ONTARIO ENERGY BOARD

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

AND IN THE MATTER OF an Application by Enbridge
Gas Distribution Inc. for an Order or Orders approving
or fixing rates for the sale, distribution, transmission and
storage of gas commenting January 1, 2008.

AND IN THE MATTER OF an Application by Union
Gas Ltd. ("Union Gas") for an Order or Orders
approving or fixing rates for the sale, distribution,
transmission and storage of gas commenting January 1,
2008.

AND IN THE MATTER OF a combined proceeding of
the Board pursuant to section 21(1) of the Ontario
Energy Board Act, 1998.

SUPPLEMENTARY EVIDENCE OF ROBERT LOUBE
ON BEHALF OF THE CONSUMERS COUNCIL OF CANADA
THE VULNERABLE ENERGY CONSUMERS COALITION AND
AND THE CITY OF KITCHENER

DECEMBER 3, 2007

1. <u>Introduction and Summary</u>

I have been asked by City of Kitchener ("Kitchener"), the Consumers Council of

Canada ("CCC") and the Vulnerable Energy Consumers Coalition ("VECC") to review

and analyze the November Pacific Economics Group ("PEG") and Enbridge Gas

Distribution Inc. ("EGD") filings. These additional filings significantly change the

earlier recommendations of PEG and the position of EGD with regard to the X factor. I

will show that the new filings are not an improvement over the earlier PEG and EGD

filings. Rather the new filings generate new problems. The existence of still further

problems implies that even though the Board has allowed PEG and EGD multiple

opportunities to calculate reasonable X-factors, neither PEG nor EGD have been able to

provide the Board with a reasonable X-factor. Without a reasonable X-factor, it is my

opinion that the Board can only proceed with an incentive regulatory regime if it adopts

an Earnings Sharing Mechanism ("ESM") and sets the X-factor equal to the inflation rate.

Because of the timing of these filings including the fact that I am writing prior to

being able to consider the answers to the undertakings associated with the November 26,

2007 technical conference, my review cannot be comprehensive. Instead, I will focus on

two important issues raised by the filings: the definition of output and meaning of the

average use factor.

First, I discuss the changing definition of output used in determining the output

growth rate. EGD suggests it is best to rely on an index approach to measure output

rather than an econometric approach. However, EGD's consultants, Bernstein and

Carpenter, compress the number of outputs used to determine the revenue weighted

output index by eliminating the number of customers from the list of outputs.[1] This

compression distorts the resulting measure of output because the growth in the number of

customers has been faster than the growth in volume. Therefore, the compressed output

index introduces a bias that reduces the output growth, and in so doing, decreases the

measured total factor productivity (TFP) and increases the allowed increase in retail rates.

The new PEG study, on the other hand, still relies on the econometric approach to

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[1] Dr. Jeffrey I. Bernstein and Dr. Paul R. Carpenter, "X Factor Guideline and Measurement for Ontario's Natural Gas Distribution Industry," Exhibit B, Tab 3, Schedule 6, November 6, 2007, ("Bernstein and Carpenter Report").

determining the TFP.[2]   However, the PEG study changes the outputs used in the

econometric study. PEG added a variable related to the length of the distribution and

transmission plant and combined the two volume variables into one variable. The result

is that PEG recommended an entirely new set of TFP results in its November 6 filing and

then changed these values again in its November 20 filing. Therefore, the Board now has

before it at least four sets of PEG results (March, June, early November, late November).

Each set is based on a different methodology and a different combination of data.   The

number of resubmitted results reinforces my initial conclusion that it is not possible to

derive a precise and definitive measure of productivity growth. Without such a measure,

it is prudent to establish an incentive regime that contains an ESM and sets the X-factor

equal to the inflation measure.

