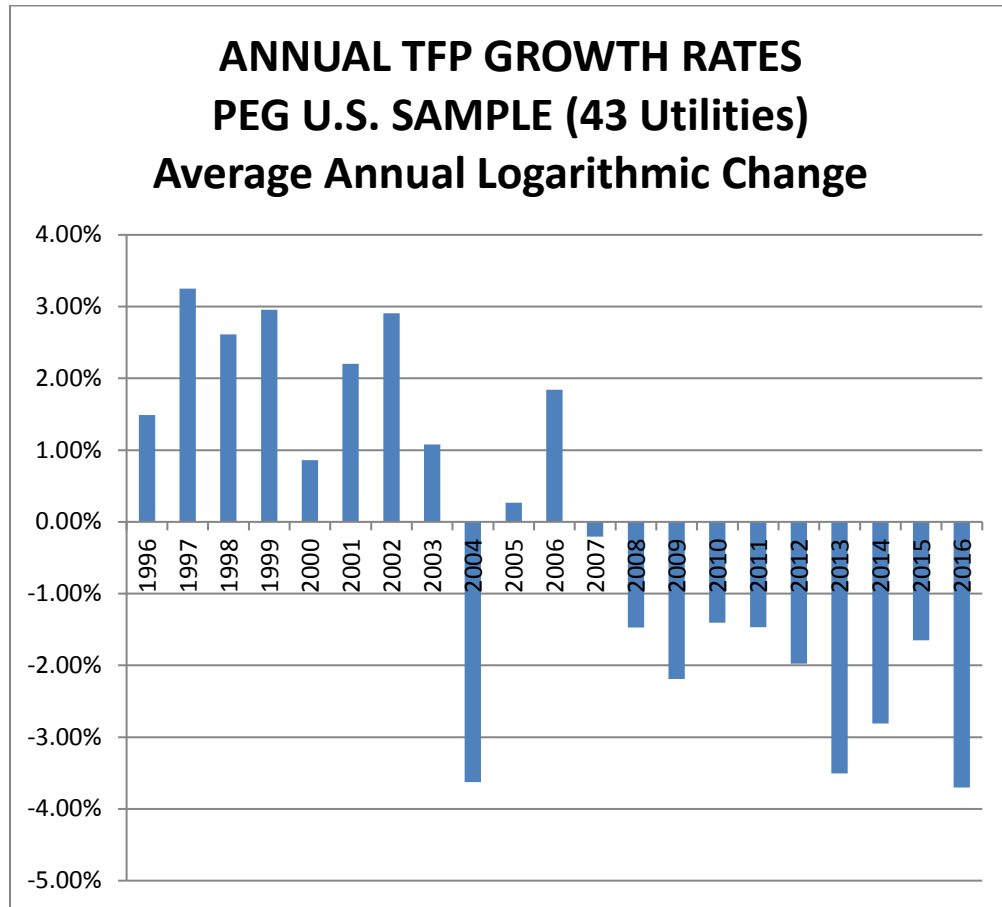
- a) PEG agrees that productivity can vary with business cycles. This is chiefly due to cyclical fluctuations in the demand for services that cause fluctuations in capacity utilization. The importance of this effect depends in part on the weight on system use in the output index.
- b) The recovery of the economy from the recession of 2008-9 has been slow and this has probably affected U.S. transmission utility productivity growth.
- c) A disadvantage of PSE's sample period is that it covers only one business cycle that was characterized by an unusually slow recovery.
- d) The PEG sample period covers two business cycles.

⁶ *ibid*, Chart 1, p.3

M1-EP-6

Reference: Exhibit M1, p.18

Preamble: Based on the column averages in the last row of the table shown above, Energy Probe has created the following chart:



- a) Does PEG agree that TFP growth in the transmission industry was strong and positive in the years 1995-2003 and 2005-2006?
- b) Does PEG agree that TFP growth was strongly and continuously negative throughout the balance of its study period 2007-2016?
- c) Does PEG agree that the period 2007-2016 includes the period that the U.S. Bureau of Labor Statistics describes as the worst American recession since the Great Depression and that the U.S. economy has been recovering from this historic decline for 7 years without returning to its previous peak even as recently as of January, 2017?

- d) Would PEG agree that negative TFP growth over its sample period is not a long-term historical trend but rather a result of offsetting cyclical peaks and troughs in its study period?

Response to Energy Probe-6: The following response was provided by PEG.

- a) PEG acknowledges that the transmission industry achieved strong productivity growth in some of the earlier years of its sample period.
- b) Productivity growth was more typically negative in the later years of the sample period.
- c) The severe recession and unusually slow recovery have probably slowed transmission industry productivity growth. However, other factors were also at play that included the ramp up of conservation and demand programs, the Energy Policy Act of 2008, and the adoption by many utilities of formula rate plans.

