UNDERTAKING – JT 1.1

City of Hamilton Technical Conference Undertaking Introduction

Undertaking

The City of Hamilton's ("COFH") interrogatories were intended to determine whether, and if so with that effect on rates, Hydro One Networks Inc. ("HONI") had included the COFH's LED conversion program for street lights in the forecast rates for the street light rate class. HONI's responses to the COFH's interrogatories appear to be in conflict with the pre-filed evidence and, as a result, do not answer the questions posed. In its interrogatory responses, HONI has identified 22 GWh of past street light CDM savings and 35 GWh of pre-approved (future) street light CDM savings. This translates to a reduction in consumption (and consequently demand) of approximately 47%. This is a significant drop in load for the rate class, however it is not identified or accounted for anywhere in the pre-filed evidence. In fact, HONI's pre-filed evidence suggests a street light load profile that has little or no change over the time period in question. These Technical Conference Questions seek clarification of the interrogatory responses, including a reconciliation of those responses with the pre-filed evidence.

Response

Hydro One clarifies that the 35 GWh of approved street light savings, referenced in Exhibit I, Tab 46, Schedule COFH-5, is the cumulative savings by 2022, and the 22 GWh of savings is the cumulative savings achieved as of 2017. Thus the 35 GWh includes 22 GWh of historical savings and 13 GWh (= 35 – 22) of future savings in 2018 to 2022.

The introduction to COFH's technical conference questions references a reduction in consumption of "approximately 47%" which suggests a misunderstanding that the total savings are 57 GWh (= 22 + 35).

City of Hamilton Technical Conference Undertaking # 1a

Reference

In HONI's response, it states that the total cumulative energy savings from municipal LED street light conversion programs is about 22 GWh. The response further states that "The actual street lighting load in 2016, which is the base for forecasting, should already reflect the conservation impact of the street lighting conversion program."

Table E.9 in Appendix E of Exhibit E1, Tab 2, Schedule 1, identifies the CDM impacts, by Rate Class that were considered in HONI's load forecasting. That table does not include the street
light class. Accordingly, is not clear how the 22 GWh of CDM savings that HONI has identified in their interrogatory response is accounted for.

Table E.6 from Appendix E of Exhibit E1, Tab 2, Schedule 1 provides HONI's actual sales and forecasted sales (in GWh) for its various rate classes. The street light class does appear in this Table. However, the load forecast in the Table is essentially flat with the exception of the load increase in 2021 and 2022 when acquired utilities are accounted for. The actual and forecast sales would, thus, not appear to reflect the impact of the LED conversions.

Table E.4 in Exhibit E1, Tab 2, Schedule 1 sets out the number of customers (historical and forecast) that contribute to HONI's load forecast. For the period between 2017 and 2020, the forecast is that the number of customers will grow by only approximately 2% for the street light class. That suggests that the impact of CDM reductions is not offset by customer growth.

Undertaking

1) Where in HONI's pre-filed evidence can the historical CDM impact of 22 GWh be found?

2) What has HONI forecast for CDM savings, on a year-by-year basis, related to the street light rate class for years 2017 through 2022?
    a) Is this information specifically identified in HONI's pre-filed evidence?
    b) If so, where can this information be found in the pre-filed evidence?

3) If the information is not identified in the pre-filed evidence, what is the basis for the

statement about the effect of the municipal LED street light conversion program on forecast loads and, therefore, on rates?

Response

1) The 22 GWh saving is implicitly reflected in the historical actual figures for street light sales in Table E.6.

2) Hydro One does not forecast the specific CDM amounts for the street light rate class. Hydro One uses an implicit method to account for the CDM impact on the forecast of street light sales.
    a) This information is not explicitly identified in the pre-filed evidence.
    b) N/A.

3) The forecast takes into account historical trends in actual street light sales, including the impact of CDM, and so the forecast would have been higher in the absence of CDM savings for street lights.

City of Hamilton Technical Conference Undertaking # 1b

Reference

By this question, the COH sought to understand the impact to HONI's street light Service Charge and Distribution Volumetric Rate given the impact of the street light load profile forecast related specifically to CDM (LED conversions).

Undertaking

1) What effect has reduced demand, due to forecasted CDM impacts, had on HONI's SLAF for the years 2018 through 2022? Please provide the SLAF values for both the CDM and non-CDM adjusted cases.

2) What would be HONI's street light rate class Service Charge and Distribution Volumetric Rates for each year (2018 through 2022).
   a) With CDM (LED conversions) accounted for?
   b) Without CDM (LED conversions) accounted for?
   c) What data and assumptions were used to generate this forecast, and how is LED technology adoption accounted for?

Response

1) A reduction in street light demand has the effect of increasing the street light adjustment factor ("SLAF") value, which reduces the number of "equivalent" primary and line transformer street light customers within the cost allocation model and therefore reduces the costs allocated to the street light class. A reduction in street light demand will also decrease the revenue collected from street light class, which could drive the need to increase distribution rates in order to recover the cost of serving the class.

   The 2018 and 2021 SLAF values for the CDM adjusted case are 8.58[1] and 8.48[2], respectively. In this application, Hydro One did not calculate 2019, 2020 and 2022 SLAF values as it did not populate a cost allocation model for those test years.

[1] See Exhibit G1, Tab 3, Schedule 1, attachment 3, Sheet "I6.2 Customer Data", 2018 Cost Allocation Model, filed June 7, 2017

[2] See Exhibit G1, Tab 3, Schedule 1, attachment 4, Sheet "I6.2 Customer Data", 2021 Cost Allocation Model, filed June 7, 2017

Hydro One does not have the information to calculate the "non-CDM adjusted" SLAF values, as this would require a set of "non-CDM adjusted" NCP4 values for all residential (i.e. R1, R2, UR, Seasonal, AR and AUR) and street light customer classes in 2018 and 2021, which are not readily available.

2) a) Hydro One's street light rate class Service Charge and Distribution Volumetric Rates for each year (2018 through 2022) with CDM (LED conversions) accounted for are provided in Table 1 of Exhibit H1, Tab 1, Schedule 1.

b) Hydro One does not have the information required to calculate street light distribution rates for each year (2018 through 2022) without CDM (LED conversions) accounted for, as this would require populating the entire cost allocation model using "non-CDM adjusted" load forecasts for all Hydro One's rate classes. This information is not readily available. In any case, distribution rates are applied to the kWh delivered to customers and it is unclear how rates based on an estimated "non-CDM adjusted" charge determinant would be implemented.

City of Hamilton Technical Conference Undertaking # 1c

Reference

HONI has stated in its response to interrogatory COFH-1 (a) that "the load forecast for the street lighting reflects the effects the COH's LED street light conversion program, as well as the LED conversion program in all other municipalities served by Hydro One".

Undertaking

1) Without consideration of other rate classes, what data and assumptions were used to develop the load forecast specific to the street light rate class for the years 2017 through 2022?

2) If CDM/LED conversions were considered as an input to the street light rate class load forecasting process, what impact did they have on the load forecast (expressed in MW) on a yearly basis from 2018 through 2022?

Response

1) The 2017-2022 forecast implicitly takes into consideration the historical trends in # of customer accounts and street light sales, as shown in Tables E.4 and E.6 respectively, and a forecast of future growth based on econometric and end-use models, as well as total CDM forecasts in accordance with the forecast methodology described in Exhibit E1, Tab 2, Schedule 1

2) N/A.

City of Hamilton Technical Conference Undertaking # 4c

Reference

In its response, HONI sets out the estimated energy savings related to municipality street lighting programs for 2015 to 2017.

While the energy savings numbers above vary significantly from year to year, the actual sales (GWh) shown in Table E.6 of Appendix E of Exhibit E1, Tab 2, Schedule 1 barely vary year-over-year (2015=122 GWh, 2016=122 GWh, 2017=121 GWh).

Undertaking

1) Can HONI explain why the 2015, 2016, 2017 energy savings figures expressed in their interrogatory answer appear to have no impact on the sales figures for those same years expressed in Table E.6?

Response

1) The actual sales figures in Table E.6 reflect the net impact of an increase in street light sales due to load growth from new and existing accounts (e.g. a new sub-division) offset by a decrease in street light sales due to conservation measures (e.g. LED conversion).

City of Hamilton Technical Conference Undertaking # 5b

Reference

In its response, HONI states that "The street lighting load profile implicitly includes any saving through the LED conversion projects noted above".

Undertaking

1) Please provide a load profile, year-over-year, spanning from 2012 through 2022 that clearly shows HONI's street light (and only street light) consumption that identifies historical and projected impacts from CDM in a format similar to Figure 2 from Exhibit E1, Tab 2, Schedule 1 of HONI's pre-filed evidence.

Response

1) Please see the table below for Sales Net of CDM (i.e. actual/forecast billed amounts) and an estimate of Sales Gross of CDM (i.e. adding back estimated CDM). There is no weather impact associated with street lights so that the actual and weather normal sales are identical. Total pre-approved CDM saving for street lights is 35 GWh of which 22 GWh relates to 2012-2017 period and the remainder, 13 GWh, is expected to occur after 2017.

Year	Sales Net of CDM	Sales Gross of CDM	% Variance
2011	125	125	0.00
2012	127	127	0.25
2013	125	126	0.77
2014	122	128	5.30
2015	122	141	15.66
2016	122	142	16.43
2017	121	143	18.57
2018	121	146	20.66
2019	122	150	22.57
2020	123	153	24.44
2021 *	133	166	24.51
2022 *	133	168	26.42

* Includes street lighting sales of Acquired Utilities.

UNDERTAKING – JT 1.2

Undertaking

To clarify which electric utility construction price index was used in the PSE work to update the industry study, and then clarify any other responses if required.

Response

PSE used the EUCPI classified as "Distribution Systems" in the 4GIR industry TFP update. This is the same index used by PEG in the 4GIR TFP research. It remains unclear if the EUCPI includes financing costs in the index and the EUCPI continues to be suspended pending review with the latest available year being 2014.

UNDERTAKING – JT 1.3

Undertaking

To provide partial factor productivities for Hydro One's cost forecast through 2022.

Response

Below are the unadjusted PFP and TFP indexes. The adjusted indexes are not possible to forecast to 2022 due to a lack of safety and reliability forecasts.

Year	PFP (OM&A)	PFP (Capital)	**TFP**
2002	1.00	1.00	**1.00**
2003	1.03	0.99	**1.00**
2004	1.10	0.98	**1.02**
2005	1.06	0.98	**1.01**
2006	0.95	0.96	**0.96**
2007	0.82	0.94	**0.89**
2008	0.86	0.93	**0.90**
2009	0.80	0.90	**0.86**
2010	0.77	0.89	**0.84**
2011	0.78	0.88	**0.84**
2012	0.82	0.87	**0.85**
2013	0.76	0.85	**0.81**
2014	0.73	0.84	**0.80**
2015	0.85	0.82	**0.83**
2016	0.88	0.82	**0.84**
2017	0.86	0.83	**0.84**
2018	0.86	0.83	**0.83**
2019	0.87	0.82	**0.83**
2020	0.88	0.82	**0.83**
2021	0.88	0.81	**0.83**
2022	0.89	0.81	**0.83**
2002-2015	**-1.2%**	**-1.5%**	**-1.4%**
2002-2010	**-3.2%**	**-1.5%**	**-2.1%**
2010-2015	**2.0%**	**-1.5%**	**-0.4%**
2015-2022	0.7%	-0.3%	0.0%
2017-2022	0.7%	-0.5%	-0.1%
2018-2022	0.8%	-0.5%	-0.2%

Witness: FENRICK Steve (PSE)

UNDERTAKING – JT 1.4

Undertaking

With reference to the term "proposal" on Exhibit I-10-SEC-10, Attachment Page 2, to provide the proposal's evidentiary reference if it is filed or to provide a copy.

Response

Please refer to attachment 1 of this undertaking.

Hydro One Networks Inc.

Request for Proposal
Dx Total Factor Productivity (TFP) Study
RFP Number 7000005911

RFP Closing Date and Time
August 5, 2015 before 11:00:01 Toronto, Ontario, Canada

Hydro One Contact
Lynnette Harris
lynnette.harris@hydroone.com

PART 4: FORM OF SUBMISSION

4.1 Company information

ALL fields are to be completed or if Not Applicable, Proponent should enter "N/A" in field.		
Full Legal Name of Proponent:		**Power System Engineering, Inc.**
Any other name under which the Proponent conducts business:		**n/a**
Complete Mailing Address:	Mailing Address: City, Province / State / Country: Postal / Zip Code:	**1532 W. Broadway** **Madison, WI U.S.A.** **53713**
Complete Remit to Address *(If different from the above Mailing Address)*:	Mailing Address: City, Province / State / Country: Postal / Zip Code:	**n/a** **n/a** **n/a**
Main Contact Person	Name: Email: Phone Number:	**Steve Fenrick** **fenricks@powersystem.org** **608-268-3549**
Accounts Receivable *Contact Person*	Name: Email:	**Pam Reffert** **reffertp@powersystem.org**
Website / URL Address:		**www.powersystem.org**
Proponent's GST / HST Registration Number:		**n/a**
Proponent's QST Registration Number:		**n/a**
Proponent's Proposal Reference Number		**7000005911**
The undersigned, hereby declare that the company is: *(Complete sub-clause* **(a)** *or* **(b)** *only, whichever applies)* **(a)** A Company incorporated under the laws of OR **(b)** An individual or partnership carrying on business under the firm name and style above stated the names and places of incorporation, if any, of the members of the partnership or joint venture being the following:		**Wisconsin U.S.A.** Click here to enter your answer.