Second, I discuss the meaning and use of the average use factor (AUF). PEG asserts

that the AUF is the difference between the cost elasticity weighted output index and the

revenue weighted output index. PEG uses the AUF to allocate a higher proportion of any

rate increase to the residential class and away from other classes of customers. At the

November 26, 2007 technical conference Dr. Lowry and Dr. Bernstein had an animated

discussion regarding the AUF.[3] To summarize that discussion, Dr. Lowry attempted to

have Dr. Bernstein agree with Dr. Lowry's interpretation, and Dr. Bernstein maintained

that while there is a difference between the two measures, that difference is not a measure

average use. Moreover, Dr. Bernstein asserted that it was not necessary to use the cost

elasticity measure, and that it is possible to rely only on the revenue weighted output

index. In addition, Dr. Lowry asserted that he relied on a particular referenced article and

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[2] PEG, "Rate Adjustment Indexes for Ontario's Natural Gas Utilities," filed November 6, revised
November 20, 2007, ("PEG study').
[3] November 26 Technical Conference Transcript, Page 98, line 6 to page 102, line 5.

that the referenced article supported his decomposition of the TFP.[4] I have reviewed that article. I have concluded that while the article provides a decomposition of TFP into a technical change factor, an economies of scale factor and a factor that is the difference between the cost-elasticity weighted and revenue weighted output indices, it does not support the position that the difference between the two indices is related to average use. Instead, it reports that the difference between the two indices is related to whether the firm sets price equal to marginal cost for all goods. Thus, the difference between the two output indices is a measure of allocative efficiency and not average use. Therefore, it is my opinion that PEG is incorrect when it recommends using the AUF to allocate rate increases among rate classes.

2. Output Measures

Output measures are used to develop output indices and TFP estimates. These indices and estimates are used to determine the X-factor. In this proceeding, the number of customers, residential and commercial volumes, total volumes, and an index of pipe distance have been used as measures of output. In the November filings, EGD's consultants, Bernstein and Carpenter, developed a revenue weighted output index based on volumes. PEG developed TFP estimates based on the number of customers, total volumes and an index of pipe distance. I discuss each of these approaches below.

2a. Bernstein and Carpenter

Bernstein and Carpenter develop a revenue weighted output index using data from the 36 U.S. gas companies in the PEG study. Their output index uses data only from 1997 to 2003. The start date is dependent on public domain data from the U.S. Energy

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[4] November 26 Technical Conference Transcript, page 125, line 5 to Page 127, line 22.

Information Agency (EIA).[5] The EIA Form 176 data base provides volume, revenue and number of customers for customers that purchase not only transmission service but also their gas from their distribution company. These customers are called bundled customers. For the distribution only customers, the data base contains information only on volume and number of customer. The data are available for residential, commercial and several classes of industrial customers.[6] Bernstein and Carpenter combine the data for the several classes of industrial customers into an "other class" of customers.[7] The data are available for every distribution company in the PEG study.   Bernstein and Carpenter do not use 2004 data because of an apparent inconsistency between the revenue data and the PEG cost of gas.[8]

Missing from the data are prices and revenue by billing determinants. Therefore, the data does not provide revenue that could be used to determine the revenue weights associated with numbers of customers and volume by customer class. Instead, Bernstein and Carpenter develop a weighted output index using only volumes as outputs. They eliminate the use of the number of customers as outputs. Because the number of customers, in general, is growing faster than volumes, the elimination of the number of customers as an output reduces the rate of growth of the output index, and thereby

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[5] It is possible to obtain data for 1996 directly from the agency.

[6] http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_annual/historical/2001/pdf/figure_a01.pdf; http://www.eia.doe.gov/pub/oil_gas/natural_gas/applications/eia_176_query-system/current/mainusersguide_special.pdf.

[7] Enbridge's responses to question 1 and 3, filed in confidence with the Board on November 21, received electronically as a PDF file on November 22, and as an Excel file on November 27.

