Kai Millyard Associates

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August 24, 2015

Ms Kirsten Walli
Board Secretary
Ontario Energy Board
2300 Yonge Street, 27th floor
PO Box 2319
Toronto, ON
M4P 1E4

<u>RE: EB-2015-0049 & 0029 Transcript Undertakings</u>

Dear Ms Walli,

    Please find enclosed 2 copies of Transcript Undertakings JT3.2-3.9 from Mr Chernick given during the Technical Conference on August 17th.

    The responses were emailed to all parties and will be uploaded to the RESS.

    Sincerely,

(Mr.) Kai Millyard
Case Manager
Green Energy Coalition

ec: All parties

Green Energy Coalition

Undertaking of Mr Chernick

To Ms. DeMarco

Undertaking:

GEC to provide any and all additional sources that Mr. Chernick looked at to substantiate the 53.1 kilograms per MMBTU value that he cites the EIA report for

Response:

The following table provides seven such cites from four sources. Most of the estimates were stated in units other than Kg/MMBtu, so I converted the units using the factors shown at the bottom of the table. Note that the North American estimates are in the 52.9–53.2 Kg/MMBtu range, while the IPCC generic estimates are about 10% higher. Also, since this section of the testimony concerns the conversion of carbon prices from ¢/kWh of gas-fired generation to \$/m^3 of direct gas combustion, the exact emission rate for natural gas combustion does not change the results.

Natural Gas Emission Rates

Source	Emissions as Stated	Stated Units	Kg CO_2/ MMBtu	Link
US EIA			53.1	eia.gov/environment/emissions/co2_vol_mass.cfm
US EPA pipeline gas				
2013	14.46	MMT C/QBtu	53.0	epa.gov/climatechange/Downloads/ ghgemissions/
2003 (min est.)	14.44	MMT C/QBtu	52.9	US-GHG-Inventory-2015-Annex-2-
2000 (max est.)	14.47	MMT C/QBtu	53.1	Emissions-Fossil-Fuel-Combustion.pdf, Table A-38
Canada National Inventory Report 2014, for Ontario				
	1,879	g/m^3	53.2	unfccc.int/files/national_reports/annex_i_ghg_inventories/ national_inventories_submissions/application/zip/ can-2014-nir-11apr.zip, Table A8–1
2006 IPCC Guidelines for National Greenhouse Gas Inventories				
Low	54,300	kg CO_2/TJ	57.3	
Default	56,100	kg CO_2/TJ	59.2	ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/
High	58,300	kg CO_2/TJ	61.5	V2_2_Ch2_Stationary_Combustion.pdf, Table 2.2

Assumptions and conversions

3.67	gCO_2/gC
1,000	Btu/ft^3
35.3	ft^3/m^3
947.8	MMBtu/Tj

Green Energy Coalition

Undertaking of Mr Chernick

To Ms. DeMarco

Undertaking:

GEC to provide the actual conversion factor used from the Synapse short tons to metric tonnes.

Response:

The computation included 1.1023 short tons per metric tonne.

Green Energy Coalition

Undertaking of Mr Chernick

To Mr. Plagiannakos

Undertaking:

GEC to provide the standard deviation for the coefficient for 0.1502 on Figure 2.

Response:

The standard error of the 0.1502 coefficient is 0.004636, so the t-statistic is 32.4 and the 95% confidence interval is 0.1410 to 0.1593.
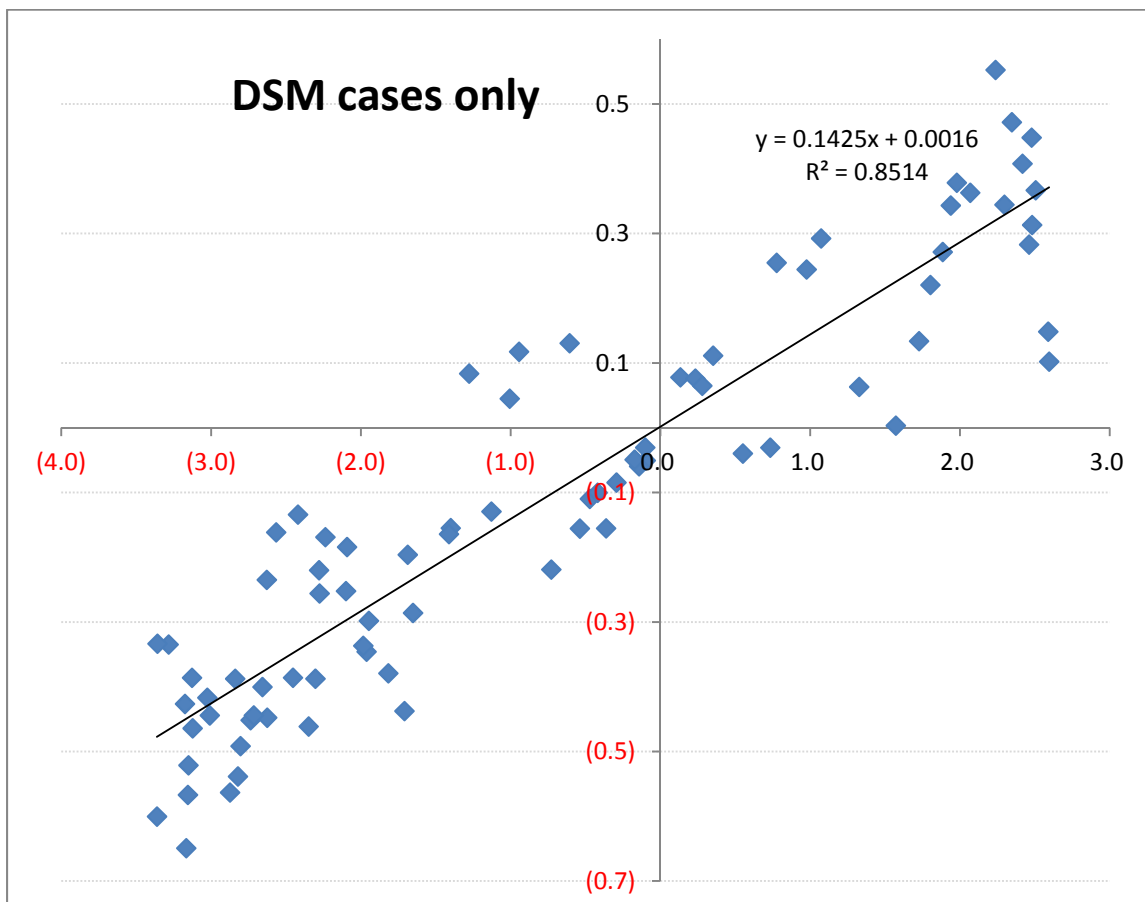
Green Energy Coalition

