Le 31 mars 2017 N<sup>0</sup> de dossier : R-3897-2014 Réponses de l'AQCIE-CIFQ à la demande de renseignements n<sup>0</sup>2 de HQDT Page 1 de 4

### RÉPONSES À LA DEMANDE DE RENSEIGNEMENTS N° 2 DE HQDT À AQCIE-CIFQ RELATIVE À LA DEMANDE D'ÉTABLISSEMENT D'UN MÉCANISME DE RÉGLEMENTATION INCITATIVE ASSURANT LA RÉALISATION DE GAINS D'EFFICIENCE PAR LE DISTRIBUTEUR D'ÉLECTRICITÉ ET LE TRANSPORTEUR D'ÉLECTRICITÉ

### 1. Préambule :

## i) C-AQCIE-CIFQ-0107 Mémoire p. 1-155

PEG has submitted a 155-page document in its "Revised HQ Draft 24 February 2017".

## 1.1 Please provide all the changes from the original 131-page PEG report dated October 26, 2015.

#### 1.1 Réponse de l'AQCIE/CIFQ :

Please see **Attachment HQDT2-AQCIE-1.1** for a version of PEG's report showing changes between the October 26, 2015 report (corrected as per feb 2<sup>nd</sup> 2016 version, C-AQCIE-CIFQ-0046) and the February 24, 2017 report.

#### 2. Préambule :

## i) C-AQCIE-CIFQ-0107 Mémoire p. 122-123

"The size and complexity of HQT's transmission system is enormous. However, these features do not make its capex (or any other cost) more variable. If anything, the opposite is the case.

Challenging climatic conditions and remote generating sites affect HQT's cost *level* more than its cost *growth*.

· · · •

Québec's grid lies at the "end of the line," and there is no need for major new projects to send power flows across it."

#### 2.1 Please provide the analytical support for each of these statements.

## 2.1 Réponse de l'AQCIE/CIFQ :

Dr. Lowry believes these statements to be self-evident but provides the following supplemental commentary.

"The size and complexity of HQT's transmission system is enormous. However, these features do not make its capex (or any other cost) more variable. If anything, the opposite is the case."

The larger and more complex a transmission (or distribution) system, the less likely it is that capex will be unusually high relative to the depreciation and revenue cap index growth that is available to finance it. Consider, for example, that transmission substations must occasionally be replaced. In a small transmission system with only one substation, cost would rise markedly if the substation were replaced (and would tend to grow relatively slowly between replacements). A large transmission system with 60 substations would, in contrast, be highly unlikely to replace *all* substations in the same year. Furthermore, there is a greater chance that at least one substation would need replacement in a given five year period.

# Challenging climatic conditions and remote generating sites affect HQT's cost *level* more than its cost *growth*.

Productivity growth is typically affected more by *changes* in business conditions that drive cost growth than it is by stable business conditions that drive cost levels. The classic mathematical decomposition of sources of productivity growth by Denny, Fuss, and Waverman makes this point clearly.<sup>1</sup> Thus, for example, a transmission system in a forested region is likely to have higher cost but this has little effect on the productivity *trend* because the extent of forestation changes only gradually. Similarly, cost is probably higher in a zone of severe winter weather. Unless the severity of winter weather increases materially, however, this does not affect productivity *growth* in a five year period

# Québec's grid lies at the "end of the line," and there is no need for major new projects to send power flows across it."

Hydro-Quebec's transmission system is chiefly designed to carry power from hydroelectric power generation facilities in Quebec and Labrador to markets in Quebec and the United States. Some deliveries are also made to Ontario. Relatively little power is wheeled *across* the system between Ontario and Labrador or the States. In contrast, a number of U.S. transmission utilities have been compelled in the last decade to make large investments in facilities to wheel power so as to improve the functioning of bulk power markets or bring renewable resources to load centers.

## 3. Préambule :

#### i) C-AQCIE-CIFQ-0107 Mémoire p. 123, ligne 23

"Indexed ARMs have already been studied by transmission owners in Ontario."

- 3.1 Please provide copies or links to any available studies by transmission owners in Ontario referenced in this statement.
- **3.2** Please indicate if Dr. Lowry is aware if an ARM has been implemented by any North American company for whom regulated transmission is its sole business? If so, please indicate the company name and date of the program.