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below. Failure to meet these requirements may result in disqualification.	**Yes**	**No**
If we are the successful Proponent, we agree to provide the following to the Purchaser within 48 hours after the Purchaser's notification or request: • Electronic Funds Transfer (EFT) information requested in **Attachment #16 – Authorization of Electronic Funds Transfer (EFT) Form** in Part 5 – Attachments and Hyperlinks. • HST Registration Confirmation as per the sample in **Attachment #17 – Sample of HST Registration Confirmation** in Part 5 – Attachments and Hyperlinks. • Copy of Certificate of Incorporation if the company is unincorporated or a certified copy of Business Name Registration or Partnership Registration (Master Business License). If outside	☒	☐

of Canada, provide evidence of your full corporate name. Proponent Note: The above documentation should **not** be submitted with your Proposal.		
We agree that, if we are the successful Proponent and at any time after submission of this Proposal our registration status changes, our name changes, or there is a change in control of our company's ownership, we will immediately notify the Purchaser, and will provide certified copies of any official documentation such as copies of Articles of Incorporation.	☒	☐

4.2 Mandatory Requirements

Mandatory requirements will be assessed on a pass/fail basis. A Proposal must include or conform with the following mandatory requirements. Proponent is to place an **"X"** mark in either the "Yes" or "No" column in each of the rows below. Failure to meet the mandatory requirements will result in **disqualification.**	**Yes**	**No**
4.2.1 Hydro One Code of Business Conduct We have examined the Hydro One Code of Business Conduct, and agree to not take any action that would cause the Purchaser or any of its directors, officers, employees, agents, representatives, or business partners to be in breach of any of the obligations set out in Hydro One's corporate Code of Business Conduct. A current copy of the code may be reviewed by downloading the electronic document by following the appropriate link at the following hyperlink (can be found and accessed in Part 5 – Attachments and Hyperlinks): http://www.hydroone.com/CodeofConduct	☒	☐
4.2.2 Acknowledgement, Agreement and Acceptance of the Terms and Conditions within Part 1 – Overview A Proponent may not take any exception to Part 1 –Overview under this RFP. Confirm your acceptance of Part 1 – Overview.	☒	☐
4.2.3 No Change of control provisions It is a mandatory requirement that if you are expressing any exceptions to Hydro One's Commercial Terms and Conditions, Hydro One cannot entertain, and your exceptions shall not contain (or you shall disclaim such section if it is part of a broader document) any change of control provisions. Confirm your acceptance of the above.	☒	☐
4.2.4 Intentionally Deleted		

4.3 Executive Summary

Provide a concise summary of your organization, number of years in business, capabilities, and compliance. Readers of this section should be able to grasp the substance of the response quickly and easily. *Answer below:* **Please see Appendix 1**

4.4 Subcontractors / Sub-consultants

(a) Please list below any subcontracting arrangements (resources, etc) who would be assigned to the Work. Hydro One reserves the right in its sole and absolute discretion to reject for any reason whatsoever any sub-consultants proposed by the Proponent.

Answer below:

No subcontractors will be used

4.5 Your Understanding of Hydro One's Requirements

Describe in your own words, your understanding of Hydro One's requirements including scope and resource requirements. Specify in detail the actual services you propose to deliver. Detail the support you will require from Hydro One. Identify any major issues as determined by your company that would need to be addressed for successful delivery of the services.

Answer below:

Please see Appendix 1

4.6 Proof of Ability, Project Team and Subject Matter Expertise

Hydro One requires detailed assurance that Proponents responding to this RFP demonstrate past performance in, and present/future resource commitment to, the utility services industry and contracts for needs similar to those expressed in this RFP. Please provide responses to the following:

4.6.1 Utility Services Background:

Provide an overview of your experience and background in the Utility field. Outline your involvement in any Energy associations or groups, including any interest groups.

Complete at least three (3) utility references in the table(s) under Section "4.6.2 – References" below, at least one of which should include a large transmission component.

Answer below:

Please see Appendix 1

Describe your experience in large scale projects, similar to the contracts sought by this RFP. Experience may also include studies in other industries governed by different but equivalent standards. Provide examples of similar projects Proponent has completed within the last three (3) years using technology and methodology you have proposed in this RFP response. Proponent is expected to provide name, location and date of work, other technologies included in solutions, time frame of delivery of the projects, challenges encountered (technology, etc), methodology used, size of project team including vendor, client and integrator with an emphasis on experience relevant to the deliverables out lined in the Terms of Reference of this RFP.

Answer below:

Please see Appendix 1

4.6.2 References

Complete the table below to demonstrate:

Project Experience and References

Referenced Project Title /Description	Proponent Contact (Name and Phone Number)	Contact Information for Reference (Name and Phone Number)	Name of Proposed Project Team Member(s) that worked on referenced project	Résumé of Proposed Team Member attached	
				Yes	No
Toronto Hydro Electric System Limited Distribution Cost and Reliability Benchmarking Study	Steve Fenrick 608.268.3549	Dmitry Balashov 416.542.2651	Steve Fenrick, Lullit Getachew, Jeff Smith, Matt Sekeres, David Williams, Erik Sonju	☒	☐
Coalition of Large Distributors 4th Generation Incentive Regulation Expert Recommendations including TFP and Benchmarking	Steve Fenrick 608.268.3549	Amanda Klein (THESL) 416.542.2729	Steve Fenrick, Lullit Getachew, Jeff Smith, Matt Sekeres, David Williams	☒	☐
Hydro Ottawa Distribution Cost and Reliability Benchmarking Study	Steve Fenrick 608.268.3549	Geoff Simpson 613.738.5499	Steve Fenrick, Lullit Getachew, Jeff Smith, Matt Sekeres, David Williams	☒	☐

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	Yes	No
Please indicate whether Hydro One may contact the provided references.	☒	☐

4.6.3 Project Team

Provide details of the personnel who would be assigned to the Work, and those who would be available as additional resources, clearly specifying for each individual whether they are "assigned" resources, or "available additional" resources. Personnel details should include proof of their ability to perform the Work including resumés detailing education, professional status and experience, (**to be attached as an Appendix**). In addition, indicate specifically which of the three reference accounts used for the "Project Experience" table under "c." above the personnel to be "assigned" to the project have worked on and in what capacity they were accountable on these projects. As mentioned, include as appendices the appropriate CVs.

Provide evidence of the subject matter expertise available to meet the requirements of this RFP. This should include having the capability in terms of personnel, training, processes, methodologies, etc.

Indicate the proposed team members' availability for the duration of this initiative.

The proposed team members are subject to Hydro One review and approval. Hydro One is particularly interested in the skills, knowledge, qualifications and relevant practical experience of the Proponent's team and the individual's experience with similar projects.

Answer below:
Please see Appendix 2

Résumé(s) **attached in Appendix # 2** to our Proposal.

4.6.4 Intentionally Deleted

4.7 Statement of Work

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	Yes	No
Provide a draft Statement of Work utilizing the attached SOW Template included in **Attachment #11 – Statement of Work** in Part 5 – Attachments and Hyperlinks. **Attached as Appendix #3** to our Proposal. Please indicate whether you have completed and attached the above documentation:	☒	☐

4.8 Schedule

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	Yes	No
Hydro One is targeting completion of the final report by October 2016. Proponents are expected to propose a project plan that meets this timeframe based on the scope, complexity, and size of the tasks. Please provide the following: • Brief summary overview of approach you will take to complete this assignment. • Work plan and schedule in a format acceptable to the Purchaser (e.g. Microsoft Project). • Resource plan. This includes resource roles and percent allocation for each major deliverable. • Hydro One resource requirements, including roles, knowledge requirements, percent available (quantity of their time needed), and timelines (at what point in the proposed work schedule they will be required). • Non-personnel resources requested of Hydro One, if required (i.e. Hydro One service providers). • Project planning assumptions including required access to senior management. *Answer below:* **Please see Executive Summary and Schedule in Appendix 1** Provide confirmation below of your ability to meet the delivery timelines outlined in Part 3: Terms of Reference	☒	☐

4.9 Hydro One Resource Requirements

Detail any required support by Hydro One resources. Include an estimate of time, the reason and at what point in the proposed work schedule the resources are required.

Also include any non-personnel resources required of Hydro One. Indicate space/facilities and equipment expected to by provide by Hydro One.

Answer below:
Hydro One will be involved in the study during key points in the project. We also included a number of pre-determined status update points within the schedule. However, if the Hydro One team wishes to have more frequent status updates, or has a need for a specific status update during the course of the project, PSE will certainly accommodate those requests.

The project schedule color-coded the Hydro One tasks or joint effort tasks. PSE estimates the following hours of effort by major deliverable and the needed role within that effort.

1. **Deliver the Draft Study Proposal:** 16 hours (Hydro One role: Provide guidance and feedback on draft proposal)
2. **Stakeholder Consultation Presentation:** 16 hours (Hydro One role: Participate in session and provide feedback to PSE on adjustments to the draft study proposal)

3. **Deliver the Draft Report:** 120 hours (Hydro One role: Provide feedback during status updates, identification of service territory conditions and challenges, gather information and data as requested)
4. **Deliver the Final report:** 40 hours (Hydro One role: Provide a thorough review and feedback on the Draft Report)

There are no non-personnel resources required of Hydro One that PSE is currently aware of.

4.10 Intentionally Deleted

4.11 Intentionally Deleted

4.12 Intentionally Deleted

4.13 Assessment Methodology

Provide a description of the methods, processes and procedures and high level plan for conducting the Work as defined in this Request for Proposal (i.e., what and how it will be done). The Proponent should state the nature, and content, and the expected artifacts/deliverables that will be generated (i.e., what will be the product and what will Hydro One expect to receive).

Answer below:
Please see Appendix 1

4.14 Assumptions and Constraints

Identify below key assumptions and constraints governing your Proposal.

Answer below:
The proposal assumes the following assumptions and constraints: 1. Hydro One will provide feedback and data as it is available and requested. 2. Stakeholder feedback will not significantly modify the overall scope of the project. The fixed price quote assumes the final project design will be similar to the proposed design in this proposal.

4.15 Risks

Using the table provided below, provide an assessment of the potential risks that may impact a successful project completion and how these risks will be mitigated.

Potential Risk	Risk Impact	Risk Mitigation
There are no obvious risks that PSE sees to the completion of a successful project. PSE is accustomed to gathering, processing, and using the data that will be necessary for this study. We have conducted TFP and benchmarking studies for rural electric cooperatives, IOUs, and within the Ontario industry. We regularly employ the techniques that will be used in this study, and we have the experts required to modify these techniques as is necessary for the successful completion of this project.		
Click here to enter your answer	Click here to enter your answer	Click here to enter your answer
Click here to enter your answer	Click here to enter your answer	Click here to enter your answer

4.16 Intentionally Deleted

4.17 Intentionally Deleted

4.18 Pricing

4.18.1 Pricing Matrix

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	**Yes**	**No**
Pricing Matrix included as **Attachment #6 – Pricing Matrix i**n Part 5 – Attachments and Hyperlinks has been completed in its entirety and is included with your Proposal. The completed Pricing Matrix, using the exact format provided in this RFP, must be inserted in a separate sealed envelope, inside the box or package containing your main Proposal and the envelope shall be clearly marked: **RFP Document #7000005911 - Dx Total Factor Productivity (TFP) Study** **Proposal Appendix #____** **Pricing Matrix** **Your Full Legal Company Name** Included in the same separate sealed envelope shall be electronic copies containing the same content of the paper copy Pricing Matrix. For number of paper copies and electronic copies required see Section 1.5.1 – Unpriced Proposal, Pricing Matrix and Number of Copies. Acknowledge that you have complied with the above by marking an "X" in the appropriate box: Attached as Appendix # **4** to our Proposal.	☒	☐
Pricing Matrix has been included in separate sealed envelope and is identified as Appendix # **4** to our Proposal. Prices/rates include: • All labour, overhead administration, work equipment, and materials necessary to perform the Work. • All insurance(s), WSIB/workers' compensation and all other charges of every kind attributable to the Work. • All applicable taxes (except for GST/HST and QST). Where applicable, all prices and rates must be net, excluding GST/HST and QST. If applicable, the GST/HST and QST shall be shown, as extra and separately, on the pricing matrix. • All reimbursable expenses. (Note: If extra, reimbursable expenses must be shown separately on the Pricing Matrix and details are to be provided in Part 4 – Form of Submission). • All other charges of every kind attributable to the Work. Prices are in Canadian dollars and are not subject to adjustment for fluctuations in foreign exchange. If not in Canadian dollars, specify currency here: Click here to enter your answer.	☒	☐

4.18.2 Firm Rates

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	**Yes**	**No**
Rates are firm for the duration of the engagement. Agreed: **If No, please provide details below:** n/a	☒	☐

4.18.3 Intentionally Deleted

4.18.4 Intentionally Deleted

4.19 Commercial Terms and Conditions

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	**Yes**	**No**
Indicate your willingness to accept the Hydro One's Commercial Terms & Conditions included in Part 2 – Request for Proposal. Failure to explicitly express any exceptions below to the proposed terms and conditions in this section will be deemed as willingness to accept. If any exceptions please state below: **n/a** Proponent Note: Any exceptions will be considered in the evaluation and may cause your Proposal to not be considered further.	☒	☐

4.19.1 Terms of Payment

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	**Yes**	**No**
Net 45 days after receipt of an acceptable invoice to be billed on a monthly basis tied to accepted deliverable or milestones or upon completion and acceptance of the work as applicable. Agreed: If No, please provide details below: **n/a**	☒	☐

Proponent proposes the following favourable **Dynamic Payment Term** that may be considered in the evaluation of this Proposal and are intended to increase the total value delivered by the successful Proponent and received by the Purchaser.

