Témoignage du
Dr Metin Celebi de The Brattle Group

BEFORE THE
QUEBEC ENERGY BOARD

QUÉBEC RÉGIE DE L'ÉNERGIE

Parties: Hydro-Québec, Applicant **File Number: R-3888-2014 – PHASE 2B**

and

Interveners

APPLICATION FOR APPROVAL OF HQT'S NETWORK UPGRADE POLICY, PHASE 2B

PREPARED DIRECT TESTIMONY

OF

METIN CELEBI, PH.D.

On behalf of

HYDRO-QUÉBEC TRANS-ÉNERGIE

March 7, 2019

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state your name and qualifications.

A. My name is Metin Celebi. I am a Principal of The Brattle Group, an economic and management consulting firm with offices in Boston, Massachusetts; Washington, DC; San Francisco, California, New York, New York; London, England; Rome, Italy; Madrid, Spain; Toronto, Canada; Sydney, Australia; and Brussels, Belgium.

I hold a Ph.D. in Economics from Boston College, where my dissertation was on transmission investment, pricing, and power system modeling, a Masters in Economics from Bilkent University in Ankara, Turkey, and a Bachelor of Science in Industrial Engineering from Middle East Technical University (METU) in Ankara, Turkey. Further details regarding my background, publications, and prior expert testimony are provided in my résumé.

For about twenty years, I have been employed as a consultant in the electric power industry. My expertise in energy regulations includes transmission system planning and operations, cost allocation, resource planning, economic viability of coal plants, and wholesale power market operations and analyses. I have recently consulted clients through studies on implications of implementing marginal losses in nodal energy price calculations, projected transmission service charges, long-term transmission investment needs, and transmission losses and transmission cost allocation impacts of several utilities joining RTO regions. I have provided expert testimony in cases before the U.S. District Court, Federal Energy Regulatory Commission (FERC), Public Service Commissions of Kentucky, Public Service Commission of Wisconsin, Pennsylvania Public Utilities Commission, Public Utilities Commission of Texas, and Superior Court of the State of Arizona.

Q. What is the purpose of your testimony?

A. I was asked by Hydro-Québec TransÉnergie (HQT) to determine:

i) Whether the categories used by HQT to classify its transmission investments are adequate to properly allocate costs among HQT's categories of investments; and

ii) Whether HQT's treatment of transmission losses in considering its transmission investments is adequate.

Q. How is your testimony organized?

A. In Section II of my testimony, I describe the transmission investment categories used by HQT, and summarize my opinions on the adequacy of those categories to properly allocate investment costs among categories of investments. In that section, I also compare HQT's use of investment categories to that of other system operators. Section III provides a summary of the practices adopted by HQT and my opinions with respect to the role and treatment of transmission losses in their transmission investments. Section IV provides a summary of my conclusions.

Q. Please summarize your conclusions.

A. I conclude the following based on my review of the relevant provisions of HQT's current and proposed *Hydro Québec Open Access Transmission Tariff* (OATT) and regulatory filings, the Régie's past decisions, the transmission investment planning practices by HQT, and HQT's evidence filed in this case:

i) The categories used by HQT to classify its transmission investments are adequate to properly allocate costs among HQT's categories of investments.

ii) HQT's use of its investment categories is similar to that of other transmission system operators' use of their investment categories in meeting the objectives that their respective systems face.

iii) HQT's treatment of transmission losses, not as a separate investment category or as a separate investment trigger but as a factor in selecting among alternative transmission projects, is adequate. I am not aware of any transmission system operator that uses transmission losses as a stand-alone investment objective or trigger to initiate a transmission upgrade.