M1-EP-7

Reference: Exhibit M1, p.18

Preamble: Energy Probe has converted the logarithmic percentage changes in the table above to their corresponding annual percentage changes. Those changes are shown in the table below.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	AVERAGE
	2.51%	4.57%	-2.64%	4.87%	2.21%	4.25%	-4.20%	-4.07%	-2.09%	-1.34%	-0.22%	3.22%	-4.88%	2.60%	-6.11%	7.99%	1.42%	0.83%	-1.85%	-1.49%	-3.77%	0.09%
	4.89%	-1.26%	7.66%	7.21%	-3.45%	3.94%	4.70%	2.30%	0.08%	-6.02%	5.87%	-0.57%	-0.03%	-1.05%	1.68%	1.10%	-0.59%	3.86%	-3.84%	-3.94%	0.64%	1.10%
	4.41%	-3.08%	6.56%	0.48%	5.54%	3.49%	-3.43%	2.34%	-7.22%	2.17%	7.83%	1.82%	-4.98%	-2.00%	-2.26%	-9.51%	-2.88%	0.82%	-0.22%	2.41%	-3.91%	-0.08%
	6.38%	1.04%	-1.07%	2.40%	0.51%	2.00%	2.87%	0.11%	-1.40%	-1.33%	-5.50%	-3.79%	-4.77%	-0.15%	0.39%	-3.37%	-1.80%	2.86%	0.06%	-1.17%	-3.51%	-0.44%
	1.69%	5.08%	1.05%	4.76%	2.91%	0.84%	-0.95%	1.74%	-27.06%	-17.26%	18.30%	1.77%	-4.83%	7.56%	0.71%	-8.52%	1.50%	2.32%	3.77%	-0.49%	7.10%	0.09%
	0.68%	-0.12%	4.04%	-0.15%	2.86%	1.55%	4.32%	1.13%	0.08%	3.22%	1.56%	-6.21%	-2.00%	-5.77%	-0.23%	-1.32%	-9.14%	-8.43%	4.58%	13.63%	-4.10%	0.01%
	2.65%	-1.77%	6.09%	2.25%	0.70%	4.43%	3.84%	2.34%	-5.05%	5.60%	-4.54%	2.66%	3.15%	-3.30%	5.47%	7.91%	-12.66%	-6.95%	-2.81%	12.26%	-2.21%	0.95%
	-2.49%	3.54%	8.39%	4.40%	0.04%	3.21%	-0.61%	6.05%	-1.89%	-4.50%	7.20%	-2.70%	11.67%	-14.36%	7.79%	2.80%	0.87%	1.75%	-2.47%	-2.48%	-2.04%	1.15%
	0.63%	7.08%	1.38%	7.44%	-0.39%	2.66%	2.16%	-3.82%	-4.59%	-3.59%	14.96%	7.69%	1.03%	3.32%	3.12%	-0.85%	-4.21%	-3.19%	0.20%	4.01%	-1.53%	1.60%
	0.42%	-2.71%	5.07%	-3.57%	-1.72%	-7.93%	7.60%	2.45%	2.97%	0.01%	10.06%	-8.55%	5.06%	-4.18%	3.60%	2.32%	-3.17%	3.59%	0.95%	-5.25%	-3.64%	0.16%
	-2.45%	7.02%	5.01%	9.51%	2.29%	6.70%	-7.16%	-0.62%	-7.31%	-1.17%	-8.43%	-17.41%	-8.12%	-27.23%	-1.03%	1.38%	1.51%	1.80%	-4.95%	1.74%	-7.61%	-2.69%
	0.59%	0.90%	-0.74%	3.61%	-1.13%	4.84%	-2.74%	3.05%	5.75%	0.97%	-4.06%	-3.63%	-3.38%	-1.51%	-4.73%	3.40%	-2.09%	9.04%	2.13%	-2.77%	-0.33%	0.34%
	-1.15%	7.66%	-0.04%	2.41%	1.80%	-2.59%	14.54%	0.22%	-2.34%	4.88%	5.24%	-4.28%	-9.56%	9.15%	-3.87%	0.16%	-2.06%	0.19%	0.34%	0.21%	-0.07%	0.99%
	0.76%	3.08%	7.58%	3.28%	-0.38%	1.21%	3.07%	2.33%	-7.11%	0.74%	-5.31%	5.27%	1.97%	-0.11%	6.57%	6.41%	-12.71%	0.66%	-3.58%	1.67%	0.48%	1.23%