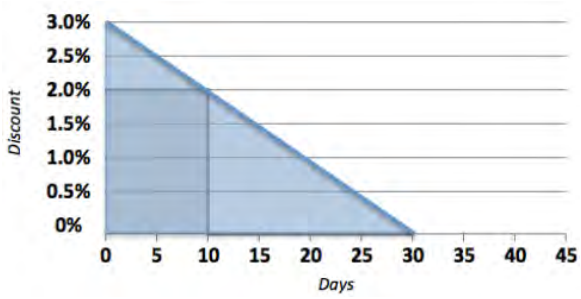
Favourable payment terms defined in this section will be applicable to only this RFP and any contract that may result from such RFP.

Choose one of the following:

(a) 0.5%, 20 / N 30	☐	**(e)** 1.75%, 10 / N 45	☐	
(b) 1%, 10 / N 30	☐	**(f)** 2%, 15 / N 45	☐	
(c) 1.25%, 20 / N 45	☐	**(g)** 4%, 10 / N 45	☐	
(d) 1.5%, 15 / N 30	☐	**(h)** 6%, 5 / N 45	☐	

By selecting one of the above **Dynamic Payment Terms**, Hydro One will initiate payment automatically on an approved invoice on or after the specified cliff date. Hydro One will receive a pro-rated discount calculated based on the date that the invoice was approved.

For example, on a 2% 10, Net 30 term, an invoice approved on or before day 10 will pay with a 2% discount and an invoice approved after day 10 but before day 30 will be paid with a discount pro-rated between 0 and 2% based on the approval date. On invoices approved prior to the cliff date, you will be presented with an option to take early pay (also at pro-rated discount) but are not required to do so.



4.19.2 Invoicing Compliance

Hydro One has implemented a supplier portal, powered by Taulia, to save suppliers time, reduce errors, and streamline suppliers' business process when submitting invoices. This easy-to-use online platform provides complete visibility into

suppliers' purchase orders, invoices and payment details.

All Hydro One suppliers will be expected to adopt and use the Taulia Supplier Portal for:

- PO Status
- Invoice Submission
- Invoice Status
- Questions related to PO, Invoice, and Payment Details

If you are already enrolled on the Taulia Supplier Portal as a supplier your invoices will be submitted via the Taulia Supplier Portal at http://portal.taulia.com, using your company ID and Password, do not submit a paper copy invoice through the Taulia Portal.

If you are not currently enrolled on the Taulia Supplier Portal you can obtain information about the program at http://supplier.taulia.com/customers/hydroone/

The above links can be found and accessed in Part 5 – Attachments and Hyperlinks. This site contains contact information as well as details on the benefits, how to get enrolled and frequently asked questions.

Payment will be made from an ORIGINAL invoice only. Fax copies will not be processed. Statements can be accepted only with original invoices attached.

Invoices MUST be submitted in accordance with the Contract documents' Terms of Payment and Invoicing requirements and in a format corresponding to the items listed on the face of the Purchase Order Release. Invoices MUST match the Purchase Order Release in price and quantity.

All invoices must clearly show:

- Invoice number and date;
- Consultant's name, address, phone number and contact name;
- 'Remit' address, if different than mailing address;
- This Agreement or Purchase Order number, the Purchase Order Release number and the Purchase Order Release line number(s) including location of the Work and a short description of the Work the charges relate to;
- Quantity 1 lot price, unless otherwise indicated on the Purchase Order or Purchase Order Release;
- Service master number, if provided;
- Applicable tax treatment must be shown separately;
- Where GST/HST/QST is billed, the registration tax number(s) must be noted on the invoice;
- The Purchaser's Project Manager/site contact name;
- Reimbursable expenses (if applicable) shall be shown separately on all invoices and be substantiated with receipts at time of invoicing. All GST/HST and QST paid on reimbursable expenses that is recoverable by Consultant must be deducted from the amount of the expense to be claimed for reimbursement from Hydro One;
- Currency (if not Canadian dollars);
- Terms of Payment as per this Agreement;
- Invoices shall detail the fixed cost, and/or hours by individual, their charge out rates, expenses (if applicable) and the Work that the fees relate to.

NOTE:

1. Invoices not conforming to the above instructions/format will be returned to the Consultant.
2. Payments will be made to the "Remittance" address only. Cheques may not be picked up.
3. Do not include charges from more than one Purchase Order Release on an invoice.

Applying the above information, prior to issuing an award, at its sole discretion, the Purchaser may request you to submit a sample invoice generated from your accounting system clearly marked "Sample Invoice" that demonstrates your understanding of Hydro One invoicing requirements.

The pricing in the sample invoice should NOT under any circumstances be representative of the specific requirement of this RFP. Failure to comply will be considered in the evaluation and may cause your Proposal to not be considered further.

The Invoice Sample should **not** be submitted with your Proposal, you will be contacted by the Purchaser if a sample invoice is required.

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	**Yes**	**No**
We will provide the required documentation as outlined above upon request by the Purchaser in this section:	☒	☐

4.19.3 Intentionally Deleted

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below. Failure to meet these requirements may result in disqualification.	**Yes**	**No**

4.19.4 Standard Insurance Certificate

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	**Yes**	**No**
We (the Proponent and/or our subcontractors) will be using licensed vehicles owned, rented or leased by the Proponent and/or its subcontractors in connection with the Work to be performed.	☐	☒
Our (the Proponent's) employees and/or our subcontractor's employees will be using their own licensed vehicles in connection with the Work to be performed.	☒	☐

Place an "**X**" mark in either the "Yes" or "No" column in **one** of the rows below. Failure to meet this requirement may result in disqualification.	**Yes**	**No**
The Proponent shall procure and maintain at its own expense, insurance(s), as described in Section 2.2 – Insurance Requirements of this RFP package, for the duration of this contract. We have examined and meet the requested insurance requirements outlined in **Attachment #5 – Hydro One Standard Insurance Certificate Form** in Part 5 – Attachments and Hyperlinks has been completed in its entirety and is included in the hard copies of our Proposal. Attached as Appendix # **n/a** to our Proposal.	☐	☒
OR		
If Proponents answered NO to the above Insurance question: We currently do not meet the requested insurance requirements. However, if we are the successful Proponent, we will obtain and meet the required insurance requirements, at no additional cost to the Purchaser, and submit the **Standard Insurance Certificate Form** and any other insurance documentation requested by the Purchaser within 48 hours after the Purchaser's notification or request.	☒	☐

4.19.5 WSIB

Place an "**X**" mark in either the "Yes" or "No" column in **one** of the rows below. Failure to meet this requirement may result in disqualification.	**Yes**	**No**
(a) Submit evidence that your company is in good standing with the Workplace Safety Insurance Board (WSIB) by including your WSIB Account Number, Clearance Certificate Number and Validity Period as well as a copy of the Clearance Certificate. For the purposes of obtaining a Clearance Certificate through the WSIB online, the "**Principal Account Number"** is **9425551** for Hydro One Networks, Inc.		
WSIB ACCOUNT # n/a | **CLEARANCE CERTIFICATE # n/a** | *Validity Period:* **FROM:** n/a **TO:** n/a		
Clearance Certificate attached as Appendix # n/a to our Proposal. Proponent's most Recent WSIB Experience Rating Sheet (CAD-7/NEER/MAP): **n/a** Proponents are required to meet or exceed the current Hydro One requirements for WSIB Rating (one of the following): • MAP maximum of 10% surcharge on WSIB premiums • NEER: < 1.5 (rebate or surcharge status) • CAD-7: -0.0 or higher (rebate or surcharge status)	☐	☒

Place an "**X**" mark in either the "Yes" or "No" column in **one** of the rows below. Failure to meet this requirement may result in disqualification.	**Yes**	**No**
OR - If Proponent is **unable** to provide information above, please complete **one** of the following: We currently do not have WSIB Clearance Certificate, and;	**Yes**	**No**
Employer by Application **(b)** We are considered "**By Application**" by the WSIB. If requested by the Purchaser, we agree to provide a letter from the WSIB indicating that there is an opportunity to obtain optional coverage under an existing rate group. We will opt for the insurance from WSIB and obtain the required WSIB Clearance Certificate irrespective of any available exemptions from the same, at no additional cost to the Purchaser, and submit a copy of the WSIB Clearance Certificate and any other documentation requested by the Purchaser within a reasonable time period upon Purchaser's request.	☐	☒
OR		
Non-Compulsory **(c)** We are considered **Exempt** by the WSIB **(Schedule II)**. If requested by the Purchaser, we agree to provide a letter from the WSIB indicating that there is no opportunity to obtain optional coverage under our existing rate group**.**	☒	☐

Proponent Note: WSIB indicates there is no fee imposed on contractors for the Independent Operator or "Decision Letter" process.

4.20 Ownership Rights

Place an "**X**" mark in either the "Yes" or "No" column in each of the rows below.	**Yes**	**No**
We agree that Hydro One will retain ownership rights of all work product, deliverables, etc. conceived and received in the course of this engagement.	☒	☐

4.21 Intentionally Deleted

4.22 Intentionally Deleted

4.23 Additional Information

Submit any additional information that supports the required competencies and capabilities as identified in the evaluation criteria outlined in Part 1 – Overview and throughout the RFP, but please keep proposed documentation to a minimum. Excessive marketing material is not required.

Answer below:
n/a

4.24 Sample Documents/Miscellaneous Information

This section is for the inclusion or attachment of any sample documentation or miscellaneous information not requested for or requested for in these documents but which is not furnished elsewhere that the Proponent may wish to provide in support of their response.

Answer below:
(**Proponent Note:** If including any attachments please include the Appendix numbers)
n/a

4.25 Intentionally Deleted

4.26 Intentionally Deleted

4.27 Conflict of Interest and Unfair Advantage

Conflict of Interest and Unfair Advantage shall have the meaning ascribed on them in the Definitions Section 1.2 of this RFP.

The Proponent, by submitting the Proposal, warrants that to the best of its knowledge, information and belief no actual or potential Conflict of Interest or Unfair Advantage exists with respect to the Proposal of the Proposal or performance of the contemplated contract other than those, if any, disclosed below. Where the Purchaser discovers a Proponent's failure to disclose all actual or potential Conflicts of Interest or Unfair Advantage, the Purchaser may disqualify the Proponent or terminate for cause any contract awarded to that Proponent pursuant to this RFP process.

In the event that the spaces below are left blank, the Proponent shall be deemed to declare that to the best of its knowledge, information, and belief **(a)** it has had no Unfair Advantage in preparing its Proposal and **(b)** there is no foreseeable actual or potential Conflict of Interest in performing the contractual obligations contemplated in the RFP.

If either or both of the statements below apply, place an "X" mark in the appropriate box below:	
The Proponent declares that to the best of its knowledge, information, and belief there is an actual or potential Unfair Advantage relating to the preparation of its Proposal.	☐
The Proponent declares that to the best of its knowledge, information, and belief there is an actual or potential Conflict of Interest in performing the contractual obligations contemplated in the RFP.	☐

In the event the Proponent declares an actual or potential Unfair Advantage and/or an actual or potential Conflict of Interest (by marking an "X" in either of the boxes above), the Proponent shall provide all relevant detailed information below:
n/a

The Proponent agrees to provide any additional information which may be requested by the Purchaser, in the form prescribed by the Purchaser.

Where, in its sole discretion, the Purchaser concludes that an Unfair Advantage and/or Conflict of Interest arises, it may, in addition to any other remedy available to it at law or in equity, **disqualify** the Proponent's Proposal, or terminate for cause any contract awarded to the Proponent pursuant to this RFP.

4.28 Proponent Signature

The undersigned hereby warrants and represents the following:

- The information provided pursuant to this RFP document is complete and accurate in all respects;
- All RFP documents including any Addenda have been thoroughly reviewed;
- The Proponent has the current capability to provide the proposed services;

The undersigned has received the following addenda as listed below (if no addenda are issued by Hydro One leave blank).

Addendum No.		Dated
	No. 1	7/28/2015
No.	Choose addendum #	**Click here to enter a date.**
No.	Choose addendum #	**Click here to enter a date.**
No.	Choose addendum #	**Click here to enter a date.**

Click here to enter extra Addenda lines (if applicable).

As detailed in Part 1 – Overview, the onus is on each Proponent to ensure its Proposal is received at the location stipulated for receipt of Proposals and before the date and time fixed for receipt of Proposals by the Purchaser regardless of the method of delivery chosen by the Proponents. Late Proposals will not be considered.

SIGNATURE _____

NAME **Erik Sonju**

TITLE **Vice President, Power System Engineering, Inc.**

DATE 7/29/2015

Proponent Note: At least one copy of your Proposal MUST include ORIGINAL (ink) signature(s). See Part 1 –Overview for number of paper and electronic copies required. No pricing information shall be included in this Part 4 - Form of Submission. Pricing shall be provided by including the completed Pricing Matrix, per Part 5 – Attachments and Hyperlinks as an Appendix to your Proposal in a separate sealed envelope as detailed in Part 1 –Overview.

List of Appendices

Appendix 1

Contents

4.3 Executive Summary

Power System Engineering, Inc. (PSE) proposes a three-part study to measure and evaluate Hydro One's total factor productivity (TFP) and cost efficiency. First, we improve the TFP calculation methodology. Second, we use econometric benchmarking to produce an assessment of Hydro One's TFP that accounts for its specific operating conditions. Third, we use econometric benchmarking to evaluate Hydro One's total cost efficiency, again accounting for its specific operating conditions.

