

CANADA  
PROVINCE DE QUÉBEC  
DISTRICT DE MONTRÉAL

No: R- 4167-2021

RÉGIE DE L'ÉNERGIE

Demande du Transporteur de modification  
des tarifs et conditions des services de  
transport pour les années 2021 et 2022;

HYDRO-QUÉBEC  
Demanderesse

- et -

OPTION CONSOMMATEURS  
Intervenante

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\* Evidence-in-Chief of Option Consommateurs Part 1

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Dr. Roger Higgin  
Sustainable Planning Associates Inc.

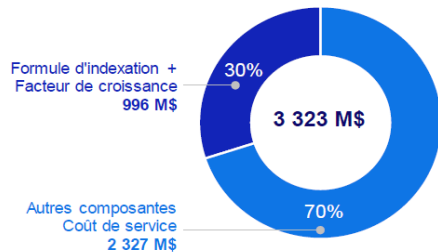
## Overview

- \* Review of Experts' Total Factor Productivity and Benchmarking Studies of February 2021
  - \* Summary of OC Memoire Key Points
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- \* Review of PEG Commentary on Brattle Studies & Brattle Response November 2021
  - \* Conclusions
- \* Note: OC has prepared Analysts Notes in support of this Presentation.

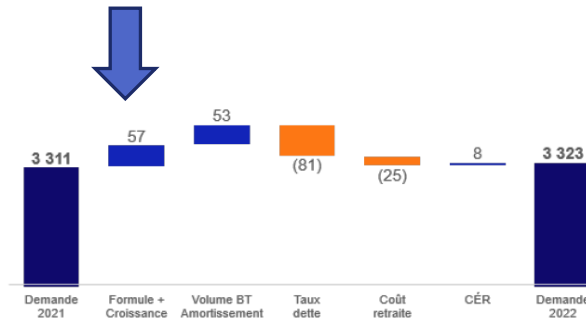
# \* Setting the 2022 MRI Parameters

## 2 Évolution des revenus requis 2021 à 2022

Revenus requis 2022



Évolution 2021 à 2022 – M\$



Source: B-0110 Page 4

The current HQT MRI Revenue Cap Index Formula applies to CNE is:

$$RR_{t+1} = (RR_t - Y_t - Z_t) \times (1 + I_t - (X + S)) + C_{t+1} + Y_{t+1} + Z_{t+1} + ER_{t-1}$$

Where:

$RR$  = CNE revenue requirement (revenus requis (\$))

$Y$  = exclusions (*exclusions* (\$))

$Z$  = exogenous factor (*éléments exogènes* (\$))

$I$  = inflation (%) (CPI-Québec and the average growth of weekly earnings (AWE(Québec)): ~64:36 weighting.

$X$  = productivity (*productivité* (%))  $X = 0.57\%$

$S$  = stretch factor (*dividende client* (%))

$C$  = growth factor (*croissance des activités*)

$ER$  = earnings sharing (*écarts de rendement* \$)