II. CATEGORIES OF TRANSMISSION INVESTMENTS AND THEIR UNDERLYING OBJECTIVES

Q. What categories does HQT use to classify the transmission investments?

A. HQT classifies transmission investments into four categories based on the investment's objectives: "*Asset Sustainment,*" "*Maintenance and Improvement of Service Quality,*" "*Compliance,*" and "*Growth.*"[1]

Q. Please explain the specific objectives behind each of these four categories used by HQT.

A. The *Asset Sustainment* category is for investments needed to replace facilities that are about to reach the end of their useful lives or no longer performing to operating standards. The *Maintenance and Improvement of Service Quality* category covers investments for maintaining and improving system reliability and efficiency. The *Compliance* category is for investments required to comply with the laws and regulations (such as environmental, public safety, and public health), and HQT's contractual commitments and standards. Finally, the *Growth* category covers investments needed to expand the network to cover load growth and transmission service requests such as interconnection requests for new/modified generation plants and interconnection facilities.[2]

Q. Why does HQT have such categories?

A. HQT uses these Régie-approved categories as a framework for properly allocating the costs of its investments.

Q. How does HQT use these categories for allocating costs of transmission projects to its customers?

A. For the investments classified as *Asset Sustainment*, *Maintenance and Improvement of Service Quality*, and *Compliance*, HQT allocates the costs to all customers by adding

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1 Description synthétique des investissements et de leurs objectifs, pièce HQT 5, Document 2 (translated version).

2 Description synthétique des investissements et de leurs objectifs, pièce HQT 5, Document 2 (translated version); HQT, Open Access Transmission Tariff, Attachment J, Section D.

such investment costs to HQT's rate base. Transmission investment costs associated with the *Growth* category are allocated to the specific transmission customers whose needs (such as load growth, new interconnection, and new generation interconnection) triggered the investment.[3]

If a project is triggered by a single objective, HQT assigns the project's full costs to the relevant investment category. If a project as a whole has multiple objectives but each of its main components is associated with a single objective, the costs of each component are assigned to the relevant category. The category type then determines the form of cost recovery.[4]

Q. Must each specific transmission project be assigned to a single category?

A. No. HQT at any point in time has a portfolio of investments it must undertake to ensure the reliability of its system. As a result, a specific transmission project may be triggered by HQT's need to meet multiple objectives (and consequently be assigned to multiple investment categories). For example, HQT has received approval to construct a new Achigan 120/25-kV project.[5] Because most of the equipment in that facility has reached the end of their useful life, it was necessary to replace the Saint-Hippolyte and Saint-Calixte substations. This is a typical project that fits into the *Asset Sustainment* category. However, since the Achigan project is also needed to meet growing electricity demand in this region, the investments of this project are also partially associated with the *Growth* category.

Q. How does HQT allocate the costs of transmission investments that are jointly triggered by multiple objectives?

A. As approved by the Régie, if the main components of a specific transmission investment are triggered simultaneously by multiple objectives, then HQT allocates the costs to each relevant investment category according to the following sequence: 1) *Compliance*, *2)*

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3 D-2002-95, R-3401-98, April 30, 2002, p. 300 (translated version).

4 D-2002-95, R-3401-98, April 30, 2002, p. 300 (translated version).

5 HQT-3, Document 2, Section 2.2, R-3888-2014 – Phase 2, September 14, 2018 (translated version).

Asset Sustainment, *3) Growth*, *and 4) Maintenance and Improvement of Service Quality*.[6] Specifically, HQT determines the portion of the total project costs to be allocated to the first investment category by estimating the cost of the optimal (i.e., the least-cost) transmission solution that would address only the objective in that first investment category. If there are only two categories that triggered the transmission investment, then the remaining cost of the investment after the allocation to the first category would be allocated to the second category. If there are more than two categories that triggered the investment, HQT determines the portion of costs that would be allocated to the second category by estimating the cost of the optimal solution that would address the combined objectives in only the first two categories, and subtract the cost allocated to the first category from that amount, and so on. I will refer to this sequencing method as "subtractive cost assignment" in the rest of this report.

For instance, in the case of the multi-purpose Achigan[7] project described earlier, total costs of the substation (part of the project, excluding the line) are estimated at $32.27 million. To allocate these costs between the *Asset Sustainment* and *Growth* categories, HQT first estimates *Asset Sustainment* costs as the replacement value of the Saint-Hippolyte and Saint-Calixte substations being dismantled by considering the generic cost of a 120-25 kV substation with a capacity equivalent to the sum of current substation capacities. This amounts to $19.84 million, therefore the remaining project costs of $12.43 million are assigned to the *Growth* category.