	0.87%	4.86%	-5.80%	7.87%	5.55%	-8.19%	2.62%	1.80%	-2.33%	1.21%	9.32%	-5.54%	-8.33%	2.20%	-1.54%	-1.68%	-0.10%	-5.14%	-2.57%	-3.87%	-4.00%	-0.61%
	7.69%	-2.14%	0.02%	3.85%	1.44%	3.44%	0.12%	4.75%	-0.87%	2.43%	-1.19%	0.66%	0.87%	0.39%	0.89%	0.10%	-2.05%	2.01%	2.00%	-3.52%	-1.55%	0.92%
	6.37%	2.17%	-7.71%	9.95%	3.70%	-4.61%	2.78%	-10.12%	-0.02%	-0.56%	4.86%	-1.14%	12.06%	2.25%	-4.56%	-6.90%	0.66%	-6.33%	-6.07%	-0.47%	-19.25%	-1.09%
	2.58%	-0.27%	5.84%	2.86%	-2.83%	-0.81%	-0.14%	-1.69%	-5.38%	1.11%	-1.85%	3.19%	-5.17%	-0.84%	0.53%	-5.79%	-2.89%	4.32%	-0.80%	0.08%	4.69%	-0.15%
	1.57%	-0.42%	3.96%	5.88%	8.00%	2.38%	4.66%	3.29%	-0.30%	11.37%	-0.55%	0.37%	-4.29%	8.01%	1.55%	1.46%	4.37%	-2.49%	-0.39%	4.62%	-6.70%	2.21%
	0.51%	2.98%	3.50%	2.31%	1.27%	2.13%	1.24%	3.13%	-12.68%	-0.34%	0.72%	22.38%	0.63%	0.24%	-3.15%	0.44%	0.53%	4.19%	3.02%	1.05%	0.57%	1.65%
	9.87%	8.09%	0.07%	0.92%	2.74%	-2.41%	6.82%	2.02%	-0.57%	-0.49%	-3.16%	-4.62%	4.82%	-9.64%	6.90%	-4.91%	-0.25%	-12.65%	-7.88%	0.82%	-9.10%	-0.60%
	2.46%	2.93%	2.61%	5.31%	4.33%	-4.32%	4.34%	5.11%	1.73%	1.45%	0.40%	4.57%	-1.58%	1.93%	-2.13%	-8.88%	-0.70%	-2.09%	2.04%	-0.42%	0.41%	0.93%
	1.51%	5.54%	1.77%	5.60%	3.03%	-0.20%	1.90%	-2.04%	1.37%	1.78%	1.49%	1.93%	-5.44%	0.96%	3.21%	-9.05%	0.90%	-2.51%	-1.18%	-2.94%	-5.45%	0.10%
	0.45%	2.92%	3.51%	-1.94%	4.79%	-1.48%	-3.45%	-3.09%	4.39%	-0.96%	3.60%	3.83%	-7.12%	20.83%	-28.27%	-1.80%	1.02%	-3.11%	-6.59%	-3.76%	-4.92%	-1.01%
	-6.44%	7.33%	1.56%	2.32%	7.56%	8.55%	-6.51%	0.54%	-0.52%	-0.02%	21.25%	0.71%	-12.65%	1.16%	3.80%	1.27%	0.30%	-10.08%	-5.99%	1.52%	-6.35%	0.44%
	1.06%	-0.31%	6.90%	-2.65%	-3.33%	2.58%	15.36%	0.80%	-1.95%	6.20%	1.36%	3.51%	6.29%	-4.75%	6.36%	3.32%	-11.07%	18.41%	-22.12%	16.33%	4.02%	2.20%
	-4.50%	17.94%	0.15%	-11.52%	-11.68%	-0.59%	-7.33%	-1.04%	-7.58%	3.15%	5.53%	2.74%	-5.34%	-2.36%	-4.27%	2.00%	6.43%	-0.42%	-6.78%	2.52%	8.37%	-0.69%
	4.96%	0.43%	-1.57%	3.29%	-1.19%	21.59%	2.51%	1.24%	-0.69%	-1.02%	-3.47%	-3.49%	-5.81%	-6.57%	-3.69%	-0.83%	-3.96%	-3.18%	2.19%	-10.45%	-9.85%	-0.93%
	9.57%	3.01%	3.75%	6.20%	-0.04%	2.19%	3.89%	-8.93%	-8.27%	-0.65%	24.20%	8.80%	-5.61%	5.25%	3.00%	-9.19%	-2.33%	-14.23%	-5.58%	-17.53%	1.29%	-0.06%
	3.08%	-1.37%	5.02%	7.46%	-0.97%	-0.15%	2.93%	6.32%	1.76%	0.29%	-0.70%	6.57%	-2.63%	-0.01%	-0.33%	-13.83%	0.60%	5.50%	-1.62%	2.09%	-3.90%	0.77%