D-2019-060 R

## OC Memoire Key Points

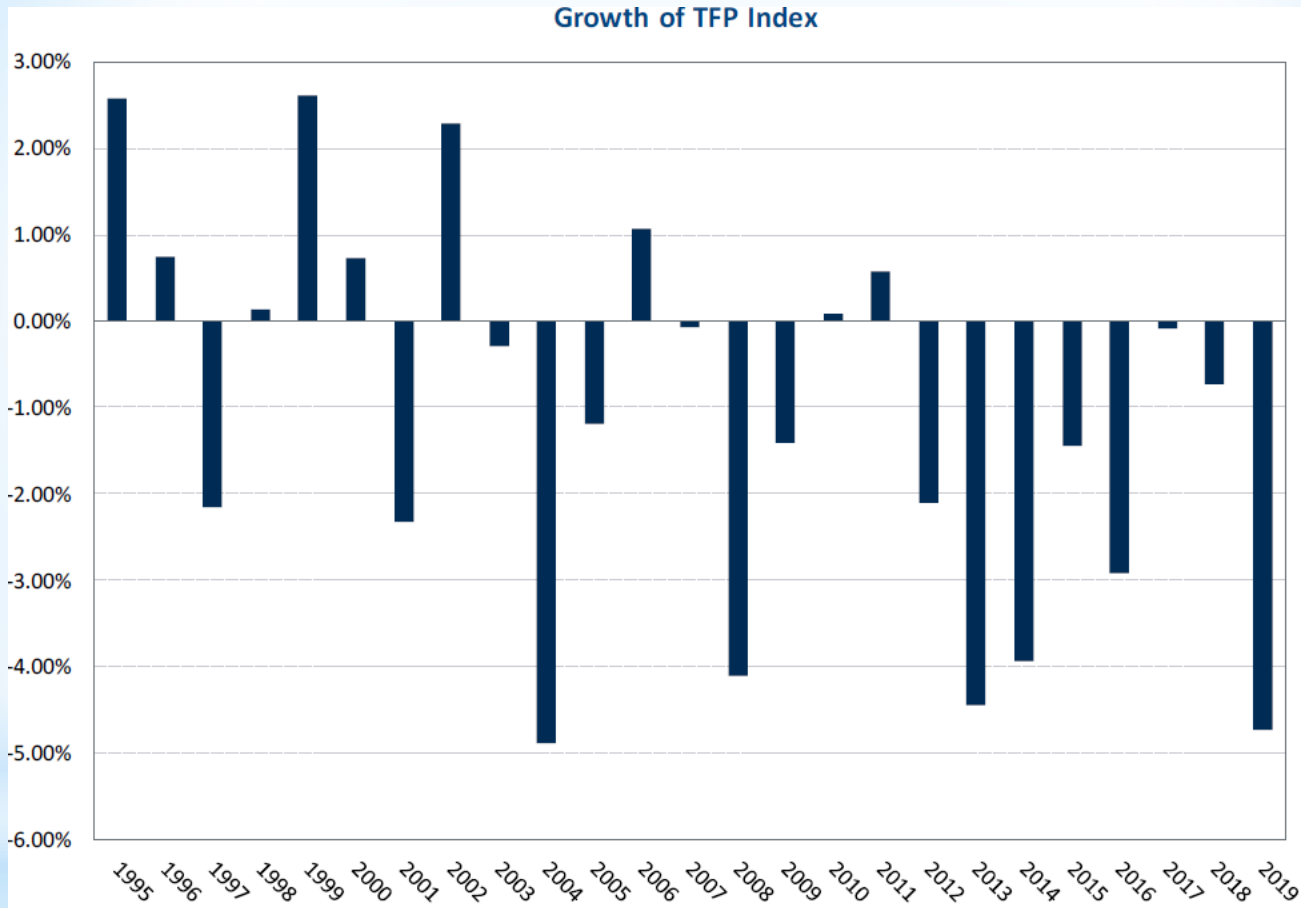
- \* Summary of Experts' Results
- \* Comment on Experts' Studies
- \* Discuss considerations for a future 2<sup>nd</sup> generation MRI

**\* Brattle and PEG Productivity and Benchmark Studies**  
**US Transmission Industry Sample-Results -February 2021**

Productivity	Brattle TFP	Brattle CNE	Brattle Capital	PEG TFP	PEG CNE	PEG Capital
2005-2019	-1.69%	-3.09%	-0.97%	-2.26%	-1.74%	-2.16%
Full Sample Period	-1.04%	<b>-3.38%</b>	-0.05%	-0.62%	<b>-0.68%</b>	-0.46%
Benchmarks to US Sample	Brattle Total Cost	Brattle CNE	Brattle Capital	PEG Total Cost	PEG CNE	PEG Capital
	<b>-4%</b>	-41%	8%	<b>67%</b>	121%	55%

Sources:  
 B-0012 Brattle Report  
 C-AQCIE/CIFQ -0050 PEG Commentary  
 Tables 1 & 2

## Brattle Graphic showing Growth of TFP Index for US TX Industry



Reference  
B-0080 HQT-10, Doc 5.1Page 8 OC IR 2.4

## \* OC Comments on Experts' Studies

### TX INDUSTRY PRODUCTIVITY GROWTH STUDIES [X-FACTOR]

- Considering how the different samples, sample periods, as well as the costs included by the experts differ, would assist the Régie to determine an appropriate 2022 X-factor for HQT.