Why a Parallel Total Cost Efficiency Study is Advisable

NOTE: We have reviewed Addendum #1, in which Hydro One stated for Question 2 that it is looking for TFP internal trends, and not total cost efficiency. **However, based on our extensive experience with the Ontario Energy Board (OEB) and our study of OEB decisions, it is our opinion that TFP should be evaluated in tandem with overall cost efficiency**. TFP trends in isolation do not paint the whole picture for the OEB; if Hydro One's TFP trends are not as expected, but come at the same time as improved cost efficiency, Hydro One's OEB evaluation of Hydro One's performance could be different than if only TFP were considered.

In PSE's opinion, it is therefore advisable to do a cost efficiency study in parallel with the TFP study—thus our proposed third step. This has the added advantage of using similar datasets for both TFP and cost efficiency (the overall datasets will not be identical, but for many metrics the sub-datasets will be the same). Thus the OEB will be able to evaluate the TFP trends in light of Hydro One's cost efficiency performance using very similar data; this could be crucial in the OEB's overall evaluation.

Thus we have proposed a three-step plan, as described below. Our price (listed separately) includes these three steps; if Hydro One does not wish to perform all three steps, our price can be adjusted accordingly.

PSE's Proposed Methodology

Our methods have several advantages over previous efforts to measure Hydro One's TFP and cost efficiency:

- Our methods address concerns that the OEB had regarding Hydro One's TFP and cost efficiency (in its March 12, 2015 Decision);
- Our improved TFP calculations are more comprehensive and accurate than past TFP calculations, because they include more outputs;
- Our TFP benchmarking is the appropriate way to evaluate Hydro One's TFP; it is more reflective of Hydro One's unique operating conditions, because it uses econometric modeling, which quantifies the effect of business conditions on TFP; and
- PSE's top-down cost efficiency econometric benchmarking evaluation will determine the historical and projected trends in Hydro One's total costs, again taking business conditions into account, and will compare Hydro One's actual costs to an "expected" value.

In the **first part** of our study, PSE will re-do the TFP trend calculations to make them far more comprehensive than the calculations performed by Pacific Economics Group (PEG). Currently the "outputs" included in PEG's TFP calculations do not include important outputs, such as service quality, reliability, employee safety, AMI costs, and regulatory and environmental efforts. Adding these outputs will enable the TFP calculation to encompass more relevant and measurable cost drivers, which in turn will allow us to measure Hydro One's output in a more accurate and fair manner.

In the **second part** of the study, PSE will create an econometric model based on the enhanced TFP calculations created in the first part. These TFP calculations will be performed for a dataset of Canadian and U.S. utilities, including investor-owned utilities and other types of utilities, such as U.S. rural electric cooperatives (RECs). RECs have territories and operating conditions that encompass some of the conditions faced by Hydro One, and so this dataset will help to create a more robust and accurate picture of Hydro One's TFP, as compared to a Canada-only dataset.

After we have calculated the TFP for each utility in the dataset, we will use econometric modeling to examine how TFP is driven by business conditions and territory characteristics. Econometric benchmarking is a way to quantify the effect of various business conditions on a utility's TFP (e.g., vegetation levels, labour costs, peak demand, customer density, weather, etc.). The model will show the expected TFP of an "average" hypothetical utility with Hydro One's specific operating characteristics. This will allow Hydro One to compare its TFP to its own customized benchmark, not to another utility's TFP, which is influenced by vastly different operating conditions. Econometric benchmarking is the evaluation method preferred by the OEB during the 4th Generation IR proceeding.

The **third part** of the study will evaluate Hydro One's cost efficiency and its trend. The OEB's current efficiency assessment (conducted by PEG) is insufficient and incomplete as it relates to Hydro One. PSE will provide a fuller, more accurate and complete assessment that properly accounts for the cost drivers faced by Hydro One. As in the second step, we will use an expanded utility dataset. Possible cost drivers that may be captured include total service area, customer density, vegetation levels, extreme weather, serving islands, and serving on the Canadian Shield. In conversations with Hydro One, more cost drivers may be identified and explored. Hydro One's actual total costs will then be compared to its expected total costs. This presents a much fuller picture than simply comparing Hydro One's "raw" costs to another utility's costs, because other utilities have vastly different operating conditions.

The remainder of this Executive Summary provides details about PSE, its personnel, and the three-part study described above.

About Power System Engineering, Inc.

PSE is a full-service consulting firm for electric utilities, state public utility commissions, and electric utility interest groups. Our clients include regulatory bodies, consumer advocate agencies, electric cooperatives, investor-owned utilities, municipal utilities, public utility districts and industry associations. The professionals at PSE include engineers, economists, financial analysts, and IT and communication experts. We are employee-owned and independent. PSE was formed in 1974.

PSE's economics group includes experts in the field of productivity and benchmarking analysis. Mr. Fenrick, the manager for this project, has provided expert witness testimony in these fields, including a number of times before the Ontario Energy Board. The topics on which Mr. Fenrick provided testimony before the OEB included total factor productivity (TFP) calculations and top-down benchmarking research. Also included on the PSE team is Dr. Lullit Getachew, who has a PhD in economics, with a focus on econometrics. Mr. Fenrick and Dr. Getachew have each authored peer-reviewed journal articles on the topics of TFP and benchmarking, and have conducted a number of industry conferences around North America on these topics.

PSE Has Detailed Knowledge of Ontario's TFP Trends

PSE's regulatory knowledge of TFP and benchmarking research within the Ontario context is unparalleled. PSE has conducted TFP and benchmarking research in the last three years for Toronto Hydro, Hydro Ottawa, and the Coalition of Large Distributors (which included six distributors) during the 4th Generation Incentive Regulation proceeding. We have also evaluated the expected TFP trends for Enbridge Gas (and compared those to actual TFP trends). From 2010 to 2013, PSE also was engaged with OEB Staff in updating the 3rd Generation IR benchmarking results used for the annual stretch factor updates. Mr. Fenrick and Dr. Getachew were also involved in developing the TFP calculations and results for the 3rd Generation IR plan in 2007 and 2008, when we were employed by Pacific Economics Group (PEG).

PSE Has Detailed Knowledge of Hydro One's Circumstances

PSE has detailed knowledge and understanding of Hydro One's current situation regarding TFP and efficiency assessments. The OEB Staff's consultant, PEG, has conducted both TFP trend research and benchmarking efficiency assessments, and has compared Hydro One's TFP and efficiency assessments to the other distributors in Ontario. PEG's current findings (using data through 2013) are that Hydro One's efficiency is second to last in the Province (72nd out of 73), with total costs 47.8% above benchmark values. PEG also calculated the individual TFP of all the distributors in Ontario, and found Hydro One's TFP trends to be negative. PEG removed Hydro One (and Toronto Hydro) from the industry-wide TFP trend summary calculation, because of the large negative influence the two companies had on the overall industry TFP trend.[1]

In Hydro One's last rate application (under the Custom IR option), the OEB's Decision (dated March 12, 2015) directed Hydro One to undertake a number of studies. One of these studies is the reason for this proposal. Under Section 3.3 of the Decision, titled "Weak benchmarking evidence," the OEB directs Hydro One to perform a TFP study:

> The OEB sees value in Hydro One measuring its own total factor productivity over time to be able to demonstrate improvement in productivity to its customers and the OEB. The OEB requires Hydro One to conduct such a study. Given Hydro One's concerns, the OEB leaves it to Hydro One

[1] Hydro One and Toronto Hydro had a large influence on the industry TFP trends because of their relative size to the rest of the industry. Both Hydro One and Toronto Hydro are extreme outliers within the Ontario electric distribution industry for a number of reasons.

to determine its preferred total factor productivity study method. However, the period of the study should include years at least going back to 2002. The results of the study must be filed as part of Hydro One's next rates application.

Immediately prior to this study directive, the OEB Decision cites both the negative productivity and total cost efficiency (as calculated by PEG) as examples of metrics that have recently shown improvement in productivity. The OEB also mentions that the study method can be chosen by Hydro One, due to the companies concerns about the accuracy of the OEB/PEG TFP and efficiency studies. Hydro One was right to have concerns about PEG's calculation methods, and these methods can be drastically improved upon, to provide a far fairer and more accurate depiction of Hydro One's TFP and total cost performance assessment.

PSE's Proposed Dataset

PSE's project plan and final study will provide Hydro One with a fairer and more accurate method to evaluate its own TFP trends, and assess that performance relative to the industry. While PEG and the OEB have recognized Hydro One's outlier status within Ontario by excluding the company from the TFP calculations, they have not altered their methodology to properly and fairly recognize this outlier status. If one looks at Hydro One's service territory characteristics, it is plainly evident that Hydro One's TFP and efficiency should not be judged solely by comparison to other Ontario distributors. Hydro One's service territory is comparatively immense, because Hydro One serves the areas that no other utilities were willing or able to serve. Hydro One also has many characteristics which are not present in most or all other Ontario utilities, including:

- Hydro One serves islands, which present numerous logistical challenges that tend to raise costs,
- Hydro One has numerous extremely rural low-density areas, which tend to result in higher costs,
- Hydro One's territory stretches to the extreme north of the province, and this area has more extreme weather conditions,
- Hydro One's northern Ontario areas are on the Canadian Shield (a Precambrian era rock formation that makes drilling underground far more expensive).

PSE will create a fair and accurate study by expanding the sample, by also including other North American distributors. This inclusion will capture and adjust for the cost challenges of Hydro One's service territory. In research for other clients, we know that only including U.S. investor-owned utilities (IOUs) into the sample will not be sufficient to capture the unique characteristics of Hydro One—we also need to include rural electric cooperatives (RECs) and other rural North American distributors.

RECs were created in the 1930s to serve areas that IOUs were unwilling or unable to serve. There are over 900 RECs in the U.S. These RECs and other utilities serve territories that are mostly rural and low-density. Some serve islands, extreme weather places (such as Alaska), and some also serve on the Canadian Shield. PSE has worked extensively with RECs in the past, and we have an on-going benchmarking and TFP study with a number of RECs. We understand their accounting systems and their operating conditions. We will

sift through this data and identify service territory characteristics and calculate variables that will assist in the development of the study.

By expanding the sample to include U.S. IOUs, RECs, and other North American utilities, PSE will be able to vastly improve the fairness and accuracy of the OEB's TFP and efficiency studies as they relate to Hydro One. We will be able to compare TFP and efficiency on an "apples to apples" basis.

PSE's Proposed Methodology

Our proposal involves a three-step process. First we will re-do the TFP trend calculations to make them far more comprehensive. Currently the "outputs" included in PEG's TFP calculations do not include important outputs, such as service quality, reliability, employee safety, AMI costs, and regulatory and environmental efforts. There is a reason why PEG found the entire Ontario industry's TFP trends to be negative. The reason is because distributors are being asked to do a lot more than just keep costs low. These added "outputs" need to be included in a comprehensive TFP calculation to provide a fair depiction of the improvement trajectory of Hydro One. PSE will calculate the more comprehensive TFP trend (beginning in at least 2002, if not earlier).

In the second step of the process, PSE will use econometric benchmark modeling to then determine the reasonableness of Hydro One's TFP, compared to other utilities. Our expanded dataset for this modeling will include utilities with similar challenges (these include the RECs, as discussed above). This comprehensive TFP evaluation, along with the vastly improved benchmarking efficiency evaluation, will provide the OEB with a drastically improved study (compared to the PEG studies), by which the OEB can properly evaluate the productivity improvements of Hydro One.

The third part of the study will evaluate the cost efficiency and the trend in cost efficiency of Hydro One. The OEB's current efficiency assessment (conducted by PEG) is insufficient and incomplete as it relates to Hydro One. PSE will provide a fuller, more accurate and complete assessment that properly accounts for the cost drivers faced by Hydro One.

PSE will then participate with Hydro One in the rates application process. Mr. Fenrick will provide expert witness testimony, as requested by Hydro One. Mr. Fenrick has been through the Ontario regulatory process a number of times, and has had his research go through a high level of scrutiny. For example, earlier this year Mr. Fenrick was on the witness stand for a day and a half during the hearing for Toronto Hydro's Custom IR application. Intervenors such as the School Energy Coalition (SEC), represented by Mr. Jay Shepherd, and OEB Staff (supported by PEG), aggressively questioned PSE's efficiency assessments of Toronto Hydro. From the viewpoint of Toronto Hydro, Mr. Fenrick was highly effective in defending and supporting his research.

In summary, PSE will provide Hydro One with a high quality study that incorporates the best available data and methodologies in calculating TFP and developing efficiency assessments. This will produce a far more fair and accurate assessment of Hydro One's TFP and efficiency levels. PSE will then defend the study and its conclusions before the Board and other intervenors.

4.4 Your Understanding of Hydro One's Requirements

It is PSE's understanding that Hydro One requires a fair and accurate TFP and efficiency study to fulfill the OEB's requirement to produce such a study in its next rate application. We emphasize the requirement for a "fair and accurate" study, because the OEB currently relies on the PEG studies, which are not fair or accurate as they relate to Hydro One.

The current situation is one where the OEB Staff's consultant, PEG, has conducted both TFP trend research and benchmarking efficiency assessments and compared Hydro One's TFP and efficiency assessments to the other distributors in Ontario. PEG's current findings (using data through 2013) are that Hydro One's efficiency is second to last in the Province (72nd out of 73), with total costs 47.8% above benchmark values. PEG also calculated the TFP of all the distributors in the Province, and found Hydro One's TFP trends to be negative.