## 3.1 Réponse de l'AQCIE/CIFQ :

In a 1997 White Paper on electric industry restructuring, Ontario's government stated its preference for a "performance-based approach to regulation in the wires sector in order to economically encourage efficiencies and keep prices competitive". The Ontario Energy Board soon after commenced incentive regulation for jurisdictional power distributors (as well as a natural gas distributor, Union Gas). These plans featured price cap indexes based on industry productivity research.

Ontario Hydro was restructured in the late 1990s under the terms of the Energy Competition Act. Its transmission and distribution services were placed in a company initially called Ontario Hydro Services Company ("OHSC") and later renamed Hydro One. This company provides most transmission services in Ontario --- a vast region that includes many communities and hydroelectric generating stations on the Canadian Shield.

<sup>&</sup>lt;sup>1</sup> Denny, Michael, Melvyn A. Fuss and Leonard Waverman, 1981. "The Measurement and Interpretation of Total Factor Productivity in Regulated Industries, with an Application to Canadian Telecommunications," in Thomas Cowing and Rodney Stevenson, eds., *Productivity Measurement in Regulated Industries*, (Academic Press, New York) pages 172-218.

## Le 31 mars 2017 N<sup>0</sup> de dossier : R-3897-2014 Réponses de l'AQCIE-CIFQ à la demande de renseignements n<sup>0</sup>2 de HQDT Page 3 de 4

OHSC proposed an incentive regulation mechanism in a 1998 filing which we provide as **Attachment HQDT2-AQCIE-3.1**. The company proposed to escalate rates established in a rate case for one year using a "performance-based regulation (PBR)" framework. The framework featured a revenue cap index with a formula

$$R_t = R_{t-1} (1 + I - X + GAF) + Z$$

where

I = Inflation Factor
X = Productivity Factor
GAF = Growth Adjustment Factor
Z = Z Factor

The proposed inflation index was the Ontario consumer price index. The Company proposed that the X factor reflect the insufficiency of I and the GAF to fund its forecasted revenue requirement but acknowledged that in future plans X might be based on productivity research. The proposed GAF was the annual weather-corrected growth in the forecasted system peak demand for power in the province.

Appendix J of the OHSC proposal contains a general discussion of PBR for the Company's transmission business. It includes the following statement about the benefits of the revenue cap approach to PBR.

- provides operational efficiency incentives to minimize costs and improve productivity
- shares the benefits of efficiency gains between customers and shareholders
- does not encourage "goldplating" or over investment in capital
- provides incentives to take risks and be innovative
- not as complex, costly and time consuming as Cost of Service regulation
- provides better revenue and financial stability than a Price Cap
- more compatible with energy efficiency objectives than a Price Cap
- provides more pricing flexibility<sup>2</sup>

This Appendix also provides a discussion of precedents for power transmission PBR.

Jurisdictions where competition has been introduced in the electricity industry and PBR has been selected to regulate vertically unbundled electrical transmission companies include England and Wales, Scotland, and Australia. It has also been used in Norway, and California to regulate electrical transmission and distribution which is bundled together. The form and components of the PBR in these jurisdictions are summarized in the table J-1 below.

The preferred form in all jurisdictions where transmission has been unbundled is a Revenue Cap.<sup>3</sup>

<sup>&</sup>lt;sup>2</sup> Ontario Hydro Services Company, *Preparing for Open Access*, Transmission Rate Order Application to the Ontario Energy Board, 1999-2000, p. 107. Provided as Attachment HQDT2-AQCIE-3.1.

<sup>&</sup>lt;sup>3</sup> *Ibid*, pp. 108-109.