On the other hand, if the components of a project are driven by both *Growth* and *Maintenance and Improvement of Service Quality*, HQT first considers what the costs would have been for a solution addressing only the growth of customer needs. HQT then looks for a solution that would improve network performance and service quality in

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6 Justification des modifications aux *Tarifs et conditions*, R-3888-2014 – Phase 2, September 14, 2018. This methodology is defined in the proposed HQT, Open Access Transmission Tariff, Section 12B. The Régie approved this methodology in D-2015-209 paragraphs 624-625.

7 HQT-3, Document 2, Section 2.2, R-3888-2014 – Phase 2, September 14, 2018 (translated version) and HQTD-2, Document 1, Section 3.2, R-4037-2018 - Demande du Transporteur et du Distributeur relative au poste de l'Achigan, April 13, 2018 (translated version).

addition to addressing the growth of customer needs, resulting in an overall optimization of the previous solution. If this last solution were to be recommended, the difference of costs between the two solutions would be attributable to the *Maintenance and Improvement of Service Quality* category. An example of such a project was the wind farm integration project from the call for tenders A/O 2005-03, which cost around $1,466.3 million.[8] In addition to connecting the wind facilities, it was determined that an overall optimized solution would help reduce severe overvoltage conditions that sometimes affect this region. To allocate costs between the two objectives, HQT first calculated that a solution considering only the growth of customer needs would cost $1,447.5 million. It then allocated the difference of $18.8 million to the *Maintenance and Improvement of Service Quality* category.

Q. Under this Régie-approved sequencing methodology for allocating the costs of integrated multi-objective transmission investments to specific investment categories, how does HQT determine the proportion of the costs allocated to each category?

A. As I described above in discussion of the sequencing methodology, HQT determines the cost of the optimal transmission solution that would address only the objectives in a specific category in order to determine the proportion of the costs that would be allocated to specific categories.[9] To perform a valid comparison of alternative solutions, each solution is validated, if required, with proper system simulation studies[10] to ensure compliance with the applicable standards.

Q. Is HQT's responsibility to determine the proportion of costs allocated to each investment category reasonable and appropriate?

A. Yes, for several reasons. First, HQT has the dual responsibilities of transmission system operator and owner. Like some Canadian entities such as BC Hydro, but unlike U.S.

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8 HQT-1, Document 1 – Demande relative au project d'intégration des parcs éoliens de l'appel d'offres A/0 2005-03 au réseau de transport d'Hydro-Québec, R-3742-2010, Sections 4.10 and 7 (translated version)

9 See the *proposed amendment to OATT,* HQT, Open Access Transmission Tariff, Section 12B.

10 HQT, Open Access Transmission Tariff, Attachment D.

RTOs, it is solely responsible to meet all of the objectives described above. It will be held fully accountable for any failure to reliably meet the requirements of its customers. In other words, HQT's accountability for providing reliable transmission service to its customers requires HQT to have the responsibility to implement the Régie-approved methodology for allocating cost of transmission upgrades to its customers.

Second, it will also be held accountable for the costs it incurs through the review of its investments by the Régie. HQT responds to its customers' needs by identifying the least-cost transmission solutions that simultaneously address its objectives, resulting in minimizing total costs across all objectives.

Third, for the multi-objective transmission investments, it aims at properly allocating the costs to specific objectives based on cost-minimizing approach to investments. The Régie-approved "subtractive cost assignment" methodology allocates the costs of such integrated multi-objective investments to specific categories. It requires a complex technical analysis of identifying optimal transmission solutions that address each of the objectives individually in a pre-determined sequence while maintaining the goal of minimizing overall costs across all objectives.

Fourth, HQT has the necessary expertise and resources to perform these technical assessments in order to determine the optimal transmission solutions that address specific objectives in each investment category and their associated costs.

Finally, HQT's determination of the proportion of the costs for a specific multi-objective investment to be assigned to each investment category is subject to regulatory oversight by the Régie and challenges by stakeholders for assessing the reasonableness of the proposed allocation.

Q. Is the set of categories used by HQT appropriate to properly allocate costs among categories of investments pertaining to integrated, multi-purpose investment projects?