Hydro One, therefore, requires a consultant to provide an improved study methodology that properly accounts and adjusts for Hydro One's unique operating conditions (e.g., enormous service area, low density, islands, extreme weather, Canadian Shield). PSE will fulfill these requirements by calculating a more comprehensive TFP trend using an expanded dataset and output metrics. This will allow PSE to assess the reasonableness to utilities in similar circumstances, and develop an efficiency assessment that incorporates the many challenges encountered by Hydro One.

PSE will be looking for support from Hydro One in the following areas:

- Identifying all of the possible service territory challenges of the company,
- Identifying the added "outputs" Hydro One has been delivering to customers (such as increased energy efficiency programs, customer service, reliability, distributed generation connections, etc…), and
- Collecting historical and projected Hydro One data regarding costs, outputs, and external variables.

We do not see any major issues with the project. PSE is confident in partnering with Hydro One to identify a number of its unique conditions and then collecting, developing, and processing the vast data needed from other North American utilities to make a fair and accurate TFP and efficiency assessment.

4.6.1 Utility Services Background:

PSE is an industry leader in utility TFP measurement and efficiency level benchmarking. We have extensive experience working on these issues within Ontario. In particular, we have dealt with the subject of TFP measurement and benchmarking, and on these issues we have worked for both the Ontario Energy Board Staff and Ontario utilities (Coalition of Large Distributors, Enbridge Gas, Toronto Hydro, and Hydro Ottawa).

Mr. Fenrick, who will be the project manager of this project, is recognized as an industry expert in utility TFP measurement and benchmarking. He puts on an annual industry conference on measuring productivity, sponsored and marketed by Energy Utility Conference Institute (EUCI). Mr. Fenrick also annually puts on a productivity course during the Institute of Public Utilities (IPU) Advanced Rates conference. The IPU conference typically includes regulators from a number of jurisdictions.

PSE is a full-service consulting firm serving the utility industry. PSE's staff includes economists, engineers, technology experts, and financial experts. This broad level of expertise is important for conducting TFP and efficiency research that accurately accounts for various differences between distributors. PSE's benchmarking team utilizes advanced statistical methods and then combines them with engineering and real-world utility operational knowledge to provide accurate and realistic conclusions that are defensible in a regulatory context.

4.6.1 Utility Services Background (Part 2):

Two large projects that display PSE's ability to provide the services requested by Hydro One are: (1) PSE's work with Toronto Hydro (THESL), and (2) PSE's work with the Coalition of Large Distributors (CLD).

PSE has worked with THESL from 2012 to 2015. During that time we have conducted two benchmarking distribution cost efficiency studies, one of which was filed with the Board, and defended by PSE during THESL's Custom Incentive Regulation (Custom IR) application. Mr. Fenrick of PSE successfully defended the benchmarking methodology and results before the OEB in February of 2015. The witness panel that Mr. Fenrick was on lasted for nearly one and a half days, with the majority of questions being fielded by Mr. Fenrick.

The THESL project is quite similar to the upcoming Hydro One project, because both THESL and Hydro One are extreme outliers in the context of the Ontario electric distribution industry. In THESL's case it is an outlier for two reasons: its enormous size relative to every other Ontario distributor (except Hydro One), and its highly urban core.

Hydro One is an outlier for different reasons: its large territory, and its rural characteristics (along with several other unique characteristics). During the THESL project, PSE provided empirical and engineering evidence that serving either a rural territory or a highly urbanized territory drastically increases utility costs relative to suburban areas. PSE's cost benchmarks adjusted for THESL's urban characteristics, just

as our techniques will be able to accurately adjust for Hydro One's rural and other characteristics (islands, Canadian Shield, etc…).

However, in Hydro One's case we will incorporate rural electric cooperatives into the dataset to enable a fair "apples to apples" comparison (this was not done for THESL). This is necessary in Hydro One's case, because to accurately determine the cost drivers of its challenges (serving islands, serving very large and rural areas, etc.), utilities with those characteristics must be present in the data set.

In PSE's work with the CLD, we offered the OEB our expert recommendations and advice regarding TFP calculations and efficiency assessments in the 4th Generation Incentive Regulation proceeding. PSE provided TFP research and cost efficiency benchmarking assessments on behalf of the six CLD members. We examined and dug into the OEB's TFP calculations. We are well-versed in how the current methodology is used, and how it can be improved upon.

In the proposed Hydro One study, we will build upon the TFP work of PEG to incorporate a more comprehensive view of Hydro One's performance. Important outputs such as the increase in environmental outputs that the company is being asked to provide have been ignored in the past. To properly assess the performance of the utility and how that has changed over time, increased output and effort in all types of areas must be assessed and weighted within the TFP calculation. Furthermore, PEG has not examined the reasonableness of specific TFP outcomes in light of such factors as the size, customer density, or customer growth of the specific utility. PSE's assessment of the reasonableness of Hydro One's TFP will account for those important characteristics and any others that are identified. These steps will provide Hydro One with a far more accurate depiction of the company's own TFP trend from 2002 to 2022.

This experience of developing productivity studies and then defending it within the Ontario regulatory context shows the ability of PSE to provide Hydro One and the stakeholders with a rigorous and accurate study that will then be effectively defended during Hydro One's rate application in 2017.

4.13 Assessment Methodology

The project will significantly enhance the OEB's efficiency and TFP assessments as they relate to Hydro One. We will use methodology similar to that used by the OEB; however, it will be enhanced and customized to appropriately account for the uniqueness of Hydro One's service territory. The OEB methodology, while appropriate for the vast majority of Ontario distributors, requires modification and enhancement for it to be a fair and accurate depiction of Hydro One's distribution performance.

As did the OEB in its efficiency assessment, PSE will likely use the econometric benchmarking method as the foundation of the benchmarking research. The econometric approach estimates a cost model by calculating the correlations between a number of explanatory variables and an independent variable, which in this case is cost. This model provides a direct quantification of the effect of each variable on cost, and properly "weights" that variable based on its contribution to costs. Unlike the current OEB efficiency assessment (which ranks Hydro One 72nd out of 73 distributors), PSE will properly account for the service territory challenges encountered by Hydro One. These include the enormous area served, serving islands, extreme weather, Canadian Shield, and others.

The econometric approach is the preferred approach of the Ontario Energy Board in its regulation of electric distributors.[2] PSE is a leading expert of the approach, especially within Ontario regulation.[3]

The TFP trend assessment will also likely follow a similar method as that used by the OEB. However, the current OEB methodology is very limited in its focus on the true "outputs" being delivered by distributors. It also makes no adjustment for the differences in service territories. PSE will create a far more comprehensive TFP calculation by including other "outputs" such as regulatory, service quality, and environmental to provide the OEB with a comprehensive outlook at Hydro One's TFP. We will assess the reasonableness of that TFP by creating a "TFP-driver" model that examines the expected TFP for Hydro One based on the company's service territory conditions.

PSE has a great deal of experience working on TFP calculations. Mr. Fenrick was recognized as a TFP expert during the 4th Generation Incentive Regulation proceeding. We fully understand the OEB's current methodology, including its weaknesses and strengths.

[2] The Board's 4th Generation IR decision in 2013 uses the econometric method to determine stretch factors. The decision excluded the peer group approach in favor of only using the econometric method.

[3] From 2010 to 2013, PSE worked with Board Staff in annually updating the econometric and peer group results for all 70 Ontario distributors within the 3rd Generation IR. During the 4th Generation IR proceeding, PSE worked with the Coalition of Large Distributors in helping the Board determine how to move forward with benchmarking. PSE recommended using the econometric approach to determine stretch factors, which the Board decided was the proper course. In 2014, PSE filed an econometric study of total costs and reliability for Toronto Hydro in their Custom IR filing. In 2015, PSE filed a similar econometric study of total costs and reliability for Hydro Ottawa in their Custom IR filing.

The expected deliverables that will be generated by PSE are:

1. Study Design Proposal: This will be in a Word document, laying out the study design, steps, and result formats.
2. Stakeholder Consultation Presentation: A PowerPoint presentation will be put together summarizing the Study Design Proposal. Mr. Fenrick will present at a stakeholder session.
3. Draft Report: A draft report will be provided to Hydro One for a thorough review. Prior to the Draft Report, PSE will be providing status updates to keep Hydro One well-informed about the study's progress.
4. Final Report: A PDF version of the Final Report will be delivered to Hydro One.
5. Participation in the Defense of the Final Report (Part B, in 2017): PSE will be readily available as requested to defend and support the findings of the Final Report.

4.8 Schedule

See project schedule on following page.

The project schedule is built around the major milestones listed in section 3.3 of the RFP. The detailed project schedule (following) is broken down by weeks with tasks assigned to PSE, Hydro One, or both. The schedule achieves the timeline for milestones discussed in the RFP. These are:

Major Milestone Completion Dates

1. **Deliver draft proposal for the Study:** August 2015
2. **Participate in stakeholder sessions:** September 2015
3. **Deliver the Draft Report:** August 2016
4. **Deliver the Final report:** October 2016
5. **Fully participate in the regulatory proceedings:** As required

We fully anticipate meeting these deadlines and providing high quality deliverables that meet or exceed the expectations of Hydro One.

PSE Resource Requirements for Each Major Deliverable

The projected percent allocation of total hours is shown in the table below. Our estimated hours of effort for each PSE employee is only an estimate. During the course of the project, hours may be proportioned differently. However, the fixed price for Part A will be unaffected and remain as quoted.

PART A PSE Resource Plan

Major Deliverables (Part A)	% Allocation
Deliver draft proposal for the Study	2.0%
Participate in stakeholder sessions	1.7%
Create Models; Deliver the Draft Report	90.1%
Deliver the Final Report	6.2%
Total	100.0%

Regarding Part B of the project, we provide hourly rates and estimated hours in section 4.18 (“Pricing”). As the RFP recognizes, the level of effort is difficult to accurately gauge, since it is a function of stakeholder interrogatories and other unknown regulatory requests.

Anticipated Project Timeline

	Task	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16
		1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4
1	Kick-off call with PSE/Hydro One															
2	Develop Study Plan															
3	Present Study Plan to stakeholders															
4	Meeting between PSE and Hydro One															
5	Information and Data request to Hydro One															
6	Hydro One fills out data request															
7	Determine list of variables that are theoretically plausible and available for data processing															
8	Gather and process North American cost, outputs, and explanatory variable data															
9	Estimate cost driver model															
10	Determine comprehensive "outputs" for Hydro One TFP															
11	Develop appropriate "weights" for comprehensive outputs for TFP															
12	Calculate Hydro One TFP trend from 2002-2022															
13	Calculate TFP trends for the rest of the sample															
14	Develop TFP-driver model that provides expected TFP based on Hydro One service															
15	Develop Hydro One total cost efficiency benchmarking evaluation															
16	Prepare draft TFP study and preliminary study results															
17	Receive feedback from Hydro One															
18	Present final TFP study to Hydro One															
19	Status update calls (PSE is always available to provide status update when requested)															
20	Participate in the defense of the TFP Study (Part B)	2017 as requested														

PSE Task
Hydro One Task
Joint Task

Appendix 2: Project Team and Resumes

PSE will use the following personnel on the Work. All personnel listed are "assigned" resources and will be available throughout the length of the Work.

- Steve Fenrick, M.S.
- Erik Sonju, P.E.
- Lullit Getachew, Ph.D.
- Jeff Smith, M.S.
- David Williams, J.D.
- Matt Sekeres
- PSE staff (as needed)

The capacity of each team member on the references in 4.6.2 is listed below.

1. Toronto Hydro Electric System Limited

    - Steve Fenrick: Project manager; oversaw all modeling; report writing; expert witness testimony
    - Erik Sonju: Power system expertise; expert witness testimony; report writing
    - Lullit Getachew: Econometric modeling
    - Jeff Smith: Econometric modeling
    - David Williams: Report writing
    - Matt Sekeres: Database preparation and analysis

2. Hydro Ottawa

    - Steve Fenrick: Project manager; oversaw all modeling; report writing
    - Lullit Getachew: Econometric modeling
    - Jeff Smith: Econometric modeling
    - David Williams: Report writing
    - Matt Sekeres: Database preparation and analysis

3. Coalition of Large Distributors

    - Steve Fenrick: Project manager; oversaw all modeling; report writing; expert witness testimony
    - Lullit Getachew: Econometric modeling
    - Jeff Smith: Econometric modeling
    - David Williams: Report writing
    - Matt Sekeres: Database preparation and analysis

Resumes

Resumes of the following team members begin on the next page:

Steve Fenrick, M.S.
Erik Sonju, P.E.
Lullit Getachew, Ph.D.
Jeff Smith, M.S.
David Williams, J.D.
Matt Sekeres

STEVEN A. FENRICK

Leader, Economics & Market Research Group

SUMMARY OF EXPERIENCE AND EXPERTISE

- Leader of PSE's Economics and Market Research group which conducts research in the fields of DSM, performance benchmarking, incentive regulation, load research and forecasting, and survey design and implementation
- Manages PSE's cost, productivity, and reliability performance benchmarking practice
- Directs research on value-based reliability planning efforts for electric utilities
- Expert in performance-based ratemaking and incentive regulation
- Directs economic research on investigating the impacts and costs/benefits of DSM programs and designing statistically robust pilot designs

PROFESSIONAL EXPERIENCE

Power System Engineering, Inc.– Madison, WI (2009 to present)

Leader, Economics and Market Research

Responsible for providing consulting services to utilities and regulators in the areas of reliability and cost benchmarking, incentive regulation, value-based reliability planning, demand-side management including demand response and energy efficiency, load research, load forecasting, end-use surveys, and market research.

