Q. **Reference: Regulated Activities Evidence**

A forecast conversion factor of 612 kWh/bbl is proposed for the 2013 Test Year. This forecast conversion factor results from a ten-year regression analysis of conversion factor versus Holyrood gross monthly average unit loading, with a station service factor of 6.6% applied to the gross energy production. Provide the detailed regression analysis used to derive the 2013 Test Year fuel conversion factor of 612 kWh per barrel. (Regulated Activities Evidence, page 2.46, lines 22 to 24)

A. To derive the 2015 Test Year fuel net conversion factor of 607 kWh/bbl, Hydro used the past five years and seven months of monthly operating data (June 2009 – December 2014) at the Holyrood generating station, i.e.:

i. Unit average gross loading (kW)
ii. Running fuel heating content (BTU/US gal)
iii. Fuel consumption rate (bbls/hour)

The data is attached as Table 1. A linear regression analysis was performed using Microsoft Excel in order to correlate gross average unit loading, fuel heating content and fuel consumption rate. The result of the regression analysis and an indication of the correlation are presented in Table 2 and Chart 1, respectively.

In 2015, Hydro is forecasting the average unit loading to be 109.57 MW while the unit is operating (on a net basis). The methodology and formulas that result in a net forecast fuel conversion rate of 607 kWh/bbl are also outlined in Table 2.

Table 1 (Part 1 of 2)
Holyrood Fuel Conversion Rate
Data Used in the Regression Analysis

Month	Year	Total Unit Operating Hours	Gross Average Unit Loading (kW)	Running Heat Content (BTU/US gal)	Gross Consumption Rate (bbl/Hr)
6	2009	200	71,091	154,143	116.4
7	2009	0	0	154,143	0.0
8	2009	0	0	154,143	0.0
9	2009	0	0	155,195	0.0
10	2009	644	75,298	154,237	117.0
11	2009	1440	75,700	155,105	115.0
12	2009	2032	78,024	154,415	118.6
1	2010	2107	81,906	152,392	128.3
2	2010	1549	82,415	152,868	127.2
3	2010	1803	75,749	151,918	120.0
4	2010	1247	76,985	151,798	121.6
5	2010	680	72,920	150,544	118.9
6[(1)]	2010	96	83,246	149,172	142.7
7	2010	0	0	0	0.0
8	2010	0	0	0	0.0
9[(1)]	2010	5	38,391	149,172	264.9
10	2010	666	70,184	150,011	113.6
11	2010	1303	73,847	152,752	115.4
12	2010	1727	74,294	152,722	119.3
1	2011	2,037	77,676	153,232	121.7
2	2011	2,000	85,344	153,401	131.9
3	2011	1,799	84,075	155,008	129.9
4	2011	1,205	75,640	156,505	117.2
5	2011	572	72,994	155,126	115.8
6	2011	247	71,342	153,958	113.9
7	2011	0	0	0	0.0
8	2011	0	0	0	0.0
9	2011	0	0	0	0.0
10	2011	659	71,770	153,824	111.5
11	2011	1,306	81,673	153,938	126.1
12	2011	2,040	80,565	154,179	122.6

Table 1 (Part 2 of 2)
Holyrood Fuel Conversion Rate
Data Used in the Regression Analysis

Month	Year	Total Unit Operating Hours	Gross Average Unit Loading (kW)	Running Heat Content (BTU/US gal)	Gross Consumption Rate (bbl/Hr)
1	2012	2,181	84,168	155,071	130.8
2	2012	1,893	85,815	155,043	131.6
3	2012	1,718	88,363	154,738	136.4
4	2012	848	82,420	154,956	129.2
5	2012	529	79,936	153,499	128.5
6	2012	275	80,683	153,380	128.7
7	2012	0	0	0	0.0
8	2012	0	0	115,076	0.0
9	2012	0	0	0	0.0
10	2012	423	68,480	153,380	111.5
11	2012	992	87,972	154,232	135.9
12	2012	1,823	92,417	154,699	145.2
1	2013	1,684	114,417	151,528	176.7
2	2013	1,344	116,354	152,966	180.1
3	2013	1,451	88,437	153,627	139.3
4	2013	1,147	83,883	153,192	134.1
5	2013	536	77,727	153,476	125.4
6	2013	373	73,148	153,388	122.6
7	2013	0	0	0	0.0
8	2013	0	0	0	0.0
9[(1)]	2013	30	67,479	153,123	0.0
10	2013	888	66,210	153,662	108.3
11	2013	1,421	79,103	153,368	124.2
12	2013	2,055	101,525	152,493	156.8
1	2014	2,052	93,026	150,413	152.0
2	2014	1,945	108,111	151,743	169.9
3	2014	2,194	98,353	150,900	153.5
4	2014	1,526	83,670	148,228	134.1
5	2014	1,021	84,570	149,898	137.8
6	2014	600	71,873	150,054	116.3
7	2014	631	69,459	148,672	117.6
8	2014	744	70,242	149,225	115.9
9	2014	758	70,269	152,233	119.6
10	2014	885	73,695	151,903	122.9
11	2014	1,408	86,013	150,550	138.8
12	2014	2,049	93,017	149,736	147.4

Note 1: June 2010, September 2010 and September 2013 removed from regression analysis as they were outliers.

Table 2 - Regression Analysis

2009-2014 Linear Regression (Gross)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.989472798
R Square	0.979056419
Adjusted R Square	0.978183769
Standard Error	2.402549111
Observations	51

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	12952.1706	6476.085298	1121.935816	5.07251E-41
Residual	48	277.0676271	5.772242232		
Total	50	13229.23822			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	167.8348449	27.73749326	6.050829586	2.09685E-07	112.0648768	223.6048129	112.0648768	223.604813
	0.00142118	3.0505E-05	46.58838007	1.28259E-41	0.001359845	0.001482514	0.001359845	0.00148251
	-0.00101164	0.000179773	-5.62730095	9.25211E-07	-0.001373097	-0.00065018	-0.0013731	-0.0006502

Calculation of 2015 Test Year Conversion Rate:

1	Unit net average loading (kW)	109,570	
2	Fuel Heating Content (BTU/US gal)	152,200	
3	Station Service Factor	6.56%	
4	Unit gross average loading (kW)	117,260	Line 1/(1-Line 3)
5	Coefficient 1	0.00142	(from regression equation)
6	Coefficient 2	-0.00101	(from regression equation)
7	Intercept	167.8348	(from regression equation)
8	Fuel consumption rate (bbls/hour)	180.51	Line 7 + (Line 4 x Line 5) + (Line 2 x Line 6)
9	Net fuel conversion factor (kWh/bbl)	**607**	Line 1/Line 8

Chart 1

Regression Correlation Chart (Revision 2)