Table J-1 PBR for Transmission in Other Jurisdictions

UK         Revenue Cap         Transmission         4 years         4 years         4 years         4 wet in explanations           Criticual         R <sub>2</sub> = R <sub>1</sub> (1+PF)X, where R=Revenue         (ever Tx connoction         198-2001         (etail price         planuing & operating standards, accurity, availability, of exciso.           Criticual         R <sub>2</sub> = R <sub>1</sub> (1+PF)X, where R=Revenue         (exclution)         5 years         1%         R <sup>2</sup> planuing & operating standards, accurity, availability, and quality of service.           Scottah         P <sub>1</sub> = P <sub>1</sub> (1+PF)X), where P=avg, Price/Wn, kWh =         1994-1998         1%         R <sup>2</sup> planuing & operating standards, accurity, availability, and quality of service.           Scottah         P <sub>1</sub> = P <sub>1</sub> (1+PF)X), where P=avg, Price/Wn, kWh =         1995-2000         1995-2000         1995-2000         1995-2000           Victoria         P <sub>1</sub> = P <sub>1</sub> (1+CF)X), where P=avg, Price/Wn, kWh =         Transmission         5 years         1796         CPI         tax changes operating standards, reporting standards, reporting standards, reporting a design standards, reporting a design standards, reporting R design standa	Company &	PBR Type	Scope	Duration	Duration X-Factor Offset	Inflation	Z Factor	Service Quality Safeguards
R <sub>i</sub> = R <sub>i</sub> (1+RP1-X), where R=Revenue (additional incertive scheme for losses)         excluded)         index)         index)           (Growth accounted for in calculation of X)         (frowth accounted for in calculation of X)         Transmission         5 years         1%         RPI           Revenue Cap         (rowth accounted for in calculation of X)         Transmission         5 years         1%         RPI           P <sub>1</sub> = P <sub>11</sub> (1+RP1-X), where P=avarage Price/KW1, KW1 = predetermined energy delivered, not actual         Transmission         5 years         1.79%         CPI         tax changes           a         Revenue Cap         (rew Tx excluded)         1995-2000         1995-2000         1.79%         CPI         tax changes           a         Revenue Cap         Transmission         3 years         1.79%         CPI         tax changes           a         Revenue Cap         Transmission         3 years         3 %         CPI         tax changes           a         Revenue Cap         Transmission         3 years         3 %         CPI         tax changes           a         Revenue Cap         Transmission         3 years         3 %         CPI         tax changes           a         Revenue Cap         Transmission         3 years         2 %         CP	UK National	Revenue Cap		4 years 1998-2001	4%	RPI (retail price	not explicit	planning & operating standards, report on system security, availability,
	Grid Co	$\mathbb{R}_{q} = \mathbb{R}_{q-1}$ (1+RP1-X), where $\mathbb{R}$ =Revenue (additional incentive scheme for losses) (Growth accounted for in calculation of X)				index)		and quality of service
P1 P1 hulter prodetermined energy delivered, not actual prodetermined energy delivered, not actual prodetermined energy delivered, not actual Revenue CapCPI Transmissiontwo controction Syears1.79% 1.79%CPI tax changesaRevenue Cap kW = predetermined peak demand, not actual kW = projected kwh/*(CPL-X)) + (nergy feamed energy frice/kw, kW = projected kwh/*(CPL-X)) +1997-1999 3%3% SyearsCPI tax changesaRevenue Cap (rew Tx excluded)1997-1999 1997-19993% SyearsCPI tax changesbRevenue Cap (rew Tx excluded)1997-1999 1997-19993% SyearsCPI tax changescRevenue Cap (reu up for actual Akwh2) where Revenue, Akwh = predetermined % growth Revenue, Akwh = predetermined % growth Reference, Akwh = predetermined % growth Rate Cap5 years Syears2% SyearsCPI tax changesaRate Cap Rate CapSystribution 1997-20011997-2001 	Scotland	Revenue Cap	Transmission	5years	1%	RPI		plauning & operating standards,