[8] Bernstein and Carpenter Report, footnote 15.

reduces the measured TFP and the X-factor, allowing rates to increase at a faster trend rate then if the number of customers had been retained as part of the output measure.[9]

To illustrate this process, I have constructed the following three tables. Table One is the basic data. The data were obtained from Table 7 of the PEG June 2007 report

Table One: Enbridge data for the years 2000-2005

year	residential customer	residential customer revenue	total residential volume	total res volume revenue	other customers	other customer revenue	other volume	other volume revenue	total revenue
2000	1,325,938	143.50	4,116	352.71	138,800	31.09	7,668	241.48	768.76
2001	1,377,459	164.82	4,185	339.55	141,580	34.50	7,467	247.62	786.49
2002	1,423,525	170.18	4,222	337.30	143,185	35.85	7,486	237.55	780.88
2003	1,476,603	176.28	4,512	365.92	145,413	42.82	7,698	238.58	823.61
2004	1,529,297	176.28	4,544	374.44	147,083	42.82	7,611	243.84	837.37
2005	1,575,322	211.75	4,598	376.98	149,394	43.76	7,526	249.16	881.65

and PEG's responses to interrogatories.[10] I divided the data for customers, volume and revenue for the sake of the illustration. The outputs are residential customers, residential volumes, other customers, and other volumes.

Table 2 shows the growth rates of each individual output, the revenue shares for each output and the revenue weighted output index. Note that the fastest growing average annual output growth rate. 3.45 percent is for residential customers and that the other customers growth rate is higher than the other volume growth rate.

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[9] Enbridge's responses to question 1 and 3, filed in confidence with the Board on November 21, received electronically as a PDF file on November 22, and as an Excel file on November 27.
[10] PEG Responses to EGD Interrogatory No. 2, and CCC/VECC Interrogatories Nos. 1, 2, 3 and 4.

year	residential customer growth rate	residential customer revenue share	residential volume growth rate	residential volume revenue share	other customer growth rate	other customer revenue share	other volume growth rate	other volume revenue share	revenue weighted output index
2000		18.67%		45.88%		4.04%		31.41%	1.0000
2001	3.81%	20.96%	1.66%	43.17%	1.98%	4.39%	-2.66%	31.48%	1.0075
2002	3.29%	21.79%	0.88%	43.19%	1.13%	4.59%	0.25%	30.42%	1.0198
2003	3.66%	21.40%	6.64%	44.43%	1.54%	5.20%	2.79%	28.97%	1.0678
2004	3.51%	21.05%	0.71%	44.72%	1.14%	5.11%	-1.14%	29.12%	1.0763
2005	2.97%	24.02%	1.18%	42.76%	1.56%	4.96%	-1.12%	28.26%	1.0864
avg. ann. growth rate	3.45%		2.21%		1.47%		-0.37%		1.66%

In Table Three, I use the Bernstein and Carpenter approach. I eliminate the number of customers from the revenue weighted output index. I combine the customer revenue with the volume revenue by customer class to determine the revenue weights. These changes result in a decrease in the revenue weighted output index to 1.31 percent from the 1.66 percent reported in Table Two. Moreover, the revenue weight is no longer consistent with the output variable. The revenue weight is constructed using volume and customer revenue instead of only volume revenue.

Table Three: The Bernstein and Carpenter Method for determining the revenue weighted output index.

year		residential revenue share	residential volume growth rate			other revenue share	other volume growth rate		revenue weighted output index
2000		64.55%				35.45%			1.0000
2001		64.13%	1.66%			35.87%	-2.66%		1.0012
2002		64.99%	0.88%			35.01%	0.25%		1.0078
2003		65.83%	6.64%			34.17%	2.79%		1.0628
2004		65.77%	0.71%			34.23%	-1.14%		1.0636
2005		66.78%	1.18%			33.22%	-1.12%		1.0679
avg. ann. growth rate			2.21%				-0.37%		1.31%

To show how my example uses the same technique as Bernstein and Carpenter used, it is necessary to drill down into their report in the following manner. Bernstein and Carpenter construct the revenue share weights by combining the EIA data with the