	1.33%	1.27%	4.07%	5.54%	2.49%	4.23%	4.46%	3.66%	2.80%	7.06%	6.29%	-1.32%	-1.98%	-3.11%	0.77%	-3.62%	-1.41%	-3.90%	-2.39%	-4.12%	-3.78%	0.87%
	2.24%	-1.24%	6.07%	3.11%	5.24%	-0.09%	64.27%	0.52%	-7.31%	-1.65%	-0.70%	2.07%	6.18%	-7.52%	-7.59%	-2.34%	-13.32%	-3.48%	-5.10%	-16.83%	-21.46%	0.05%
	2.67%	6.72%	3.03%	-0.09%	7.79%	4.34%	-4.49%	2.78%	-1.04%	0.09%	-3.55%	7.27%	-4.55%	-3.10%	-6.31%	-2.74%	3.12%	-18.08%	-4.10%	0.13%	0.10%	-0.48%
	3.74%	2.90%	7.59%	8.49%	-3.05%	8.77%	5.69%	3.31%	-30.49%	8.99%	-0.14%	-7.18%	-3.89%	-14.65%	-5.94%	0.07%	-4.67%	1.90%	-6.97%	-1.55%	-12.80%	-1.90%
	1.77%	6.28%	1.77%	-0.42%	-8.00%	8.59%	1.33%	2.14%	-16.25%	5.59%	10.17%	-10.29%	1.85%	-7.05%	0.64%	7.96%	-0.30%	-5.92%	-14.19%	0.02%	5.88%	-0.40%
	1.22%	8.05%	2.55%	1.74%	-2.08%	-0.16%	-3.33%	-5.63%	0.02%	-6.35%	-8.64%	-5.38%	-0.83%	-5.27%	-5.63%	-3.13%	-0.09%	-45.31%	4.33%	-5.89%	-3.89%	-3.99%
	-3.37%	-4.67%	3.14%	4.78%	1.67%	2.60%	3.93%	1.36%	-0.39%	-6.66%	-4.71%	6.86%	-4.56%	-2.49%	-3.27%	1.17%	-3.75%	-1.39%	1.11%	-5.47%	-3.11%	-0.82%
	2.68%	4.57%	3.77%	4.48%	0.13%	3.95%	-4.48%	0.18%	2.37%	-1.58%	-3.96%	1.98%	-1.01%	-5.64%	-6.68%	1.37%	-0.73%	-9.90%	-14.15%	-5.30%	-6.96%	-1.66%
	1.83%	3.67%	4.50%	0.24%	-0.88%	2.03%	13.05%	1.60%	4.92%	-13.21%	1.64%	-13.10%	-13.73%	1.94%	-5.01%	-13.99%	2.40%	-9.17%	0.93%	-1.88%	-0.50%	-1.56%
	-1.79%	-1.09%	5.65%	1.27%	-3.47%	-3.05%	0.98%	4.67%	2.80%	0.06%	-0.69%	0.29%	6.11%	-3.45%	-8.34%	0.61%	-6.78%	-8.85%	-4.96%	-19.55%	-10.20%	-2.37%
	12.02%	-1.83%	-1.64%	5.49%	1.89%	7.79%	5.44%	5.56%	-8.83%	1.03%	-10.91%	5.60%	1.28%	-0.92%	-4.59%	-1.48%	-3.29%	-0.83%	0.49%	-0.32%	-3.23%	0.41%
	3.99%	3.43%	4.59%	3.00%	5.91%	0.81%	3.70%	5.92%	0.03%	9.99%	-1.81%	-5.48%	10.11%	-8.62%	4.35%	-1.11%	-4.81%	-0.67%	-0.35%	-5.11%	-7.81%	0.96%
	<u>-19.57%</u>	<u>37.52%</u>	<u>-0.47%</u>	<u>-2.02%</u>	<u>-1.33%</u>	<u>12.56%</u>	<u>-0.65%</u>	<u>5.92%</u>	<u>0.61%</u>	<u>6.94%</u>	<u>3.60%</u>	<u>-0.59%</u>	<u>9.01%</u>	<u>-3.58%</u>	<u>6.92%</u>	<u>5.18%</u>	<u>-2.32%</u>	<u>-1.62%</u>	<u>-1.46%</u>	<u>1.06%</u>	<u>-4.41%</u>	<u>2.44%</u>
AVERAGE	1.62%	3.50%	2.71%	3.07%	0.94%	2.35%	3.39%	1.15%	-3.25%	0.41%	2.13%	0.01%	-1.28%	-1.89%	-1.19%	-1.31%	-1.87%	-2.93%	-2.62%	-1.41%	-3.45%	0.0035%