where P=average Price/KWh, KWh =where P=average Price/KWh, KWh =prodetermined energy delivered, not actualTransmission5years1.79%CPItax changesa Revenue Cap $P_1 + P_{11} + P_{11} + P_{12} + P_{$	Power	$P_t = P_{t+1}$ (1+RPL-X),	Oluce Coll	0001-1001			-	and quality of service
a         Revenue Cap         Transmission         Systems         1.79%         CPI         tax changes           et $P_1 = P_{1,1} (1+CP1-X)$ , where $P=avg$ . Price/kw, kW = predetermined peak domand, not actual         Transmission         1995-2000         1995-2000         tax changes           a         Revenue Cap         Transmission         3years         3%         CPI         tax changes           a         Revenue Cap         Transmission         3years         3%         CPI         tax changes           a         Revenue Cap         Transmission         3years         3%         CPI         tax changes           fd         charge*Projected kwh)*(CPL-X))+         Transmission and         5 years         2%         CPI            SF         Revenue Cap         Transmission and         5 years         2%         CPI             SF         Revenue, Akwh = predetermined % growth         1997-2001         1997-2001         1977-2001               Rate Cap         Rate Cap         State         5 years         12% 97         CPI         Nine criteria           ti         Rate Cap         In on-stual Akwh after 5 years         1997-2001         1.4% 98		where P=average Price/kWh, kWh = predetermined energy delivered, not actual						
et       P <sub>1</sub> = P <sub>11</sub> (1+CPI-X), where P=avg. Price/kw, kW = predetermined peak demand, not actual at Revenue Cap       1995-2000         at Revenue Cap       Revenue Cap       3%       CPI         at Revenue Cap       Transmission       3% ars       3%       CPI         at Revenue Cap       Transmission       3% ars       3%       CPI         at Revenue Cap       Transmission       3% ars       3%       CPI         Revenue Cap       Transmission and Gharge*Projected kw)*(CPL-X)) +       Transmission and 5 years       2% cPI       CPI         St       Revenue Cap       Distribution       1997-2001       2% cPI       CPI       Nine criteria         Revenue, dxwh = predetermined % growth       Exercence, dxwh after 5 years       2% cPI       Nine criteria         Rate Cap       Rate Cap       5 years       1.997-2001       1.4% 98       CPI       Nine criteria         Rate Cap       Rate, (1+CPL-X) ±Z       (non-generation)       1997-2001       1.4% 98       CPI       Nine criteria	Australia	Revenue Cap	Transmission	Syears	1.79%	CPI	tax changes	operating & design standards
et P <sub>1</sub> = P <sub>11</sub> (1+CP1-X), where P=avg. Frice/Kw, kW = predetermined peak demand, not actual a Revenue Cap Refifixed charge*Projected kwh*(CP1-X))+ (energy the fifteed charge*Projected kwh*(CP1-X))+ (demand charge*Projected kwh*(CP1-X))+ Revenue Cap Revenue	Victoria		(new Tx excluded)	1995-2000				
a     Revenue Cap     3%     CPI       a     Revenue Cap     Transmission     3%     CPI       b     F(fixed charge*(CPI-X))+ (energy     1997-1999     3%     CPI       charge*projected kwh)*(CPL-X))+     Transmission and     5 years     2%     CPI       SF     Revenue Cap     Distribution     1997-2001     2%     CPI       SF     Revenue Cap     Distribution     1997-2001     2%     CPI       Revenue Cap     Revenue Cap     Distribution     1997-2001     2%     CPI       Revenue. Akwh = predetermined % growth     Incl. Iosses)     1997-2001     1.9% 97     CPI       Rate Cap     Rate Cap     States.1 (1+CPI-X) ±Z     fuon-generation)     1997-2001     1.4% 98       Rate Cap     Rate, I (1+CPI-X) ±Z     (non-generation)     1997-2001     1.4% 98	PowerNet	Pt = Pt1 (1+CPI-X), where P=avg. Price/kw,						
an Anoverance cup     Transmission and charge*(CPI-X))+ (energy     Transmission and charge*(CPI-X))+ (energy       (demand charge*Projected kwh)*(CPL-X))+     Transmission and charge*Projected kwh)*(CPL-X))+     Transmission and charge*Projected kwh)*(CPL-X))       SF     Revenue Cap     Distribution     1997-1999       SF     Revenue Cap     Transmission and charge*Projected kwh2) where     5 years       R     Revenue Cap     Distribution     1997-2001       R     Revenue. Akwh = predetermined % growth     1997-2001     1.4% 98       Rate Cap     Rate Cap     1.997-2001     1.4% 98       Rate Cap     Rate, 1(1+CPL-X) ±Z     (non-generation)     1.997-2001		KW - predetriging peak definition, not actual		lugare	30%	CPI		onerating & decign standards