PEG data. First, they divide the total revenue associated with bundled customers into residential, commercial and other bundled revenue. Second, they determine the ratio of bundled revenue for each customer class to total revenue. Third, Bernstein and Carpenter multiply the class revenue ratio times the total cost of gas to determine the customer class cost of gas. Then they determine three distribution prices, one for each customer class, where the residential distribution price equals residential bundled revenue less the calculated residential cost of gas divided by residential bundled volumes. Note that this distribution price is not the volume or customer or volume rate. Rather it is a residual price (meaning a combination of everything left over after the cost of gas is removed from the equation) that is affected by the volume and customer rates. Next, the distribution price for each class is multiplied by the total volume (the sum of the distribution only and bundled volumes) for each class. Total revenue is the sum of those three class revenues just calculated, and the revenue share used to weight the outputs is the ratio of the calculated class revenue divided by the sum of the calculated class revenues.[11]

The Bernstein and Carpenter revenue weighted output index uses the three calculated revenue shares to sum the output growth rates of residential, commercial and other volumes. Thus, as in my example, the Bernstein and Carpenter output index is distorted because it uses only the volumes as outputs and its revenue shares are not consistent with the outputs. The revenue shares are the sum of the customer charge and volume revenue rather than being just the volume revenue shares.[12]

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[11] Bernstein and Carpenter Report, pages 13 to 15 (The report has two sets of page numbers. One set in the header and another at the bottom of the page. This reference refers to the page numbers in the header).
[12] In fact the revenue includes taxes and any fees collected on top of the retail rates.

Bernstein and Carpenter also report that the number of customers growth rate, 0.61 percent, is greater than their output growth, 0.08 percent.[13] Therefore, removing customers from the calculation of the growth rate reduces their output growth calculation. Moreover, the Bernstein and Carpenter customer growth rate is distorted due to the use of inconsistent revenue weights to sum the customer class growth rates. Bernstein and Carpenter used their residual combined revenue shares to weight the customer class growth rates instead of using customer revenue. Because volume revenue is relatively higher for other customers, the use of the residual combined revenue shares placed excessive weight on the other customer growth rate compared to a result that is based on customer revenue.

  2b. <u>The PEG Study</u>

  The PEG November studies introduce four additional estimates of the X-factor for each company. For Enbridge, the new estimates based on the geometric decay cost of capital are higher than the June estimates, and the new estimates based on cost-of-service cost of capital are lower than the June estimates. Compared to the range of X-factors that I calculated in Table 2 of my initial filing, the new PEG estimates for Enbridge are in the lower part of that range.[14] For Union, all four November estimates are higher than the June estimates. Compared to the range of X-factors that I calculated in Table 2 of my initial filing, the new PEG estimates for Union are in the middle of that range.

  The November PEG studies rely on a new econometric regression equation.   PEG added an output, the index of pipe distance, and combined the two previously separated

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[13] Bernstein and Carpenter Report, page 6 (The report has two sets of page numbers. One set in the header and another at the bottom of the page. This reference refers to the page numbers in the header)

[14] Evidence of Robert Loube on behalf of the Consumers Council of Canada, The Vulnerable Energy Consumers Coalition and The City of Kitchener, October 22, 2007, Table 2.

volume variables.[15] Using the results, PEG asserts that it is easier to establish peer

groups for Enbridge and Union. Based on the peer groups, it determines the industry

TFP. Because Enbridge and Union have different peer groups, the industry TFP assigned

to the two companies is different.[16]

At this point I do not have sufficient time or information to determine if the PEG

peer group analysis is proper. However, PEG then combines the industry TFP estimates

with company specific AUFs and Input Price Differentials (IPD).[17] This combination of

apples and oranges cannot generate reasonable results.   The company specific AUFs are

employed because revenue-weights for U.S. outputs cannot be determined for the

aggregated data. Company specific IPDs are used because PEG maintains that Canadian

price trends are significantly different from US industry input price trends. While it is

true that proper U.S. revenue weights cannot be computed, and it may be true the U.S.

industry price trends are different from Canadian price trends, those problems do not

justify the ad hoc combination of data from the different sources. For example, the

combination of an industry cost-elasticity weighted output growth rate with a company

specific AUF does not generate an industry revenue-weighted output growth rate.