### HQT BENCHMARKING STUDIES [S-FACTOR]

As summarized above, in the current case, the expert's econometric cost benchmarking models produce markedly different results;

- Brattle concluded that HQT is a relatively good performer compared to a US peer group ( $\pm 10\%$ ).
- However, PEG concluded that HQT Total Costs are 67% above its US peer group and is a relatively poor performer.
- The above econometric modelling results are so different, that OC wonders whether there could either be an error in the data each consultant included, in the base assumptions or in the specification of their models.

## \* Considerations for a Second Generation MRI

The following are some features that OC suggests may be considered for inclusion in an RCI formula and associated regulatory framework:

- Inflation Factor I
- X-Factor
- Inclusion of Capital
  - C-Factor (capital factor)
  - Scap (capital stretch factor)
  - Incremental Capital Module (ICM) or Additional Capital Module (ACM)
  - Capital in Service Variance Account (CIVSA)
- Growth Factor (G)
- Earnings Sharing Mechanism (ESM)
- Term of the Plan
- Off-ramps
- Z-factor

### Possible Second Generation MRI

$$RR_{t+1} = [(RR_t - Y_t - Z_t) \times (1 + (I_t - (X + S)))] + (C - \text{Scap}) + (G_{t+1}) + (Y_{t+1} + Z_{t+1} + ER_{t-1})$$

$RR$  = revenue requirement ((CNE+Capital) revenues requis (\$))

$Y$  = exclusions (*exclusions* (\$))

$Z$  = exogenous factors (*éléments exogènes* (\$))

$I$  = Input Price Index (%) (CPI-Québec and growth in) OR GDDPPI(Québec)/AWE

$X$  = productivity (*productivité* (%))

$C$  = Capital Factor (Capital Revenue Requirement)(+Capital In-Service Variation Account (CIVSVA)

Scap = capital stretch factor

$G$  = growth factor (*croissance des activités*)

$ER$  = earnings sharing mechanism (*écarts de rendement* (\$).)