A. Yes, the four categories used by HQT are adequate and sufficient as a framework for encompassing and allocating the costs of all transmission investment projects. My opinion is based on the following observations.

First, HQT's four categories are exhaustive of the types of objectives that are relevant to the currently expected needs of Quebec electric system. In fact, since 2001, I understand from my discussions with HQT that all of HQT's currently proposed and planned projects correspond to one or more of the existing categories.[11]

Second, each of the four categories are mutually exclusive. In other words, the underlying objectives for each category are distinct from the objectives of the remaining categories.

Third, the potential introduction of any new categories that are subsets of the existing four categories would be redundant for the purpose of allocating the cost of new transmission projects to HQT's customers. As explained above, the costs of transmission projects in the *Growth* category are allocated to the specific customers whose needs triggered the investment. Therefore, there is no need to introduce any new subcategory within the *Growth* category as it would have no effect on the allocation of costs. Similarly, the costs of projects triggered by the remaining three categories (*Asset Sustainment*, *Maintenance and Improvement of Service Quality*, and *Compliance*) are recovered from all customers by adding such investment costs to HQT's rate base. Therefore, introducing new subcategories under those three categories would again have no effect on the allocation of costs.

Q. Are the descriptions proposed by HQT for each of the four investment categories adequate for regulatory purposes?

A. Yes. HQT provides descriptions of its transmission investment categories in a publicly available document titled "Description synthétique des investissements et de leurs objectifs", which is annually filed in HQT's investment budget for projects whose individual costs is less than $25 million, the last one being in the Application R-4059-

[11] Régie de l'energie Québec, "Hydro-Québec dans ses activités de transport," accessed February 15, 2019 at http://www.regie-energie.qc.ca/audiences/TermElecTransInv.html.

2018.[12] In addition, for each project requiring investments in excess of $25 million, a request is filed at the Régie for approval, thereby offering an opportunity to challenge the choice of categories identified by HQT and the cost allocation between those categories in a transparent public hearing.

Since the four investment categories form the foundation for implementing HQT's Régie-approved cost allocation methodology that I summarized above, the Régie and HQT's customers should be provided with sufficiently detailed and clear descriptions of the objectives and types of transmission projects that would be classified under each investment category. Such descriptions would allow the Régie to perform its oversight and HQT's transmission customers to understand how HQT classifies each of its proposed transmission projects into the predefined investment categories as an input to the cost allocation process. Therefore, HQT's descriptions should be transparent, publicly available, and clear.

I conclude from my review of HQT's proposed document "Summary Description of Investments and Their Objectives" that HQT's category descriptions provide a transparent and clear explanation of the objectives served and types of investments that would be classified in each category, so that the Régie and the stakeholders can understand HQT's classification of specific transmission investments in the process of allocating the costs to HQT's investment categories.

Q. How does the use of transmission investment categories by HQT compare to other system operators in Canada or in the U.S.?

A. In general, the HQT's transmission investment categories encompass the same types of investments as the categories of other system operators for meeting objectives that are relevant in the context of HQT system. In addition, HQT's categories are put to similar use as the categories of other system operators, that is, they serve both to identify the types of investments needed to maintain a reliable electric system responsive to their customers' needs, and to allocate the costs across investment categories.

[12] HQT-1, Document 2 – Description synthétique des investissements et de leurs objectifs, R-4059-2018, July 27, 2018 (translated version).

Q. Are there any examples of other system operators you reviewed for the purpose of comparing categories of transmission investments?

A. Yes. I reviewed the investment categories and the underlying objectives used by British Columbia Hydro (BC Hydro) in Canada and PJM in the U.S. to assess commonalities and differences in investment categories.

In comparison to BC Hydro and PJM, HQT's investment categories have significant commonalities on key objectives and main drivers. In particular, while the specific names of the categories are different, HQT, BC Hydro, and PJM use separate categories to distinguish between network upgrades triggered by their customers' service requests versus the upgrades for maintaining reliable transmission service for the benefit of all customers. But there are also differences in categories arising from the contextual differences among the systems, such as the lack of need for new transmission to address congestion costs in the HQT system, as also recognized by the Régie.[13] Differences in investment categories also exist among other system operators, depending on the relevance of categories to each of their systems. Therefore, HQT's approach for categorizing transmission investments is aligned with those of other system operators.