Question:

Please confirm/disconfirm that the 903 annual percentage changes in this table and the row and column averages are correctly calculated and, in particular, that the simple average annual TFP growth rate is 0.0035%.

Response to Energy Probe-7: The following response was provided by PEG.

The calculation is confirmed. Below is a version of this table using the revised results referenced in response to question 4.

Arithmetic Growth Rates		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
2.51%	4.58%	-2.65%	4.83%	2.20%	4.26%	-4.19%	-4.07%	-2.09%	-1.35%	-0.33%	3.11%	-4.77%	2.49%	-6.12%	7.90%	1.41%	0.83%	-1.90%	-1.48%	-3.75%	0.07%		
4.89%	-1.26%	7.62%	7.20%	-3.45%	3.94%	4.70%	2.30%	0.08%	-6.11%	5.89%	-0.58%	-0.03%	-1.05%	1.68%	1.11%	-0.59%	3.86%	-4.31%	-3.70%	0.34%	1.07%		
4.70%	-2.56%	6.68%	0.70%	5.67%	3.65%	-2.88%	2.67%	-6.62%	2.45%	7.83%	1.91%	-4.66%	-1.77%	-2.02%	-9.09%	-2.68%	0.91%	-0.11%	2.49%	-3.70%	0.17%		
6.28%	1.05%	-1.07%	2.40%	0.52%	2.02%	2.87%	0.11%	-1.40%	-1.33%	-5.50%	-3.78%	-4.76%	-0.15%	0.39%	-3.37%	-1.80%	2.86%	0.05%	-1.17%	-3.51%	-0.44%		
1.70%	4.93%	1.04%	4.74%	2.89%	0.80%	-0.96%	1.74%	-27.20%	-17.52%	18.28%	1.74%	-4.83%	7.63%	0.79%	-8.55%	1.50%	2.32%	3.77%	-0.49%	7.18%	0.07%		
0.68%	-0.14%	4.03%	-0.18%	2.85%	1.54%	4.29%	1.13%	0.07%	3.19%	1.48%	-6.20%	-2.09%	-5.68%	-0.24%	-1.32%	-9.13%	-8.43%	4.28%	13.59%	-4.16%	-0.02%		
2.65%	-1.77%	6.09%	2.18%	0.70%	4.41%	3.79%	2.34%	-5.05%	5.56%	-5.59%	2.25%	3.25%	-3.57%	5.30%	8.13%	-12.68%	-7.21%	-2.77%	12.55%	-2.31%	0.87%		
-2.50%	3.53%	8.36%	4.35%	0.03%	3.21%	-0.63%	6.05%	-1.89%	-4.50%	7.20%	-2.69%	11.28%	-14.64%	7.75%	2.75%	0.70%	1.99%	-2.65%	-2.89%	-1.58%	1.11%		
0.63%	7.05%	1.33%	7.41%	-0.42%	2.66%	2.16%	-3.84%	-4.59%	-3.60%	13.07%	8.24%	0.97%	3.29%	3.26%	-0.80%	-4.14%	-3.27%	0.20%	4.12%	-1.47%	1.54%		
0.42%	-2.71%	5.07%	-3.74%	-1.71%	-7.93%	7.61%	2.50%	2.98%	0.02%	9.79%	-8.80%	5.07%	-4.12%	3.64%	2.27%	-3.17%	3.58%	0.94%	-5.24%	-3.69%	0.13%		
-2.45%	7.00%	5.01%	9.45%	2.29%	6.67%	-7.16%	-0.62%	-7.32%	-1.20%	-8.73%	-18.16%	-8.16%	-27.09%	-1.25%	1.66%	1.53%	1.80%	-4.70%	1.94%	-7.60%	-2.72%		
0.60%	0.89%	-0.74%	3.56%	-1.13%	4.82%	-2.74%	3.05%	5.75%	0.92%	-4.87%	-4.23%	-3.33%	-1.71%	-4.98%	4.87%	-2.09%	9.04%	1.43%	-2.11%	-0.31%	0.32%		
-1.15%	7.66%	-0.03%	2.38%	1.79%	-2.60%	14.54%	0.22%	-2.34%	4.85%	5.23%	-4.28%	-9.56%	9.15%	-4.58%	0.27%	-2.21%	0.42%	0.41%	0.15%	0.06%	0.97%		
3.60%	3.37%	-1.26%	0.50%	9.29%	-9.54%	12.02%	6.58%	-5.24%	-0.27%	-1.27%	7.52%	-13.20%	2.85%	5.31%	-10.78%	-2.64%	-4.43%	-2.94%	1.91%	6.39%	0.37%		