# **Experts' Commentary and Reply Evidence**

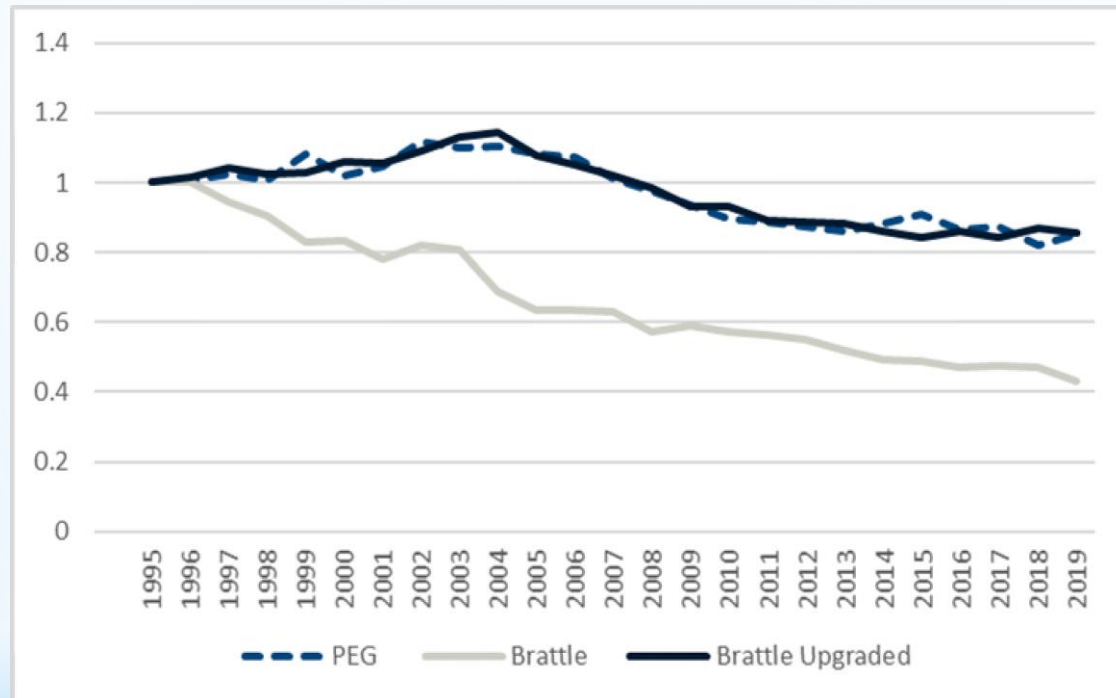
**November-December 2021**



# Summary of Experts Key Points

PEG Critical Points	Brattle Reply
Productivity Study of US TX Industry 1995-2019	Productivity Study of US TX Industry 1995-2019
<ul style="list-style-type: none"> <li>Brattle excludes certain OM&amp;A costs</li> <li>In particular, accounting for "Transmission by Others".</li> <li>Accounting for Structural Change- ISO Complications &amp; Costs</li> </ul>	<ul style="list-style-type: none"> <li>We include accounts 561, 565, and 566 in our productivity study, exclusion of these accounts results in upward bias in productivity</li> <li>FERC O&amp;M accounts specifically capture expenses re ISOs and RTOs. Accounts 575 and 576 are Regional Market Expenses accounts.</li> </ul>
<ul style="list-style-type: none"> <li>Exclusion of General Costs-Admin and General costs</li> </ul>	<ul style="list-style-type: none"> <li>Including Common costs does not change result for PFP CNE. Other Transmission costs are &gt; 50% of O&amp;M. Exclusion results in upward CNE bias.</li> </ul>
<ul style="list-style-type: none"> <li>Sampled Companies -data issues (6/71)</li> </ul>	<ul style="list-style-type: none"> <li>Excluding companies resulted in an upward bias, thus resulting in <u>higher</u> TFP and CNE growth see reply evidence Section II. A.</li> </ul>
<ul style="list-style-type: none"> <li>ROE same for all companies</li> </ul>	<ul style="list-style-type: none"> <li>Specific ROE used for each company</li> </ul>
<ul style="list-style-type: none"> <li>Benchmark Year -Capital Stock 1964</li> </ul>	<ul style="list-style-type: none"> <li>1988 - readily available data. Weighted average</li> </ul>
<ul style="list-style-type: none"> <li>Labour Price</li> </ul>	<ul style="list-style-type: none"> <li>Brattle revised with same Index. no impact on measured TFP or CNE growth,</li> </ul>
<ul style="list-style-type: none"> <li>One hoss shay for capital -service life sensitivity</li> </ul>	<ul style="list-style-type: none"> <li>Our use of one hoss shay results in materially <u>higher</u> TFP growth, CNE growth not affected by selection of one hoss shay vs. GD.</li> </ul>
<ul style="list-style-type: none"> <li>Output Variable-Ratcheted (monthly) peak demand</li> </ul>	<ul style="list-style-type: none"> <li>Using ratcheted peak demand artificially constrains the output growth to be no lower than zero</li> </ul>
Cost Benchmarking of HQT 2017-2019	Cost Benchmarking of HQT 2017-2019
<ul style="list-style-type: none"> <li>Brattle includes certain OM&amp;A costs</li> </ul>	<ul style="list-style-type: none"> <li>Brattle notes PEG's econometric cost-benchmarking study includes account 561 and account 566 but left 'transmission of electricity by others' out.</li> </ul>
<ul style="list-style-type: none"> <li>Sampled Companies- data issues (6/71)</li> </ul>	See above
<ul style="list-style-type: none"> <li>Benchmarking Sample Period</li> </ul>	See above
<ul style="list-style-type: none"> <li>Econometric Model Estimation Procedure-Fixed Effects ("FE") and Random Effects ("RE") estimators rather than OLS estimators</li> </ul>	<ul style="list-style-type: none"> <li>See reply evidence Section III. A. for full description of our opinion on this topic</li> <li>The FE estimator controls for HQT's unique factors. Statistical tests performed on our data confirm that a FE model is required and that pooled OLS would result in unreliable cost benchmarking.</li> </ul>
<ul style="list-style-type: none"> <li>Similar concerns to TFP Study. Input price; OHS -service life; output demand</li> </ul>	<ul style="list-style-type: none"> <li>See reply evidence pp. 40-42 and Table 15 for results of our cost benchmarking sensitivity analysis.</li> </ul>
<ul style="list-style-type: none"> <li>No secondary variables; forestation, construction cost index (per ClearSpring EA for Hydro One)</li> </ul>	<ul style="list-style-type: none"> <li>Unlikely that the score's for HQT and Hydro One are the same, thus further biasing the cost benchmarking analysis.</li> </ul>