- Leads research, on an annual basis, with over a dozen electric utilities in evaluating cost, productivity, and reliability performance and uncovering methods to improve their operations
- Benchmarking consultant to the Ontario Energy Board regarding their 3rd Generation Incentive Regulation Plan for the last two years
- In the process of designing and analyzing DSM pilot projects at over 25 electric utilities across the country
- Testimony experience regarding performance value-based reliability planning, benchmarking and productivity analysis
- Has given several presentations on performance benchmarking and productivity analysis, costs and benefits of DSM programs, and measurement and verification (M&V) techniques.
- Key speaker at EUCI conferences regarding cost and reliability performance evaluation and productivity analysis of distribution utilities

Pacific Economics Group – Madison, WI (2001 - 2009)

Senior Economist

- Co-authored research reports submitted as testimony in numerous proceedings in several states and in international jurisdictions. Research topics included statistical benchmarking, alternative regulation, and revenue decoupling.

- Instructor at 2009 EUCI "Electric Utility Cost and Service Quality Benchmarking" conference.
- Developed a reliability benchmarking model for power distribution comparing utility performance.
- Managed and supervised PEG support staff in research and marketing efforts.

EDUCATION

University of Wisconsin - Madison, WI
Bachelor of Science, Economics (Mathematical Emphasis)

University of Wisconsin - Madison, WI
Master of Science, Agriculture and Applied Economics

Publications & Papers

- "Demand Impact of a Critical Peak Pricing Program: Opt-In and Opt-Out Options, Green Attitudes and other Customer Characteristics:, *The Energy Journal*, January 2014. (With Lullit Getachew, Chris Ivanov, and Jeff Smith).
- "Evaluating the Cost of Reliability Improvement Programs", *The Electricity Journal*, November 2013. (With Lullit Getachew)
- "Cost and Reliability Comparisons of Underground and Overhead Power Lines", *Utilities Policy*, March 2012. (With Lullit Getachew).
- "Formulating Appropriate Electric Reliability Targets and Performance Evaluations, *Electricity Journal*, March 2012. (With Lullit Getachew)
- "Enabling Technologies and Energy Savings: The Case of EnergyWise Smart Meter Pilot of Connexus Energy", November 2012. (With Chris Ivanov, Lullit Getachew, and Bethany Vittetoe)
- "Estimation of the Effects of Price and Billing Frequency on Household Water Demand Using a Panel of Wisconsin Municipalities", *Applied Economics Letters*, 2012, 19:14, 1373-1380.
- "Altreg Rate Designs Address Declining Average Gas Use", *Natural Gas & Electricity*. April 2008. (With Mark Lowry, Lullit Getachew, and David Hovde).
- "Regulation of Gas Distributors with Declining Use per Customer", *Dialogue*. August 2006. (With Mark Lowry and Lullit Getachew).
- "Balancing Reliability with Investment Costs: Assessing the Costs and Benefits of Reliability-Driven Power Transmission Projects." April 2011. *RE Magazine*.
- "Ex-Post Cost, Productivity, and Reliability Performance Assessment Techniques for Power Distribution Utilities". Master's Thesis.

Expert Witness Experience

- Docket EB-2015-0004, Hydro Ottawa, Custom Incentive Regulation Application.
- Docket 15-SPEE-357-TAR, Application for Southern Pioneer Electric Cooperative, Inc., Demand Response Peak Time Rebate Pilot Program.
- Docket EB-2014-0116, Toronto Hydro, Custom Incentive Regulation Application.
- Docket EB-2010-0379, The Coalition of Large Distributors in Ontario regarding "Defining & Measuring Performance".
- Docket No. 6690-CE-198, Wisconsin Public Service Corporation, "Application for Certificate of Authority for System Modernization and Reliability Project".
- Expert Witness presentation to Connecticut Governors "Two Storm Panel", 2012.
- Docket No. EB-2012-0064, Toronto Hydro's Incremental Capital Module (ICM) request for added capital funding.
- Docket No. 09-0306, Central Illinois Light rate case filing.
- Docket No. 09-0307, Central Illinois Public Service Company rate case filing.
- Docket No. 09-0308, Illinois Power rate case filing.

Recent Presentations

- EUCI conference chair in Chicago. "Evaluating the Performance of Gas and Electric Distribution Utilities." June 2015.
- Institute of Public Utilities Advanced Rate Conference at Michigan State University, "Performance Benchmarking". October 2014.
- Cooperative Exchange Conference, Williamsburg VA. "Smart Thermostat versus AC Direct Load Control Impacts". August 2014.
- EUCI conference chair in Chicago. "The Economics of Demand Response". February 2014.
- Institute of Public Utilities Advanced Rate Conference at Michigan State University, "Performance Benchmarking". October 2013.
- EUCI conference chair in Chicago. "Evaluating the Performance of Gas and Electric Distribution Utilities." August 2013.
- Presentation to the Ontario Energy Board, "Research and Recommendations on 4th Generation Incentive Regulation".
- Presentation to the Canadian Electricity Association's best practice working group. 2013
- Conference chair for EUCI conference in March 2013 titled, "Performance Benchmarking for Electric and Gas Distribution Utilities."
- Presentation to the board of directors of Great Lakes Energy on benchmarking results, December 2012.
- Presentation on making optimal infrastructure investments and the impact on rates, Electricity Distribution Association, Toronto, Ontario. November 2012.
- Conference chair for EUCI conference in August 2012 titled, "Performance Benchmarking for Electric and Gas Distribution Utilities."
- 2012 presentation in Springfield, IL to the Midwest Energy Association titled, "Reliability Target Setting and Performance Evaluation".
- 2012 presentation in Springfield, IL to the Midwest Energy Association titled, "Making the Business Case for Reliability-Driven Investments".

- Conference chair for EUCI conference in 2012 titled, "Balancing, Measuring, and Improving the Cost and Reliability Performance of Electric Distribution Utilities". St. Louis.
- Conference chair for EUCI conference in 2012 titled, "Demand Response: The Economic and Technology Considerations from Pilot to Deployment". St. Louis.
- 2012 Presentation in the Missouri PSC Smart Grid conference entitled, "Maximizing the Value of DSM Deployments". Jefferson City.
- 2011 conference chair on a nationwide benchmarking conference for rural electrical cooperatives. Madison.
- 2011 presentation on optimizing demand response program at the CRN Summit. Cleveland.
- Conference chair for EUCI conference in 2011 titled, "Balancing, Measuring, and Improving the Cost and Reliability Performance of Electric Distribution Utilities". Denver.
- 2010 presentation on cost benchmarking techniques for REMC. Wisconsin Dells.

History of Major Research Projects

1. Cost and reliability econometric benchmarking in Custom Incentive Regulation filing, Hydro Ottawa, 2015.
2. Long-range load forecasts for six distribution utilities and G&T, Sunflower Electric, 2015.
3. Load research study review and VEE process review, Minnesota Power, 2015.
4. Demand Side Management Business Case Guidebook, CRN, 2015.
5. Prepare research, design, and application to Kansas Commission on Peak Time Rebate Pilot for Southern Pioneer Electric Cooperative, 2015.
6. Cost and reliability econometric benchmarking in Custom Incentive Regulation filing, Toronto Hydro, 2014/2015.
7. Emergency response benchmarking for gas utilities, Vectren, 2014.
8. Set-up DSM pilots and optimize portfolio, Sunflower G&T, 2014/2015.
9. Central Wisconsin Electric demand response study, 2014/2015.
10. Long range load forecasts for Wolverine, Allegheny, and Sunflower, 2014.
11. Spatial load forecast for Rochester Public Utilities, 2014.
12. Revenue requirement and cost of service study for Todd-Wadena, 2014.
13. Development of a performance based regulation plan for Toronto Hydro. 2013/2014.
14. Set internal econometric reliability targets for Great Lakes Energy, 2014.

15. Conduct research, provide recommendations, and provide expert witness testimony on the 4th Generation Incentive Regulation on behalf of the Coalition of Large Distributors, 2013.
16. Testimony for Wisconsin Public Service Corporation (WPS) regarding the cost effectiveness of their reliability-driven capital project, 2013.
17. Transmission & Distribution Cost Benchmarking for Pacific Gas & Electric, 2013.
18. Evaluation and review of business cases for reliability-driven projects, Toronto Hydro, 2012/2013.
19. Cost and reliability benchmarking research for Toronto Hydro, 2012/2013.
20. Transmission and distribution cost benchmarking research for Vectren, 2013.
21. Power plant benchmarking for coal and natural gas fired plants, Sunflower Electric, 2012.
22. Peak Time Rebate demand response calculations, Heartland Electric, 2012/2013.
23. Resource planning and integration of DSM resources, Sunflower Electric, 2012.
24. Energy efficiency whitepaper on estimating Effective Useful Life, Cooperative Research Network, 2012.
25. Demand response whitepaper on the value proposition of increasing distribution load factors via demand response, Cooperative Research Network, 2012.
26. Energy efficiency rebate optimization, Corn Belt, 2012.
27. Energy efficiency and demand response customer baseline load algorithm development for an MDM system vendor, 2012.
28. Incentive Regulation Productivity and Benchmarking, Enbridge Gas Distribution, 2011/2012
29. Reliability Benchmarking and Target Setting, Vectren 2011/2012
30. DSM potential analysis, South Central Indiana, 2011/2012
31. Annual benchmarking updates of Ontario's 77 power distribution utilities, OEB 2011
32. Cost and reliability benchmarking research involving a group of 20 electric utilities, 2011
33. Energy Efficiency program design and cost effectiveness, Corn Belt 2011
34. Cost/Benefit model of direct load control, Corn Belt 2011
35. Peak time rebate demand response program design and cost effectiveness, Heartland 2011/2012
36. Value Based Reliability Planning project at New Hampshire Electric Cooperative, 2010

37. DSM research on pilots at 25 electric utilities, 2010-2014, DOE Stimulus Grant.
38. Benchmarking research involving a group of 14 electric utilities, 2010
39. M&V research of OPower energy efficiency program, 2010.
40. M&V research of Smart Thermostat demand response program, 2010.
41. Benchmarking research regarding Union Electric, 2010
42. Benchmarking research regarding the three Ameren Illinois Utilities, 2009
43. Benchmarking research for Central Vermont Public Service, 2009
44. Benchmarking research on Oklahoma Gas & Electric, 2009
45. Research North American power industry revenue forecast precedents, HECO, 2008.
46. Revenue Adjustment Mechanism for CVPS Revenue Decoupling Proposal, CVPS, 2008.
47. Productivity Research for Bundled Power Service, HECO, 2008.
48. A&G Power Benchmarking Research. 2008.
49. Productivity Research of Ontario's Power Distribution Utilities, OEB, 2008.
50. Productivity Research of U.S. Power Generation and Distribution, APS, 2007.
51. Productivity Research of Northeast Power Distribution, CMP, 2007.
52. Productivity Research of Ontario's Gas Distribution Utilities, OEB, 2007.
53. Benchmarking Research of Ontario's Power Distribution Utilities, OEB, 2007.
54. Benchmarking Research of Electric A&G Expenses, Michigan PSC, 2006.
55. Productivity Research for Gas Distribution, Sempra, 2006.
56. Productivity Research for Power Distribution, Sempra, 2006.
57. Benchmarking Research for Gas Distribution, Nstar Gas, 2006.
58. Benchmarking Research for Power Distribution, Central Vermont PSC, 2005.
59. Benchmarking Research of Nuclear Power Generation, Sempra, 2005.
60. Research on Rate Trends for Electric Power, EEI, 2005.
61. Benchmarking Research of Bundled Power Service, Florida Power, 2005.
62. Benchmarking Research of Canadian Electric Distribution, Hydro One, 2005.
63. Benchmarking Research of Gas Distribution, Bay State, 2005.
64. Benchmarking Research of Electric Distribution, Aquaelectra, 2004.
65. Benchmarking Research for the Caribbean Water Distribution Industry, Aquaelectra, 2004.
66. Compensatory Rate Trend for the U.S. Gas Industry, 2004.

67. Productivity Research for the U.S. Electrical industry, TXU, 2004.
68. Research on Productivity and Benchmarking for Queensland, Australia Electrical Companies, 2004.
69. Research on Productivity and Benchmarking for Gas and Electric Industries for Sempra, 2004.
70. Research on Productivity and Benchmarking for Jamaican Power Company. JPS, 2003-4.
71. Cost analysis research and benchmarking for the Bolivian Power regulator, 2003.
72. Research on Productivity and Benchmarking for a Canadian Power Transmission Company, 2002.
73. Research on Productivity and Benchmarking for a Natural Gas Distributor. Boston Gas, 2002-3.
74. Research on Benchmarking for Bundled Power Service. AmerenUE, 2002
75. Statistical Benchmarking for Electric Power Transmission. Transcend, 2002.
76. Statistical Benchmarking for three Australian Gas Utilities, 2001.
77. Power Distribution TFP trends for Bangor Hydro, 2001.

ERIK S. SONJU, P.E.
VICE PRESIDENT – POWER DELIVERY PLANNING AND DESIGN

SUMMARY OF EXPERIENCE AND EXPERTISE

- Experienced Professional Engineer in areas of electric transmission and distribution system operations, studies, capital asset planning, design, and reliablity assessment.
- Other areas of expertise include system protection and coordination, power quality investigations, system loss analysis, and distributed generation interconnections.
- Instructor for professional development courses in power delivery planning, system protection, and line design.
- Expert witness in regulatory electric rate cases and civil trials requiring specialized knowledg in the field of electrical enginering and power systems.
- Licensed Professional Engineer in 18 states.