I provide the specifics of commonalities and differences in HQT's categories in comparison to categories used by BC Hydro and PJM below.

Comparison to BC Hydro

BC Hydro uses four categories to classify transmission investments. Three of these categories (*Direct Assignment Facilities*, *Transmission Provider Interconnection Facilities*, and *Network Upgrades*) refer to investments that are triggered by customer requests for generation interconnection or transmission service, and the fourth one (*System Plan Network Upgrades*) refers to investments to maintain system reliability to serve BC Hydro's long-term firm service commitments (Point-to-Point (PTP) and

[13] D-2012-010, R-3669-2008 – Phase 2, February 10, 2012, paragraphs 246-322 (translated version).

Network Integration Transmission Service (NITS) customers, including expected load growth) for the benefit of all users.[14]

In comparison to HQT's four categories, the combination of BC Hydro's three categories (*Direct Assignment Facilities*, *Transmission Provider Interconnection Facilities*, and *Network Upgrades*) is similar to HQT's *Growth* category, with the only difference that HQT classifies the objective of addressing the load growth as part of the *Growth* category,[15] while BC Hydro includes that objective as part of the *System Plan Network Upgrades*. BC Hydro's *System Plan Network Upgrades* category is similar to the combination of the HQT's two categories *Asset Sustainment* and *Maintenance and Improvement of Service Quality*.

Comparison to PJM

PJM classifies its transmission investments under five categories: Baseline Reliability, Operational Performance, Generation and Transmission Interconnection, Public Policy Requirements, and Market Efficiency.[16] PJM's Baseline Reliability[17] and Operational Performance[18] categories are similar to the combination of HQT's Asset Sustainment and Maintenance and Improvement of Service Quality categories, with the only difference that upgrades necessary to meet load growth are considered by PJM as part of the Baseline Reliability category, while HQT classifies investments triggered by load growth under the separate Growth category. PJM's Generation and Transmission Interconnection category is similar to HQT's Growth category in that the triggers for

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14 BC Hydro, Open Access Transmission Tariff, Attachment O, p. 2.

15 D-2002-95, R-3401-98, April 30, 2002, pp. 298-300 (translated version)

16 PJM, Manual 14B: PJM Regional Transmission Planning Process, Section 2.1, p. 24.

17 PJM identifies the *Baseline Reliability* upgrades to "ensure the security and adequacy of the Transmission System to serve all existing and projected long term firm transmission use including existing and projected native load growth as well as long term firm transmission service." See PJM, Manual 14B, p. 21.

18 PJM's *Operational Performance* driven upgrades are implemented "to address system limitations encountered during real-time operations" and typically address "Transmission Loading Relief (TLR), Post Contingency Local Load Relief Warning (PCLLRW) events, and persistent uplift payments". See PJM, 2017 Regional Transmission Expansion Plan Book 2, p. 5 and PJM, Manual 14B, Section 2.7, p. 51.

these upgrades include customer requests for generation and transmission interconnection service. PJM's Public Policy Requirements[19] transmission upgrade category is similar to HQT's Compliance category.

The only major difference between the categories used by PJM and HQT is PJM's additional category of *Market Efficiency*[20] that is not one of HQT's categories. The *Market Efficiency* category in the case of PJM captures upgrades aimed to reduce congestion costs, which is not applicable to the HQT system as explained above.

III. ROLE AND TREATMENT OF TRANSMISSION LOSSES

Q. What are transmission losses, and how do they impact the cost of electricity for customers?

A. Transmission losses refer to the power consumed by the transmission elements (e.g., lines and transformers) between the generation plants and the load centers, largely due to heat dissipation caused by resistance and due to the ionization of air molecules near the high-voltage transmission line conductors (corona effect). Since losses reflect the portion of the power generated but that could not reach the electricity customers, higher losses result in higher costs for the power consumed by customers.