0.76%	3.06%	7.66%	3.28%	-0.38%	1.21%	3.08%	2.33%	-7.19%	0.73%	-5.31%	5.26%	1.96%	-0.12%	6.55%	6.37%	-2.70%	0.65%	-3.59%	1.68%	4.05%	1.22%		
0.85%	4.85%	-5.83%	7.82%	5.54%	-8.19%	2.62%	1.77%	-2.33%	1.18%	9.27%	-5.54%	-8.33%	2.20%	-1.55%	-1.68%	-0.10%	-5.14%	-2.57%	-3.89%	-4.00%	-0.62%		
7.64%	-2.13%	0.02%	3.85%	1.44%	3.44%	0.11%	4.72%	-0.88%	2.38%	-1.66%	0.59%	1.14%	0.19%	0.83%	0.03%	-2.13%	1.99%	2.17%	-3.48%	-1.58%	0.89%		
6.34%	2.17%	-7.71%	9.95%	3.66%	-4.60%	2.74%	-10.13%	-0.02%	-0.57%	4.53%	-1.11%	12.15%	2.09%	-4.63%	-6.88%	0.71%	-6.35%	-6.12%	-0.42%	-19.22%	-1.12%		
2.51%	-0.27%	5.82%	2.84%	-2.85%	-0.81%	-0.14%	-1.69%	-5.37%	1.10%	-2.08%	2.86%	-5.16%	-0.71%	0.52%	-5.79%	-3.06%	4.31%	-0.95%	0.14%	4.69%	-0.19%		
1.57%	-0.42%	3.94%	5.87%	8.00%	2.37%	4.64%	3.29%	-0.30%	11.35%	-0.58%	0.25%	-4.33%	8.07%	1.60%	1.48%	4.37%	-2.49%	-0.39%	4.62%	-6.69%	2.20%		
0.49%	2.97%	3.47%	2.29%	1.25%	2.13%	1.24%	3.09%	-12.68%	-0.33%	0.70%	22.38%	0.63%	0.25%	-3.15%	0.45%	0.52%	4.19%	3.02%	1.06%	0.57%	1.64%		
9.80%	7.95%	0.07%	0.92%	2.74%	-2.41%	6.82%	2.03%	-0.57%	-0.49%	-3.16%	-4.94%	5.13%	-9.65%	6.91%	-4.92%	-0.28%	-12.68%	-7.89%	0.82%	-9.11%	-0.61%		
2.46%	2.91%	2.60%	5.26%	4.33%	-4.32%	4.31%	5.10%	1.73%	1.39%	0.38%	4.55%	-1.60%	1.90%	-2.13%	-8.88%	-0.70%	-2.09%	1.98%	-0.43%	0.41%	0.91%		
1.51%	5.52%	1.77%	5.55%	3.03%	-0.20%	1.92%	-2.06%	1.37%	1.75%	1.48%	1.91%	-5.44%	0.97%	3.21%	-9.04%	0.90%	-2.51%	-1.18%	-2.94%	-5.45%	0.10%		
0.43%	2.91%	3.51%	-1.94%	4.79%	-1.47%	-3.54%	-3.09%	4.39%	-0.95%	1.21%	3.26%	-8.12%	21.99%	-28.01%	-2.33%	0.54%	-2.39%	-6.54%	-3.51%	-4.83%	-1.13%		
-6.44%	7.31%	1.51%	2.29%	7.52%	8.54%	-6.52%	0.54%	-0.52%	-0.01%	21.24%	0.22%	-12.19%	1.06%	3.69%	1.21%	0.25%	-10.07%	-6.15%	1.44%	-6.33%	0.41%		
1.06%	-0.31%	6.89%	-2.66%	-3.34%	2.56%	15.33%	0.79%	-1.95%	6.16%	1.10%	3.64%	6.39%	-4.72%	6.09%	3.43%	-11.03%	18.52%	-22.09%	16.23%	4.00%	2.19%		
-4.55%	17.96%	0.06%	-11.51%	-11.74%	-0.59%	-7.43%	-1.03%	-7.61%	3.08%	5.18%	2.62%	-4.83%	-2.38%	-4.27%	1.99%	6.43%	-0.42%	-6.78%	2.52%	8.35%	-0.71%		
2.26%	0.12%	2.01%	1.28%	6.02%	2.84%	2.51%	2.99%	2.95%	8.41%	5.13%	1.41%	-5.98%	-4.63%	5.21%	-5.23%	2.57%	-3.00%	7.60%	-3.63%	0.70%	1.50%		
4.96%	0.42%	-1.58%	3.26%	-1.20%	21.40%	2.51%	1.26%	-0.68%	-1.02%	-3.49%	-3.48%	-5.81%	-6.57%	-3.69%	-0.82%	-3.95%	-3.18%	2.23%	-10.43%	-9.84%	-0.94%		
9.56%	2.99%	3.71%	6.15%	-0.04%	2.19%	3.89%	-8.95%	-8.27%	-0.70%	24.17%	8.57%	-5.49%	5.09%	2.85%	-9.14%	-2.21%	-14.23%	-5.57%	-17.50%	1.34%	-0.08%		