## PEG Figure 2 Comparison of PEG-amended Brattle and PEG CNE Productivity Results



Source C-AQCIE-CIFQ 50 Page 38

## Brattle Revision of PEG’s Productivity Results

**Brattle Table 5 TFP Results–PEG Methodology on Brattle and PEGs Samples: B-0094 page 13**

Model	TFP Growth (1995 - 2019)	Growth of PFP O&M (1995 - 2019)	Growth of PFP Capital (1995-2019)
PEG Base Case with Brattle Companies (74)	1.22%	-0.94%	-0.72%
PEG Base Case with PEG companies(47)	-0.87%	-0.04%	-0.7%
Difference due to PEG sample selection bias	0.35%	0.98%	0.02%

**Brattle TABLE 8: Upward Bias in Measured Productivity from removal of (certain) O&M Accounts**

Model	TFP Growth (1995 - 2019)	Growth of PFP O&M (1995 - 2019)
Brattle Base Model	-1.04%	-3.38%
Removing Load Dispatching (Act: 561)	-0.90%	-2.98%
Removing Transmission by Others (Act: 565)	-0.64%	-2.32%
Removing Miscellaneous Transmission Expense (Act: 566)	-0.86%	-3.00%
Removing All Three Accounts	-0.34%	-1.20%

**Brattle shows the “upward bias” in PEG’s productivity study by removing certain FERC accounts**

Source: B-0094- page 15 Brattle TFP Model; Note: The “PEG Base Case” referenced in the table uses the Brattle TFP model with the sample of 47 companies that are common to the Brattle and PEG sample. It also includes the assumptions used by PEG to model productivity for the US sample-geometric decay for capital, output weights, exclusion of transmission accounts 561, 565, and 566, inclusion of share of A&G and general plant, ratcheted peak demand and asset service life

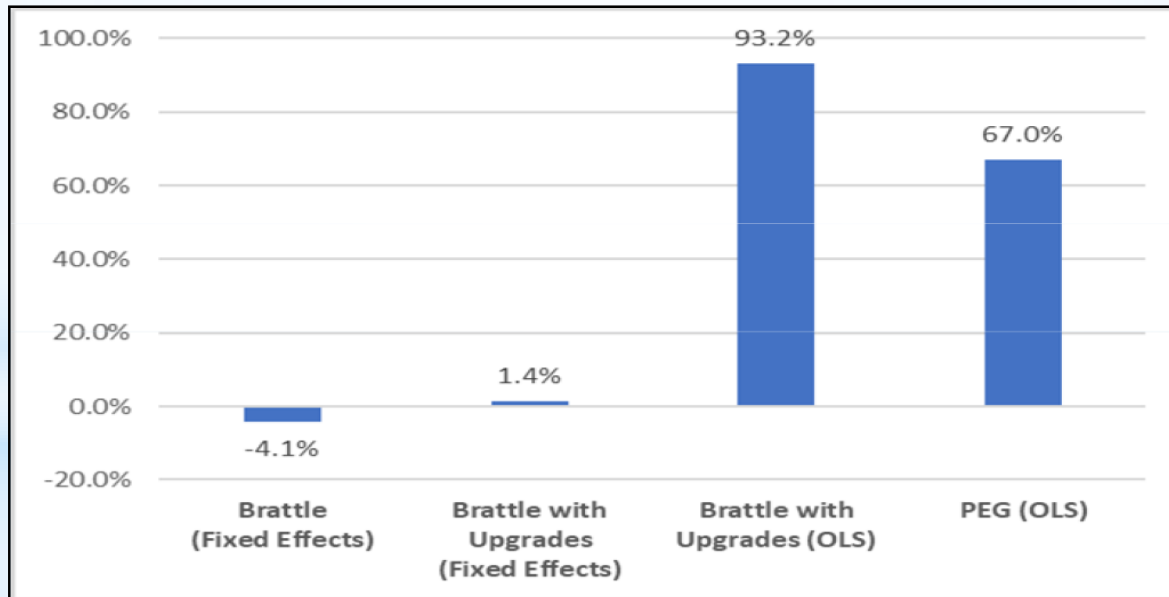
# PEG Revision of Brattle Benchmarking Results