Q. Please explain the key factors that affect the magnitude of transmission losses in a power system.

A. Transmission losses in a system depend on multiple factors including the lengths and voltage levels of transmission lines, materials used in transmission lines and facilities,

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[19] PJM defines *Public Policy Requirements* as "policies pursued by: (a) state or federal entities, where such policies are reflected in duly enacted statutes or regulations, including but not limited to, state renewable portfolio standards and requirements under Environmental Protection Agency regulations; and (b) local governmental entities such as a municipal or county government, where such policies are reflected in duly enacted laws or regulations passed by the local governmental entity." See PJM, Operating Agreement, OA 1. Definitions.

[20] PJM defines *Market Efficiency* upgrades as "transmission enhancements that relieve congested facilities, allowing lower cost power to flow to consumers." See PJM, 2017 RTEP Book 2, Section 1: 2017 Executive Summary, p. 5.

level of power flows on the transmission elements and ambient conditions (such as temperature and wind). Transmission losses tend to be higher with longer lengths and lower voltages at transmission lines, and with higher levels of power flows on the transmission system.[21]

Q. How are transmission losses considered in HQT's OATT for transmission investments?

A. According to Attachment D in HQT's OATT, HQT considers the cost savings associated with reduced transmission losses in its economic evaluation of alternative scenarios for a transmission project in order to meet one or more of the four categories of objectives for transmission investment. Due to the prevalence of long transmission lines that connect remote generation plants to load centers in the HQT transmission system, transmission losses could be an important factor in evaluating alternative scenarios for a transmission project. However, besides the treatment of losses as a factor in economic evaluation of alternative transmission projects, HQT does not implement a transmission investment for the sole purpose of minimizing losses.

HQT's approach regarding transmission losses is codified in its OATT. Attachment D Methodology for Completing a System Impact Study explicitly mentions:

- losses as a factor considered to identify the least-cost transmission expansion plan (article 1), and
- impact of losses on the Transmission Provider's System taken into account in the System Impact Study (article 6).

Furthermore, the Régie acknowledged that transmissions losses are implicitly part of the economic analysis in two specific decisions for investment projects.[22] In those decisions,

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[21] Antonio Gomez-Exposito, Antonio J. Conejo, and Claudio Canizares, *Electric Energy Systems: Analysis and Operation* (Boca Raton: CRC Press, 2018), pp. 4, 9, 23-24.

[22] D-2012-152, R-3819-2012 - Demande d'autorisation d'Hydro-Québec dans ses activités de transport d'électricité relative au projet Saint-Césaire – Bedford, November 12, 2012, paragraph 64 (translated version) and D-2012-160, R-3816-2012 - Demande du Transporteur visant les modifications relatives au remplacement des compensateurs statiques au poste de la Nemiscau, November 26, 2012, paragraphs 29, 42 and 43 (translated version)

the Régie requested that economic data related to transmission losses be presented explicitly, including reference prices, as these directly influence the outcome of the analysis. In addition, the Régie ordered HQT to consider the transmission losses only from the commissioning date of the asset.

Q. Is it a typical practice with other system operators in Canada and in the U.S. to treat reduction of transmission losses as a separate, stand-alone investment category or investment trigger?

A. No, it is not. I am not aware of any system operator that treats the minimization of transmission losses as a stand-alone investment category or stand-alone investment trigger for transmission upgrades. This finding is not surprising. Indeed, most types of transmission projects have varying degrees of impacts on transmission losses, hence transmission loss is a common element that is present across different categories of transmission investments. Consequently, transmission losses are more properly considered as a relevant economic factor in the comparative review of multiple or competing scenarios to carry out a given investment project. Transmission losses constitute a factor in selecting or optimizing among alternative scenarios for a transmission project depending on the significance of the relative impacts of those scenarios on system losses. Generally speaking, transmission loss can be a more significant factor in selecting or optimizing a transmission project design when the project requires large capacities and flows over a long distance, as can be the case in the HQT system.[23]

Q. Is HQT's treatment of transmission losses in considering its transmission investments appropriate?

A. Yes, for the reasons outlined above, I find that HQT's treatment of transmission losses, not as a separate investment category or as a separate investment trigger but as a factor in selecting among alternative scenarios for a transmission project is appropriate.