3.04%	-1.37%	4.99%	7.47%	-0.98%	-0.15%	2.92%	6.33%	1.75%	0.29%	-1.18%	6.36%	-2.73%	0.06%	-0.30%	-13.77%	0.57%	5.50%	-1.55%	2.10%	-3.90%	0.74%		
5.91%	-3.53%	9.91%	10.44%	-3.33%	1.21%	9.12%	4.44%	-5.19%	-5.28%	6.79%	-2.43%	1.11%	-2.05%	0.05%	-0.64%	7.68%	-6.71%	3.75%	-0.35%	2.71%	1.60%		
1.26%	1.17%	4.05%	5.55%	2.45%	4.16%	4.39%	3.65%	2.77%	7.03%	5.50%	-1.88%	-1.80%	-3.45%	0.75%	-3.98%	-1.50%	-3.80%	-2.35%	-4.26%	-3.90%	0.75%		
2.23%	-1.24%	6.07%	3.10%	5.22%	-0.09%	65.51%	0.52%	-7.34%	-1.65%	-1.22%	2.20%	6.17%	-7.49%	-7.49%	-2.35%	-13.31%	-3.40%	-5.18%	-17.02%	-21.32%	0.09%		
-2.23%	6.59%	1.41%	4.88%	0.71%	0.19%	-0.49%	-2.32%	1.18%	25.34%	-9.85%	-5.55%	-0.95%	6.42%	-6.11%	6.59%	0.04%	-4.48%	1.98%	-3.47%	-2.36%	0.83%		
2.66%	6.70%	2.99%	-0.10%	7.71%	4.33%	-4.52%	2.74%	-1.03%	0.08%	-3.55%	7.29%	-4.55%	-3.07%	-6.31%	-2.69%	3.25%	-18.20%	-4.10%	0.13%	0.10%	-0.48%		
3.75%	2.90%	7.56%	8.44%	-3.05%	8.75%	5.67%	3.32%	-30.71%	8.94%	-0.57%	-8.25%	-3.80%	-14.68%	-6.18%	0.32%	-4.74%	1.90%	-6.63%	-1.02%	-12.79%	-1.95%		
1.77%	6.28%	1.78%	-0.42%	-7.99%	8.55%	1.31%	2.19%	-16.25%	5.56%	10.12%	-10.28%	1.85%	-7.05%	0.64%	7.64%	-0.37%	-5.90%	-14.24%	0.17%	5.98%	-0.41%		
1.23%	7.97%	2.49%	1.74%	-2.11%	-0.16%	-3.32%	-5.63%	0.00%	-6.35%	-9.18%	-5.53%	-1.01%	-5.08%	-5.95%	-3.16%	-0.06%	-45.31%	4.39%	-5.90%	-3.66%	-4.03%		
-3.36%	-4.68%	3.11%	4.75%	1.67%	2.60%	3.90%	1.35%	-0.39%	-6.70%	-4.88%	6.79%	-4.19%	-2.67%	-3.34%	1.17%	-3.73%	-1.38%	1.11%	-5.39%	-3.11%	-0.83%		
2.68%	4.54%	3.74%	4.48%	0.13%	4.01%	-4.53%	0.18%	2.35%	-1.62%	-4.38%	1.99%	-1.04%	-6.36%	-6.78%	1.37%	-0.93%	-10.14%	-14.40%	-5.47%	-7.19%	-1.78%		
1.83%	3.67%	4.48%	0.20%	-0.89%	2.02%	13.02%	1.59%	4.92%	-13.22%	1.44%	-13.24%	-13.54%	0.85%	-4.98%	-13.90%	2.47%	-9.12%	0.80%	-1.92%	-0.87%	-1.64%		
-1.79%	-1.09%	5.62%	1.27%	-3.51%	-3.13%	1.09%	4.62%	2.80%	0.06%	-0.73%	0.29%	6.11%	-3.47%	-8.34%	0.63%	-6.77%	-8.85%	-4.93%	-19.54%	-10.19%	-2.37%		
11.99%	-1.84%	-1.64%	5.48%	1.89%	7.72%	5.44%	5.56%	-8.83%	0.99%	-13.49%	5.18%	1.48%	-0.75%	-4.54%	-1.41%	-3.20%	-0.39%	0.07%	-0.70%	-2.98%	0.29%		
3.99%	3.44%	4.57%	3.01%	5.91%	0.83%	3.68%	5.88%	0.05%	9.91%	-2.04%	-5.40%	10.14%	-8.54%	4.42%	-1.08%	-4.78%	-0.65%	-0.32%	-5.07%	-7.77%	0.96%		
-19.58%	37.52%	-0.47%	-2.04%	-1.36%	12.49%	-0.65%	5.92%	0.61%	6.93%	3.08%	-0.36%	9.19%	-3.48%	6.67%	5.24%	-2.31%	-1.44%	-1.48%	1.03%	-4.45%	2.43%		
Average	1.68%	3.33%	2.73%	3.16%	1.12%	2.03%	3.62%	1.31%	-3.11%	0.96%	1.63%	-0.09%	-1.54%	-1.71%	-1.04%	-1.38%	-1.56%	-3.04%	-2.22%	-1.38%	-2.99%	0.0721%	