PROFESSIONAL EXPERIENCE

Power System Engineering, Inc. –Madison, WI (2006-present)

Vice President – Power Delivery Planning and Design (2010 - Present)

Responsible for PSE's efforts in electric transmission and distribution studies and planning, substation design, transmission line design and distribution line design. Other responsibilities include overseeing system protection and coordination studies, system operations and maintenance support, distributed generation interconnection studies, and specialty studies.

Leader of System Planning and Line Design (2008 – 2010)

Senior engineer and leader of system planning and line design. Emphasis included short range and long range system planning studies, distributed generation system impact studies, system protection studies, and expert testimony in regulatory proceedings associated with engineering analysis used for State Commission and FERC filed tariffs. Other responsibilities included distribution and transmission line design.

Leader of System Planning (2006 – 2008)

Senior engineer and leader of distribution system planning projects.

Great Lakes Energy –Boyne City, MI (2001-2006)

System Engineer and Manager of Engineering

System engineer and engineering department manager for a newly formed 120,000 customer electric distribution cooperative following the merger of three cooperatives in Michigan.

Heartland Engineering Services – Rockford, MN (1999-2001)

System Engineer

Consulting engineer for electric utilities owning transmission and distribution facilities.

United Services Group – Elk River, MN (1997-1999)

Planning Engineer

Consulting engineer within a department of United Power Association (currently Great River Energy) for its distribution cooperative members and non-member utilities.

EDUCATION

North Dakota State University, Fargo, ND
Bachelor of Science in Electrical Engineering with Emphasis in Power Systems, 1997

University of Nebraska, Lincoln, NE
NRECA Management Internship Program, 2006

Numerous technical and business continuing education courses focusing on issues and topics within the power industry.

TRAINING SEMINARS AND CONFERENCE PRESENTATIONS

- Head instructor for Distribution Line Design Training Courses to Electric Cooperatives, Municipals and Investor Owned Utilities.
- Instructor for NRECA's Introduction to Distribution Engineering Course for topics on:
  - Distribution System Planning
  - Distribution System Protection and Sectionalizing
- Industry conference presentations on:
  - Mechanical Loading of Overhead Electrical Equipment on Wood Poles
  - Distributed Generation Interconnection
  - Application of Series Capacitors on Distribution Systems
  - Impact of Electric Motors, Drives, and Phase Converters on Distribution Systems
  - Substation Protection Considerations
  - National Electric Safety Code Rules and Requirements Pertaining to Communication Attachments on Power Supply Structures.

STATES LICENSED AS PROFESIONAL ENGINEER

Arkansas	Iowa	New Hampshire	Wisconsin
Colorado	Kansas	New Mexico	Wyoming
Florida	Minnesota	Ohio	
Illinois	Montana	South Dakota	
Indiana	Nebraska	Virginia	

EXPERT WITNESS AND TESTIMONY

Utility / Entity	Jurisdiction Body	Case No.	Description	Year
Toronto Hydro-Electric System Limited	Ontario Energy Board	EB-2014-0116	Industry expert on behalf of Toronto Hydro. Developed and filed report regarding independent review of the cost to serve developed environments including core downtown areas. Followed by oral testimony.	2014-15
Crow Wing Power	State of Minnesota District Court - Cass County	Court File No: 11-CV-12-1670	Testimony on behalf of CWP in the matter of a stray voltage law suit. Specific evidence related to conditions of underground distribution cable running adjacent to a dairy farm.	2013-14
MidAmerican Energy Company	State of Iowa District Court - Polk County	Law No. CL 114962	Industry expert on behalf of defendant providing engineering analysis showing the probable cause of failure of a 161kV transmission structure while under construction. Included affidavit of the analysis results and deposition by plaintiff attorney.	2013
Toronto Hydro-Electric System Limited (THESL)	Ontario Energy Board	EB-2012-0064	Written and oral testimony regarding the replacement of aging electric infrastructure in the matter of THESL's application for 2012, 2013, and 2014 IRM Rate Adjustments and ICM Rate Adders	2012
Governor Dannel P. Malloy's Two Storm Panel	State of Connecticut	N/A	Expert witness presentation to Governor Malloy's Two Storm Panel regarding distribution system reliability in the aftermath of Tropical Storm Irene and 2011 Halloween nor'easter snow storm.	2011

LULLIT GETACHEW, PhD
SENIOR ECONOMIST

SUMMARY OF EXPERIENCE AND EXPERTISE

- Expert in applying econometric methods to utility research topics.
- Provides econometric support and review on all PSE economic and market research practice areas.
- Conducts empirical studies using multiple programming languages.

PROFESSIONAL EXPERIENCE

Power System Engineering, Inc. – Madison, WI (2011-present)

Senior Economist

Provides consulting services to electric utilities nationwide in load forecasting and research, performance benchmarking, customer and end-use surveys, market research, energy efficiency filings, and demand-side management.

Pacific Economics Group Research – Madison, WI (2002-2011)

Senior Economist

Conducted research in support of regulatory filings of energy utilities. Analyzed efficiency of regulated entities using various econometric and non-parametric methods including panel data, frontier methods, and system estimators. Prepared studies and reports for performance-based regulation of transmission and distribution energy businesses, undertook total and operation cost benchmarking, prepared reports for rate settlements, and marketed flexibility in rate designs. Undertook studies on service quality conditions and requirements in regulation.

Rice University Economics Department – Houston, TX (1999-2002)

Research Assistant to Professor Robin Sickles (Summer 1999-Summer 2002)

Performed a time-series analysis of aircraft demand by major world airlines. Worked on a stochastic distance frontier model used to assess the productive performance of a group of European airlines. Developed a detailed panel with input and output data for the private manufacturing sector of Egypt. Used parametric and non-parametric methods to examine total factor productivity improvements of this sector from 1987 to 1996, particularly in light of reforms undertaken in 1991.

Instructor, Principles of Macroeconomics (Spring 2000-Spring 2001)

Prepared lectures and taught the students enrolled in the class. Researched and presented articles related to concepts covered by the course material. Evaluated students' performance.

LULLIT GETACHEW, Ph.D.

EDUCATION

Rice University - Houston, TX
Ph.D., Economics, 2002

The Fletcher School, Tufts University - Medford, MA
Master of Arts in Law and Diplomacy (MALD)

Mount Holyoke College - South Hadley, MA
Bachelor of Arts Degree

PUBLICATIONS

"Formulating Appropriate Electric Reliability Targets and Performance Evaluations," 2012, with S.A. Fenrick, *The Electricity Journal*, 25 (2): 44-53.

"Cost and reliability comparisons of underground and overhead power lines," 2012, with S.A. Fenrick, *Utilities Policy*, 20: 31-37.

"Estimation of the effects of price and billing frequency on household water demand using a panel of Wisconsin municipalities," 2012, with S.A. Fenrick, *Applied Economics Letters*, 19: 1373–1380.

"Econometric TFP Targets, Incentive Regulation and the Ontario Gas Distribution Industry," 2009, with Mark N. Lowry, *Review of Network Economics*, 8 (4): 325-345.

"Alternative Regulation, Benchmarking, and Efficient Diversification," 2009, with Mark N. Lowry, *Dialogue: United States Association for Energy Economics*, 17 (2): 27-31.

"The Market Structure of the Power Transmission and Distribution Industry in the Developed World", 2009, in Hunt, Lester C. and Joanne Evans (eds.). International Handbook on the Economics of Energy. Cheltenham, UK: Edward Elgar Publishing.

"The Economics and Regulation of Power Transmission and Distribution: The Developed World Case," 2009, with Mark N. Lowry, in Hunt, Lester C. and Joanne Evans (eds.). International Handbook on the Economics of Energy. Cheltenham, UK: Edward Elgar Publishing.

"Statistical Benchmarking in Utility Regulation: Role, Standards and Methods," 2009, with Mark N. Lowry, *Energy Policy* 37: 1323-1330.

"Price Control Regulation in North America: Role of Indexing and Benchmarking," 2009, with Mark N. Lowry, *The Electricity Journal*, 22: 63-76.

"AltReg Rate Designs Address Declining Average Gas Use," 2008, with Mark N. Lowry, David Hovde and Steve Fenrick. *Natural Gas & Electricity* 24 (9): 13-18.

"The Policy Environment and Relative Price Efficiency of Egyptian Private Sector Manufacturing," 2007, with R.C. Sickles, *The Journal of Applied Econometrics*, 22 (4): 703-854.

"Regulation of Gas Distributors with Declining Use Per Customer", 2006, with M.N. Lowry and S. Fenrick, *Dialogue: United States Association for Energy Economics*, 14 (2): 17-21.

"Econometric Benchmarking of Cost Performance: The Case of U.S. Power Distributors," 2005, with M.N. Lowry and D. Hovde, *The Energy Journal*, 26 (3): 75-92.

"Specification of Distance Functions Using Semi- and Non-parametric Methods with An Application to the Dynamic Performance of Eastern and Western European Air Carriers," 2002, with R. Sickles and D. Good, *Journal of Productivity Analysis*, 17 (1-2): 133-155.

"A Model of World Aircraft Demand," 1998, with D. Good, A.K. Postert and R. Sickles, in Michael T McNerney (ed.) Airport Facilities: Innovations for the Next Century American Society of Civil Engineers: Reston, VA. 40-59.

JEFF A. SMITH
ECONOMIST

SUMMARY OF EXPERIENCE AND EXPERTISE

- Experienced in econometric modeling and forecasting.
- Market research experience includes experiment design, stratified random sampling, sample and response validation, questionnaire design, and analysis.
- Provide support for benchmarking, load research, DSM and economic research practice areas.

PROFESSIONAL EXPERIENCE

Power System Engineering, Inc. – Madison, WI (2010-present)

Economist

Provide consulting services to cooperative, investor owned, and municipal electric utilities in the areas of demand-side management, end-use surveys, market research, load forecasting and benchmarking.

- Design statistically robust market research projects and develop end-use and customer demographic questionnaires that provide managers with insights into customer perceptions, values, and segments.
- Provide analytical support for economic research project areas.

Pacific Economics Group – Madison, WI (2008-2010)

Economist

- Conducted empirical research and provided evidence required for utilities to secure authorization for rate changes by quantifying productivity and cost trends, as well as the sufficiency of alternative price caps in competitive market simulations.

United States Marine Corps Reserve (1993-2001)

EDUCATION

Marquette University - Milwaukee, WI
Masters of Science in Applied Economics, 2008

University of Wisconsin - Whitewater, WI
Bachelor of Science (Summa cum laude) in Economics and Political Science, 2002

PROFESSIONAL MEMBERSHIPS

American Economic Association

DAVID C. WILLIAMS
RESEARCH ANALYST

SUMMARY OF EXPERIENCE AND EXPERTISE

- Expert in utility industry research
- Expert in legal and technical writing and editing

PROFESSIONAL EXPERIENCE

Power System Engineering, Inc. - Madison, WI (2011-present)

Research Analyst

- Author of several technical papers on electric utility industry topics, including: line losses, expected useful life calculations, load factor, and the economics of variable frequency drives.
- Performs research for load forecasts, work plans, resource planning studies, and performance benchmarking reports.
- Experienced in internet research, technical writing and editing, legal research, and documentation.

Coastal Carolina University - Conway, South Carolina (2010-2011)

Teaching Associate

Taught university-level philosophy courses.

Axley Brynelson Law Firm - Madison, Wisconsin (2006-2009)

Attorney, Business Practice Group

- Negotiated settlements with state and federal agencies, including a settlement with the U.S. Department of Justice in a major CERCLA action (disposal of hazardous materials).
- Drafted numerous memoranda and opinion letters to clients explaining and evaluating complex legal issues, including state and federal regulatory issues, state statutory and local ordinances interpretation, and land use issues.
- Drafted litigation documents, motions, briefs, settlement agreements, and mediation statements for a variety of proceedings, including engineering negligence suits, construction contract disputes, and Wisconsin State regulatory actions.

EDUCATION

University of Wisconsin-Madison Law School - Madison, Wisconsin
Juris Doctor, *cum laude*, member of Wisconsin Law Review

University of Wisconsin-Madison - Madison, Wisconsin
Master's Degree, Philosophy

North Carolina State University - Raleigh, North Carolina
Bachelor of Science Degree, Nuclear Engineering

MATTHEW S. SEKERES
ECONOMIST

SUMMARY OF EXPERIENCE AND EXPERTISE

- Expert in the use of MS Word and Excel.
- Experienced in using SAS and MS Access.

PROFESSIONAL EXPERIENCE

Power System Engineering, Inc. – Madison, WI (2011-present)

Economic Analyst

Gathers and analyzes industry data to be used for forecasting. Prepares databases for econometric modeling and forecasting for several of PSE's load forecast clients. Prepares scenario analysis, tracking analysis, and weather normalization products used for forecasting. Creates tables, graphs, reports, and other key deliverables for many projects. Assists in load research, resource planning, DSM planning, and benchmarking studies. Performed the database management and report writing for several of the load forecast clients.

- Assists with load research and demand side management studies.
- Assists with benchmarking studies.

EDUCATION

University of Wisconsin, Madison, WI
Bachelor of Science Degree in Economics, 2005

Statement of Work
for the
Dx Total Factor Productivity (TFP) Study
RFP Number 7000005911

Draft

[MMMM DD, YYYY]

Document History			
Version	State / Changes	Date	Author

1 Hydro One – Dx TFP Study Project

This document provides an overview of the tasks to be completed by Power System Engineering, Inc. (PSE) in the Scope of Work (SOW) for the successful completion of the Dx TFP Study project.