3. <u>Average Use Factor</u>

The PEG study defines the average use factor to be the difference between the cost

elasticity weighted output growth rate and the revenue weighted output growth rate. The

PEG study uses the so-called average use factor to establish service specific price cap

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[15] PEG Study, Pages 99 to 105.

[16] PEG Study, Pages 44 to 52.

[17] The company specific AUFs are calculated on pages 54 to 58 of the PEG Study, and these company specific AUFs are combined with the other factors to determine the X-factor as shown on the summary table, Price Cap Index Details, PEG Study, page iv.

formulas. However, it has been shown that the difference between the two output growth

rates is eliminated when a company sets the price equal to the marginal cost for every

output.[18] This result is dependent on the fact that when price equals marginal cost, the

output elasticity also equals revenue for the product divided by the cost.

1. If Price equals marginal cost $P_j = \partial C/\partial Q_j$ and

2. Elasticity is defined as $\varepsilon = Q_j/C * \partial C/\partial Q_j$

3. Then Elasticity also equals $P_j Q_j/C$ and

4. The sum of the elasticities equals $\sum P_j Q_j/C$ or Revenue/C

    Which implies that

5. the elasticity weight equals the revenue weight because the elasticity

    weight is equal to $P_j Q_j/C/\sum P_j Q_j/C$ which equals the revenue weight, or

    $P_j Q_j/\sum P_j Q_j$.

These equations show that when price equals marginal cost, the two output growth rates

are equal. Thus, the difference in the output growth rates is a measure of allocative

efficiency rather than a measure of average use, and the difference between the two

output growth rates should not be used to determine service specific price cap formulas.

4. Conclusions

The review of the November filings shows that the Board should not rely on either

the Bernstein and Carpenter report or the PEG study to determine the IR formulas

because both the report and the study make a number of ad hoc calculations that bias their

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[18] Michael Denny, Melvyn Fuss, and Leonard Waverman, "The Measurement and Interpretation of Total
Factor Productivity in Regulated Industries with an Application to Canadian Telecommunications," in
Productivity Measurement in Regulated Industries, edited by Thomas G. Cowing and Rodney E.
Stevenson.

findings. The Bernstein and Carpenter report eliminates fast growing output variables and retains slow growing output variables, and therefore generates a bias that decreases measured output growth. If the Bernstein and Carpenter report had retained the number of customers as one of several outputs or had used the number of customers rather than volumes as the measure of output, then the calculated output index would have been higher than the output index used in the report. A higher and unbiased output index would have increased the measured TFP and increased the X-factor.

The PEG study combines industry data and company specific data. This combination generates X-factors that are inconsistent. The impact of the use of inconsistent data cannot be estimated at this time. However, given that PEG relies on the combination of inconsistent data to determine the X-factor, it is my opinion that PEG's recommendations cannot be relied on to establish a reasonable X-factor in this proceeding.

In addition, PEG's attempt to use the difference between the revenue-weighted output growth rate and the cost-elasticity-weighted output growth rate to establish service specific price cap formulas is improper. That difference measures only whether rates are equal to marginal cost. As it has previously been shown, the difference between the two output measures is not related to average usage by service class because it is not possible to determine service specific productivity growth rates.[19]

The difficulties in determining an appropriate and reasonable X-factor, as identified above, reinforce my recommendation that the Board adopt an earnings sharing mechanism and set the X-factor equal to the inflation rate.

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[19] Dr. Jeffrey Bernstein, Incentive Regulation, and X Factor Analysis: Implications for Ontario's Gas Utilities, Exhibit B, Tab 3, Schedule 3, August 1, 2007, pages 24-27.