M1-EP-8

Reference: Revised Transcript, EB-2016-0152, OPG Volume 11, Thursday March 23, 2017, p.38

Preamble: Energy Probe handed out the chart below in its compendium prior to PEG's oral evidence in EB-2016-0152. It shows Statistics Canada data on multi-factor productivity in the Canadian business sector 1961-2014 (blue line) and in the electricity sector 1961-2010 (red line).

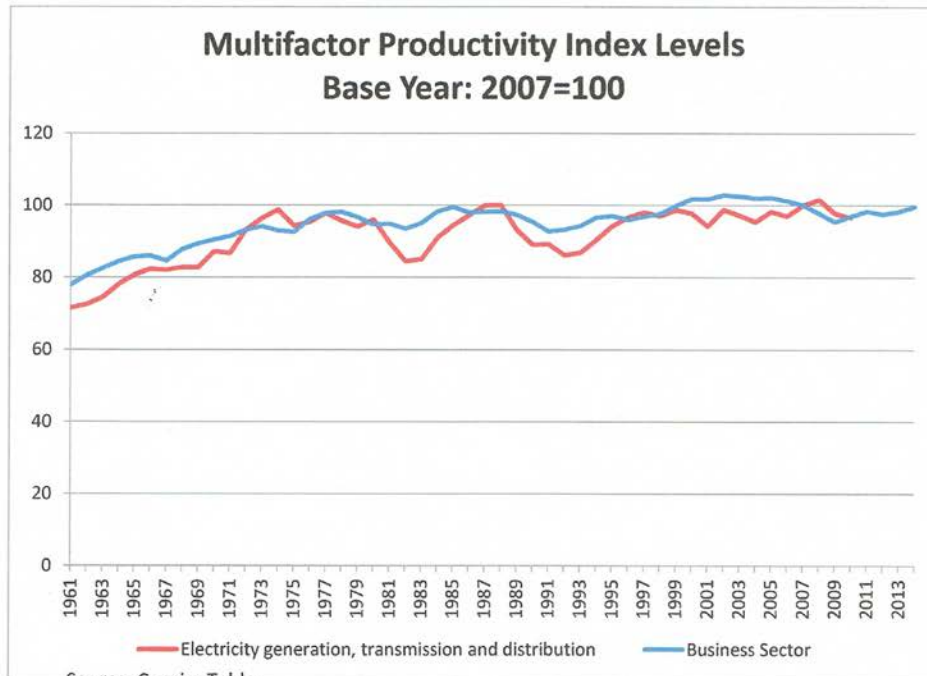
Question: Please confirm/disconfirm (or accept subject to check) that in EB-2016-0152, you testified that the chart disclosed a discernable long-term trend in multi-factor productivity in the Canadian business sector and that the most-recent 5-year and 10-years periods were "off-trend".

Response to Energy Probe-8: The following response was provided by PEG.

PEG accepts this subject to check but notes that the MFP growth of the Canadian private business sector has recently accelerated.

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Filed: 2016-10-26
 EB-2016-0152
 Exhibit L
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The LEI Updated Report used a study period of 2002-2014. According to Figure 27 of the Updated Report, total-factor productivity growth was negative in five of those years.

The CANSIM data tend to support LEI's conclusion of declining productivity growth in the study period used in its Updated Report. In the overlapping eight years, the CANSIM series has 5 negative growth years and the mean annual growth rate is -0.25%; the Updated Report (Figure 27) has 3 negative growth years and the mean annual growth rate is -0.54%.

In the Report of the Board in EB-2010-0379, the Board refers to the "long-run productivity of the sector" (at p.15).

1. Please confirm that the study period used in the Updated Report was selected, in part, because LEI could not obtain comparable data for earlier years.
2. Does OPG regard LEI's study period as providing evidence on the "long-term productivity growth rate" to which the Board has referred?

Witness Panel: Overview, Rate-setting Framework