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[23] Antonio Gomez-Exposito, Antonio J. Conejo, and Claudio Canizares, *Electric Energy Systems: Analysis and Operation* (Boca Raton: CRC Press, 2018), p. 23.

IV. CONCLUSIONS

Q. What are your conclusions?

A. I conclude the following:

i) The categories used by HQT to classify its transmission investments are adequate to properly allocate costs among HQT's categories of investments.

ii) HQT's use of its investment categories is similar to that of other transmission system operators' use of their investment categories in meeting the objectives that their respective systems face.

iii) HQT's treatment of transmission losses, not as a separate investment category or as a separate investment trigger but as a factor in selecting among alternative transmission projects, is adequate. I am not aware of any transmission system operator that uses transmission losses as a stand-alone investment objective or trigger to initiate a transmission upgrade.

APPENDIX A: KEY DOCUMENTS

HQT'S FILINGS IN R-3888-2014 – PHASE 1

HQT-3, Document 1, Section 7.2, Complément de preuve du Transporteur à la suite de la décision D-2014-117 de la Régie de l'énergie, September 12, 2014 (translated version)

HQT'S FILINGS IN R-3888-2014 – PHASE 2

HQT-3, Document 2, Section 2, Complément de preuve numéro 2 du Transporteur pour la phase 2A à la suite de la décision D-2018-077 de la Régie de l'énergie, September 14, 2018 (translated version)

HQT 5, Document 1, Preuve du Transporteur pour la phase 2B à la suite de la décision D-2018-152 de la Régie de l'énergie, March 7, 2019 (translated version)

HQT 5, Document 2, Description synthétique des investissements et de leurs objectifs, March 7, 2019 (translated version)

PAST RÉGIE FILINGS AND ORDERS

Proposed amendment to OATT, Hydro-Québec, Open Access Transmission Tariff, Section 12B

D-2002-95 - Décision concernant la demande révisée relative à la modification des tarifs de transport d'électricité, R-3401-98, April 30, 2002, p. 298-300 (translated version)

D-2012-010, R-3669-2008 – Phase 2, February 10, 2012, paragraphs 246-322 (translated version)

HQT-3, Document 2, Section 2.2, R-3888-2014 – Phase 2, September 14, 2018 (translated version)

D-2015-209, R-3888-2014 - Demande de modification de la politique d'ajouts au réseau de transport, December 18, 2015, paragraphs 594-631 (translated version)

Justification des modifications aux *Tarifs et conditions*, R-3888-2014 – Phase 2, September 14, 2018 (translated version)

HQTD-2, Document 1, Section 3.2, R-4037-2018 - Demande du Transporteur et du Distributeur relative au poste de l'Achigan, April 13, 2018 (translated version)

HQT-1, Document 1 – Demande relative au project d'intégration des parcs éoliens de l'appel d'offres A/0 2005-03 au réseau de transport d'Hydro-Québec, R-3742-2010, Sections 4.10 and 7 (translated version)

HQT-1, Document 2 – Description synthétique des investissements et de leurs objectifs, R-4059-2018, July 27, 2018 (translated version)

D-2012-152, R-3819-2012 - Demande d'autorisation d'Hydro-Québec dans ses activités de transport d'électricité relative au projet Saint-Césaire – Bedford, November 12, 2012, paragraph 64 (translated version)

D-2012-160, R-3816-2012 - Demande du Transporteur visant les modifications relatives au remplacement des compensateurs statiques au poste de la Nemiscau, November 26, 2012, paragraphs 29, 42 and 43 (translated version)

TARIFFS AND MANUALS

BC Hydro, Open Access Transmission Tariff, Attachment O

Hydro-Québec, Open Access Transmission Tariff, Attachment D and Attachment J, Section D

PJM, Manual 14B: PJM Regional Transmission Planning Process, Sections 1.4 and 2

PJM, Operating Agreement, OA 1. Definitions

PJM, 2017 Regional Transmission Expansion Plan Book 2, Section 1: 2017 Executive Summary

TEXTBOOKS

Gomez-Exposito, Antonio, Antonio J. Conejo, and Claudio Canizares, *Electric Energy Systems: Analysis and Operation* (Boca Raton: CRC Press, 2018), Section 1