PEG Table 11 C-AQCI-CIFQ –50 page 38

## PEG Summary of Alternative Econometric Benchmarking Results: Total Cost

Years	Remove 6 Companies with Bad Miscellaneous Transmission Expenses							
	Brattle		Upgraded Benchmark Year Adjustment (A)			(A)+Remove Transmission by Others		
	FE	RE	FE	RE	OLS	FE	RE	OLS
2001 - 2019	-1.7%	0.6%	-1.2%	0.7%	109.3%	-0.7%	0.9%	89.0%
2005 - 2019	-2.7%	-0.3%	-2.1%	-0.1%	109.3%	-0.4%	1.3%	90.2%
2010 - 2019	-5.8%	-3.3%	-4.8%	-2.7%	106.2%	-2.1%	-0.3%	88.6%
2017 - 2019	-3.8%	-0.5%	-3.2%	-0.4%	107.5%	1.4%	4.2%	93.2%

PEG Figure 3: PEG Comparison of Brattle and PEG Benchmarking Results: Total Cost



## Brattle Reply to PEG Benchmarking Results

TABLE 13: COMPARISON OF PEG'S BENCHMARKING RESULTS: OLS VS. FIXED-EFFECTS

	OLS			Fixed Effects		
	Total Costs	Capital Costs	O&M Costs	Total Costs	Capital Costs	O&M Costs
2008 - 2019	74.1%	61.3%	124.5%	-0.5%	-0.5%	-2.1%
2017 - 2019	67.4%	54.8%	121.1%	-7.1%	-8.2%	-1.1%

.Note: This analysis uses the same data and specifications as laid out by Brattle in the July report.

TABLE 14: BRATTLE COST-BENCHMARKING RESULTS USING OLS

	OLS			Fixed Effects		
	Total Costs	Capital Costs	O&M Costs	Total Costs	Capital Costs	O&M Costs
2001 - 2019	114.3%	118.3%	68.1%	-1.7%	-1.1%	-8.5%
2005 - 2019	114.4%	122.2%	57.7%	-2.8%	1.9%	-20.8%
2010 - 2019	111.4%	123.1%	43.5%	-6.0%	2.5%	-35.2%

Source B-0094 Brattle reply Evidence

## Brattle Reply to PEG Benchmarking Results (B-0094 page 30)

“ In its Report, PEG discussed unique features of HQT comparison with its U.S. counterparts. Among the unique HQT characteristics that PEG identified were:

- Being a crown corporation (p. 83) and having a unique corporate structure (p. 87);
- Transmission of large amounts of power over large distances has over the years encouraged HQT to use *unusual and innovative technologies* including 735 kV alternating current lines and high-voltage direct current line, new tower design, and remote monitoring systems (p. 85);
- Sizable lakes, rivers, cold winters throughout territory with postes sometimes housed in structures (p. 86);
- Special logistical challenges, many facilities are distant from good roads (p. 86);
- Extensive telecommunications network (p.85);
- HQT operating asynchronously from North America’s Eastern Interconnection (p. 85);
- Sizable portion of HQT’s access to transmission corridors achieved by easements (p. 85);
- Hard rock close to the surface, difficult to establish footing for structures (p. 86);
- Accounting idiosyncrasies (p. 88);
- A list of cost advantages including scale and scope economies, low borrowing rates, and no income taxes (pp. 86-87);

From the results presented in Brattle Table 13 and Table 14, it is evident that the **vast differences in conclusions by PEG and Brattle are driven primarily by the choice of estimators [emphasis added]**. The differences in conclusions are generally not driven by the underlying data, TFP assumptions, or methodologies”

## \* OC Comments on Experts Updated Commentaries and Reply

- OC suggests that the Experts' CNE Productivity results are very different due to differences in sample composition, inclusion/exclusion of certain FERC accounts, use of OHS vs GD for capital etc..
- OC also suggests that the Cost Benchmarking Results are totally different, due to the different methodologies and Models used by the Experts, resulting in very different S-Factor recommendations

OC summarizes the Experts results for the X-Factor, S-Factor for a 2022 CNE MRI RR<sup>1</sup>