R= {fixed charge*(CPI - X)} + {(energy)     R= {fixed charge*(CPI - X)} + {(energy)       Id     charge*projected kwh*(CPL-X)}     Fransmission and       SF     Revenue Cap     Syears       Revenue. Cap     Distribution     1997-2001       Ref=Revenue. Akwh = predetermined % growth     1997-2001     2%       Rate Cap     Rate Cap     1997-2001       Rate Cap     Rate, (1+CPL-X) + Z     (non-generation)       Rate Cap     8 (non-generation)     1997-2001	New South			1997-1999	2			on more reference as ferroused as
Id     churge*projected kwh*(CPL-X))+       Revenue Cap     (demand charge*Projected kw)*(CPL-X))       SF     Revenue Cap       Revenue Cap     Distribution       SF     Revenue. Akwh = predetermined % growth       Reservenue. Akwh = predetermined % growth     1997-2001       Rate Cap     Rate Cap       Rate Cap     Kon-interview       Rate Cap     Spears       Rate Cap     Rate, (1+CPL-X) ±Z	Wales)	R={fixed charge*(CPI -X)}+ (energy						
Revenue Cap     Transmission and     5 years     2%     CPI       R_a R_av(1+RPI)(1-X)(1+Akwh2)     Distribution     1997-2001     1997-2001     R       R=Revenue, Akwh = predetermined % growth     in energy, true up for actual Akwh after 5 years     1.2% 97     CPI     Nine criteria       Rate Cap     & EDistribution     1997-2001     1.4% 98     for Z. factors       Rate(ap)     Rate(1+CPI-X) ±Z     (non-generation)     1.997-2001     1.4% 98	Р	charge*projected kwh)*(CPL-X)}+ (demand charge*Projected kw)*(CPL-X)}						
$ \begin{array}{c c} R_{t} = R_{t,t}(1+RP)(1-X\chi) + \Delta kwh2) & \text{where} & (incl. losses) \\ R=Revenue, \Delta kwh = predetermined % growth \\ in energy, true up for actual \Delta kwh after 5 years \\ Rate Cap \\ Rate Cap \\ Rate_{=} Rate_{t,t} (1+CP1-X) \pm Z \\ Rate_{=} Rate_{t,t} (1+CP1-X) \pm Z \\ \end{array} $	Norway	Revenue Cap	Transmission and	5 years	2%	CPI		None but considering: technical
R=Revenue, Akwh = predetermined % growth in energy, true up for actual Akwh after 5 years     East 1.2% 97     CPI     Nine criteria       Rate Cap     & Distribution     1997-2001     1.4% 98     for Z factors       Rate= Rate, (1+CPLX) ±Z     (non-generation)     1997-2001     1.6% (99-	Statnett SP	R. = R., (1+RPD(1-X)(1+Akwh/2) where	(incl. losses)	1007-1661				for undelivered energy, & contracts
in energy, true up for actual ∆kwh after 5 years Rate Cap & CPI Nine criteria & Syears 1.2% 97 CPI Nine criteria & & Distribution 1997-2001 1.4% 98 [for Z factors Rate_rate_rate_rate_rate_rate_rate_rate_r		R=Revenue, Akwh = predetermined % growth						specifying quality
Rate Cap         Transmission         5 years         1.2% 97         CPI         Nine criteria           Rate_Rate_at (1+CPLX) ±Z         (non-generation)         1997-2001         1.4% 98         for Z factors           Rate_Rate_at (1+CPLX) ±Z         (non-generation)         1.997-2001         1.6% (99-         for Z factors		in energy, true up for actual Akwh after 5 years						
Rate= Rate, (1+CPI-X) ±Z (non-generation) 1.6% (99- to 2001)	USA		Transmission & Distribution	5 years	1.2% 97 1.4% 98	CPI	Nine criteria for 7. factors	financial rewards & penalties for: relisbility (duration & frequency)
to 2001)	California		(non-generation)		1.6% (99-			customer satisfaction, and health &
	Edison				to 2001)			safety

HON continued research and deliberations on PBR for power transmission for several years. From 2000 to 2003, Pacific Economics Group was their advisor and did extensive work to calculate transmission productivity trends and develop plan design options. Our work included several reports, but these are not to our knowledge in the public domain. A draft PBR proposal was nearly finalized which featured a price cap index. We recollect that the plan was never formally proposed due to changed circumstances.

#### Réponses de l'AQCIE-CIFQ à la demande de renseignements n<sup>0</sup>2 de HQDT Page 4 de 4

Le 31 mars 2017

N<sup>0</sup> de dossier : R-3897-2014