Undertaking of Mr Chernick

To Mr. Plagiannakos

Undertaking:

GEC TO RE-ESTIMATE THE EQUATION ON FIGURE 2 USING THE DSM-RELATED CASES.

Response:

The slope in this case is \$0.1425/MMBtu per quad, with an R^2 of 0.8514.

Green Energy Coalition

Undertaking of Mr Chernick

To Mr. Plagiannakos

Undertaking:

GEC to confirm 850-billion m^3 for North American gas consumption.

Response:

That is about the right scale. The US consumption is about 740 $10^9\,m^3$, Canada about 105 $10^9\,m^3$ and Ontario consumption is about 28 $10^9\,m^3$, or 3% of North American consumption.

Green Energy Coalition

Undertaking of Mr Chernick

To Mr. Plagiannakos

Undertaking:

GEC to calculate the elasticity compared to the average consumption and average price in all of those cases, so convert the 0.1502 value to inverse elasticity.

Response:

Using the average price and average US consumption level in all the cases used in the analysis, Mr. Chernick estimates an inverse elasticity of 0.76 for the percentage change in North American prices as a function of the percentage change in US consumption. Using the ratio of Mr. Plagiannokos's estimate of North American gas consumption to US consumption (about 1.147), the inverse elasticity would be about 0.87 as a function of the percentage change in North American consumption.

Green Energy Coalition

Undertaking of Mr Chernick

To Mr. Plagiannakos

Undertaking:

GEC to calculate the impact using the North American market.

Response:

Using this approach, a reduction of North American consumption by $10^9 \, \text{m}^3$ (about 3.5% of Ontario consumption) or about 0.118% would reduce the gas supply price by about $0.87 \times 0.118\% = 0.103\%$. For the average nominal Dawn price in ICF's gas price forecast for 2016–2031 (a sixteen-year life for a measure installed in 2016) is \$7.82/MMBtu in US dollars, or \$0.369/m^3 Canadian. The reduction in price would be \$0.000378/m^3 per $10^9 \, \text{m}^3$ saved. Multiplying that ratio by 28.2 $10^9 \, \text{m}^3$ consumed in Ontario would result in a DRIPE component for avoided cost of \$0.011/m^3 saved. This value is 40% greater than the estimate in Mr. Chernick's evidence, and would similarly increase line 2 of Mr. Neme's Table 3 by about 40%.

Green Energy Coalition

Undertaking of Mr Chernick

To Mr. O'Leary

Undertaking:

GEC to provide the number from quad to $10^9 m^3$ metres, the exchange rate or the conversion rate to Canadian dollars, and the inflation assumed.

Response:

The request is for the conversion from the DRIPE coefficient of $0.1502/MMBtu decrease in Henry Hub gas price for every quad decrease in annual gas consumption (in 2012 US dollars, from the 2014 AEO results), to $0.00027/$m^3$ per $10^9 m^3$ saved (in 2015 Canadian dollars). The conversion factors are as follows:

- Inflation of 3.6% from US 2012 dollars to US 2015 dollars.

- Currency exchange rate of 1.26 Canadian dollars per US dollar.

- 28.2 m^3/MMBtu and 28.2 $10^9 m^3$/quad.

To convert from US to Canadian units, one can multiply 1.036 for inflation and 1.26 for the currency conversion, and dividing by 28.2 twice (once for the unit in which price is measured and once for the size of the reduction). These computations result in $0.00025/$m^3$ per $10^9 m^3$ saved (in 2015 Canadian dollars); Mr. Chernick's original result of $0.00027/$m^3$ resulted from an error in converting from MMBtu to Gj to m^3. The difference is not material for the purpose of Mr. Chernick's evidence in this proceeding.