MRI Indexation Formula 2021-2022						
Factor	HQT Brattle		PEG		Current MRI	
	Increase %	\$ Million	Increase %	\$ Million	Increase %	\$ Million
1. Costs under MRI (2021 base)	-	938.9	-	938.9	-	938.9
2. I-Factor $I_{(t)}$ *	2.22	20.8	2.22	20.8	2.2	20.8
3. X-Factor $X_{(t)}$	-3.38	31.73	-0.68	-6.38	0.57	-5.35
4. S-Factor $S_{(t)}$	0.10	-0.94	0.60	5.63	0.00	0.00
<b>[I-(X+S)] %</b>	<b>5.50</b>	<b>51.64</b>	<b>2.14</b>	<b>20.09</b>	<b>1.63</b>	<b>15.30</b>
<b>Sub Totals</b>		<b>990.54</b>		<b>958.99</b>		<b>954.20</b>
5. Growth Factor C **	0.58	5.45	0.58	5.45	0.58	5.45
Totals (%) & (RR (2022) )	<b>6.08</b>	<b>995.99</b>	<b>2.72</b>	<b>964.44</b>	<b>1.63</b>	<b>959.65</b>
*Based on C-0088 Regie Question 7 iii) Table 5						
**HQT Estimated C-Factor (D-2018-001)						

1. Calculation per OC Analysts' Notes

Sources:

C- AQCI-CIFQ 0050 PEG Commentary Table 10

HQT B-0094 Brattle Reply

R-4167-2021-B-0088 Response to Regie DDR No 2 Tables 3 and 5



## Resetting MRI Parameters for 2022

- Updating the Inflation Factor (I) for 2022 is a normal annual adjustment)
- Resetting the X-factor for 2022 is possible, based on the Experts suggested ranges.
- The decision could be informed by the recent productivity trend of HQT (If the Kahn approach is used). Some data are provided in AQCIE Preuve (C-AQCIE-CIFQ 0048). This leads AQCIE to recommend retaining the X-factor of 0.57, rather than the range recommended by PEG.
- Regarding the S-factor we have an Experts range of HQT 0.1%- AQCIE-CIFQ 0.6%

## Time frame for HQT MRI

- The Régie will consider if any update to the HQT MRI is appropriate for 2022. It will also consider whether rebasing rates in 2023, and an extension into 2024 is appropriate.

### References

Régie D-2018-001

Régie D-2019-060

[D-2017-043](#), Para. 166

[C-AQCIE-CIFQ-0048](#), pp. 18 and 21.

## \* OC Conclusions re 2022 MRI

The Expert's reach different conclusions on the Productivity trend of their US Transmission Industry samples, depending on which sample period is more relevant for HQT:

- Multi-factor Productivity trend
- Partial Productivity trend for CNE
- Partial Productivity trend for Capital
- The Experts' views on setting a CNE X-factor for 2022 range from -0.68% to -3.38%
- The Experts Cost Benchmark studies reach very different results. Experts' recommend an S-factor from -0.1% to 0.6%+
- Experts do not support including Capital until possibly in a future 2<sup>nd</sup> Generation MRI

## \* OC Conclusions (continued)

For a 2022 RCI Formula applied to CNE:

- Options are to reset the MRI Formula with one of the following 3 options:
  1. The HQT/Brattle recommendations for an X-factor of -3.38% and S-factor of 0.1%
  2. The PEG recommendations for an X-factor of -0.68% and S-factor of 0.6%+
  3. Continue the current MRI with an X-Factor of 0.57%
- *OC calculates<sup>3</sup> the respective 2022 [(I-X+S)] MRI Revenue Requirements based on 2021 base of \$938.9 million:*
  - (1) \$990.5 million;
  - (2) \$959 million;
  - (3) \$954.2 million
- *OC also calculates the respective 2022 [(I-X+S)+C] MRI Revenue Requirements, including the C-factor, to be:*
  1. \$996 million; (The 2022 RR increase of \$57 million on HQT Presentation slide 4)
  2. \$964.4 million
  3. \$959.8 million

### Possible Comprehensive MRI for 2024

- For a Comprehensive MRI, applied to both CNE and Capital, the Experts recommend an X-Factor between **negative 1.04 to negative 0.62%**. The mid-range is negative 0.88. (This assumes all Capital is Indexed).

From our limited review of the HQT Capex spending pattern, we cannot conclude whether indexing some capital e.g. projects below \$25 million or below \$65 million, in a second generation IRM for HQT, is appropriate, or not.

3. Calculations per Analyst's Notes

*Thank you for your attention*