Power System Engineering, Inc. (PSE) proposes a three-part study to measure and evaluate Hydro One's total factor productivity (TFP) and cost efficiency. First, we improve the TFP calculation methodology. Second, we use econometric benchmarking to produce an assessment of Hydro One's TFP that accounts for its specific operating conditions. Third, we use econometric benchmarking to evaluate Hydro One's total cost efficiency, again accounting for its specific operating conditions.

Why a Parallel Total Cost Efficiency Study is Advisable

NOTE: We have reviewed Addendum #1, in which Hydro One stated for Question 2 that it is looking for TFP internal trends, and not total cost efficiency. However, based on our extensive experience with the Ontario Energy Board (OEB) and our study of OEB decisions, it is our opinion that TFP should be evaluated in tandem with overall cost efficiency. TFP trends in isolation do not paint the whole picture for the OEB; if Hydro One's TFP trends are not as expected, but come at the same time as improved cost efficiency, Hydro One's OEB evaluation of Hydro One's performance could be different than if only TFP were considered.

In PSE's opinion, it is therefore advisable to do a cost efficiency study in parallel with the TFP study—thus our proposed third step. This has the added advantage of using similar datasets for both TFP and cost efficiency (the overall datasets will not be identical, but for many metrics the sub-datasets will be the same). Thus the OEB will be able to evaluate the TFP trends in light of Hydro One's cost efficiency performance using very similar data; this could be crucial in the OEB's overall evaluation.

Thus we have proposed a three-step plan, as described below. Our price (listed separately) includes these three steps; if Hydro One does not wish to perform all three steps, our price can be adjusted accordingly.

PSE is well-positioned for this study. We have conducted numerous TFP and efficiency benchmarking studies for other distribution electric utilities. PSE is also well-versed in presenting TFP and benchmarking results to stakeholders in Ontario. Our prior experience working with the CLD during the 4th Generation Incentive Regulation proceeding when the OEB efficiency and TFP assessments were developed will enable PSE to "hit the ground running" on this project. We are already prepared and understand Hydro One's situation and how best to go about producing a study that is a fair and accurate portrayal of Hydro One's TFP and efficiency.

2 Scope of Work for Dx Total Factor Productivity (TFP) Study

2.1 Scope of Work Description

The scope of work is to conduct an electric distribution TFP study that involves an accurate evaluation of Hydro One's TFP trend from 2002 to 2022, including assessing the reasonableness of that trend by estimating the

expected TFP trends for a similar utility operating in Hydro One's service territory. PSE will also conduct top-down econometric benchmarking to evaluate the total cost trends relative to the cost drivers and operating conditions of Hydro One.

Power System Engineering, Inc. (PSE) proposes a three-part study to measure and evaluate Hydro One's total factor productivity (TFP) and cost efficiency. First, we improve the TFP calculation methodology. Second, we use econometric benchmarking to produce an assessment of Hydro One's TFP that accounts for its specific operating conditions. Third, we use econometric benchmarking to evaluate Hydro One's total cost efficiency, again accounting for its specific operating conditions. Our methods have several advantages over previous efforts to measure Hydro One's TFP and cost efficiency:

- Our methods address concerns that the Ontario Energy Board (OEB) had regarding Hydro One's TFP and cost efficiency (in its March 12, 2015 Decision);
- Our improved TFP calculations are more comprehensive and accurate than past TFP calculations, because they include more outputs;
- Our TFP benchmarking is the appropriate way to evaluate Hydro One's TFP; it is more reflective of Hydro One's unique operating conditions, because it uses econometric modeling, which quantifies the effect of business conditions on TFP; and
- PSE's top-down cost efficiency econometric benchmarking evaluation will determine the historical and projected trends in Hydro One's total costs, again taking business conditions into account, and will compare Hydro One's actual costs to an "expected" value.

In the **first part** of our study, PSE will re-do the TFP trend calculations to make them far more comprehensive than the calculations performed by Pacific Economics Group (PEG). Currently the "outputs" included in PEG's TFP calculations do not include important outputs, such as service quality, reliability, employee safety, AMI costs, and regulatory and environmental efforts. Adding these outputs will enable the TFP calculation to encompass more relevant and measurable cost drivers, which in turn will allow us to measure Hydro One's output in a more accurate and fair manner.

In the **second part** of the study, PSE will create an econometric model based on the enhanced TFP calculations created in the first part. These TFP calculations will be performed for a dataset of Canadian and U.S. utilities, including investor-owned utilities and other types of utilities, such as U.S. rural electric cooperatives (RECs). RECs have territories and operating conditions that encompass some of the conditions faced by Hydro One, and so this dataset will help to create a more robust and accurate picture of Hydro One's TFP, as compared to a Canada-only dataset.

After we have calculated the TFP for each utility in the dataset, we will use econometric modeling to examine how TFP is driven by business conditions and territory characteristics. Econometric benchmarking is a way to quantify the effect of various business conditions on a utility's TFP (e.g., vegetation levels, labour costs, peak demand, customer density, weather, etc.). The model will show the expected TFP of an "average" hypothetical utility with Hydro One's specific operating characteristics. This will allow Hydro One to compare its TFP to its own customized benchmark, not to another utility's TFP, which is influenced by vastly different operating conditions. Econometric benchmarking is the evaluation method preferred by the OEB during the 4th Generation IR proceeding.

The **third part** of the study will evaluate Hydro One's cost efficiency and its trend. The OEB's current efficiency assessment (conducted by PEG) is insufficient and incomplete as it relates to Hydro One. PSE will provide a fuller, more accurate and complete assessment that properly accounts for the cost drivers faced by Hydro One. As in the second step, we will use an expanded utility dataset. Possible cost drivers that may be captured include total service area, customer density, vegetation levels, extreme weather, serving islands, and serving on the

Canadian Shield. In conversations with Hydro One, more cost drivers may be identified and explored. Hydro One's actual cost efficiency will then be compared to its expected cost efficiency. This presents a much fuller picture than simply comparing Hydro One's "raw" costs to another utility's costs, because other utilities have vastly different operating conditions.

PSE's approach will create a fair and accurate study by expanding the data sample beyond Ontario distributors, to include other North American distributors. If one looks at Hydro One's service territory characteristics, it is plainly evident that Hydro One's TFP and efficiency should not be judged solely by comparison to other Ontario distributors. Hydro One's service territory is enormous, because Hydro One serves the areas that no other utilities were willing or able to serve. Hydro One also has many characteristics which are not present in most or all other Ontario utilities, including:

- Hydro One serves islands, which present numerous logistical challenges that tend to raise costs,
- Hydro One has numerous extremely rural low-density areas, which tend to result in higher costs,
- Hydro One's territory stretches to the extreme north of the province, and this area has more extreme weather conditions,
- Hydro One's northern Ontario areas are on the Canadian Shield (a Precambrian era rock formation that makes drilling underground far more expensive).

PSE will create a fairer and more accurate study by expanding the sample, by also including other North American distributors. This inclusion will capture and adjust for the cost challenges of Hydro One's service territory. In research for other clients, we know that only including U.S. investor-owned utilities (IOUs) into the sample will not be sufficient to capture the unique characteristics of Hydro One—we also need to include rural electric cooperatives (RECs) and other rural North American distributors.

RECs were created in the 1930s to serve areas that IOUs were unwilling or unable to serve. There are over 900 RECs in the U.S. These RECs and other utilities serve territories that are mostly rural and low-density. Some serve islands, extreme weather areas (such as Alaska), and some also serve on the Canadian Shield. PSE has worked extensively with RECs in the past, and we have an on-going benchmarking and TFP study with a number of RECs. We understand their accounting systems and their operating conditions. We will sift through this data and identify service territory characteristics and calculate variables that will assist in the development of the study.

By expanding the sample to include U.S. IOUs, RECs, and other North American utilities, PSE will be able to vastly improve the fairness and accuracy of the OEB's TFP and efficiency studies as they relate to Hydro One. We will be able to compare TFP and efficiency on an "apples to apples" basis.

During the study, PSE will have interim progress reports and provide summary updates on the research whenever requested. While we present high-level steps below, our project plan remains flexible and based on the needs of Hydro One. PSE will conduct this research as follows (this is subject to modification based on Hydro One directives and stakeholder session outcomes):

1. Project kick-off phone conference
2. Prepare a draft study proposal for review by Hydro One.
3. Present and explain the proposed TFP study framework and methodology at a stakeholder session.
4. Meet with Hydro One to review suggested changes resulting from the stakeholder consultation.
5. Information and data requests to Hydro One requesting the identification of all possible service territory challenges, additional "outputs" impacting TFP, and historical data elements.
6. Hydro One completes information and data request.
7. Determine list of variables with Hydro One and PSE engineering experts that are theoretically plausible and available for data processing.

8. Gather and process cost, output, and potential service territory variables for an expanded sample which potentially includes 900 rural electric cooperatives plus other North American distributors such as the U.S. IOUs and other Canadian utilities.
9. Estimate cost driver model that quantifies the cost challenges of the included service territory variables.
10. Determine comprehensive "outputs" for Hydro One TFP.
11. Determine appropriate weights for the TFP outputs to be included in the Hydro One TFP study.
12. Calculate Hydro One TFP trend from 2002-2022 (2015-2022 results will only be available once projected data is provided to PSE).
13. Calculate TFP trends of the rest of the sample.
14. Develop TFP-driver econometric model that adjusts for service territory conditions to determine expected TFP based on Hydro One's service territory conditions.
15. Develop Hydro One total cost efficiency benchmarking evaluation using cost driver model.
16. Prepare draft TFP study and preliminary study results.
17. Receive feedback from Hydro One.
18. Present a final TFP study.
19. Defend the study during Part B of the project based on the requests of Hydro One.

3 Project Execution Approach

The project execution approach is flexible and will be customized to meet the needs of Hydro One. PSE suggests a kick-off call introducing PSE team members to Hydro One team members. The project manager, Mr. Fenrick of PSE, will also be the liaison between PSE and Hydro One. We recommend that Hydro One designate a contact person for the project as well. All data requests, data submissions, scheduling, and other communications should then be coordinated between the Mr. Fenrick and the Hydro One contact person(s).

PSE will provide project updates to Hydro One regularly, as project milestones approach and whenever requested by Hydro One. Project progress will be tracked and monitored to assure key project timelines are met.

4 Assumptions

The following are assumptions are assumed within this project proposal. They are:

- Stakeholder feedback, including that of Hydro One, will not significantly modify the overall scope of the project. The fixed price quote assumes the final project design will be similar to the proposed design in this proposal.

5 Appendices

5.1 Preliminary Schedules Dx TFP Study (see Appendix 1)

PSE can meet the high-level schedule put forth by Hydro One in the RFP under section 3.3.

The project plan is put forth in section 4.8 (see Appendix 1).

UNDERTAKING – JT 1.5

Undertaking

With reference to a "purchase order" mentioned on Exhibit I-10-SEC-10, attachment page 3, to provide the purchase order's evidentiary reference if it is filed or to provide a copy.

Response

Please refer to attachment 1 of this undertaking.

VENDOR ACCEPTANCE FORM

Purchase Order number: 4500439074 Version: 3
To: POWER SYSTEM ENGINEERING INC
Attn:
FAX: 608-22-9378
Number of Pages: 8 - Including Cover Page

Return to Purchaser's Contact: Hydro One Networks Inc
Attn: LYNNETTE HARRIS
483 Bay Street, 6th Floor,
Toronto, Ontario M5G 2P5
Canada
Fax: 416-345-6068
Email: LYNNETTE.HARRIS@HYDROONE.COM

IMPORTANT NOTICE - PLEASE READ!

Immediately upon receipt of the Outline Agreement, Purchase Order Release, Purchase Order or Instruction Notice attached herein, review, duly sign and date this Vendor Acceptance Form and return it via fax or e-mail to the Purchaser's Contact.

Whether or not this Vendor Acceptance Form is signed by the Company, Contractor or Consultant (each, a "Vendor") and returned to the Purchaser's Contact, commencement of work, or supply of goods or equipment, full, partial, or progress payment made by the Purchaser after receipt of acceptable invoice from the Vendor or delivery of the goods or equipment by Vendor shall constitute absolute acceptance of the terms herein set forth or referenced herein. Acceptance may be only on the exact terms herein set forth or referenced herein. No condition stated by Vendor in accepting this offer shall be binding on Purchaser if different from or in addition to the conditions set forth or referenced herein, unless agreed to in writing by Purchaser's Contact by the issuance of a formal Instruction Notice/Change Order.

Vendor Name Power System Engineering, Inc.

By:

Steve Fenrick

Vendor Signature / Vendor Signing Authority

Print Name of Person Signing Steven A. Fenrick

Title: Leader - Economics & Market Research

Date: September 14, 2015

PROPRIETARY

Vendor:
POWER SYSTEM ENGINEERING INC
1532 W BROADWAY
MADISON WI 53713
USA
Attention:
Fax: 608-22-9378

Purchase order

PO Number:	4500439074
Version:	3
Release Date:	09/14/2015
Contract Number:	
Contact:	LYNNETTE HARRIS
Telephone:	416-345-5481
Fax:	416-345-6068
E-mail:	LYNNETTE.HARRIS@HYDROONE.COM
Company Name:	HYDRO ONE NETWORKS INC.

Please deliver to:
Hydro One Networks
99 Caplan Ave
BARRIE ON L4N 9J3
CANADA

Bill to address:
Hydro One Accounts Payable
P.O. Box 4500
Concord ON L4K 5E2

Valid from: 08/20/2015 Valid to: 12/30/2016

Incoterms: FOB PLANT
Terms of payment: within 45 days Due net in Currency CAD

INSTRUCTION NOTICE NUMBER 1
PURCHASE ORDER REVISION 002 # SAP PO 4500439074
==========

Definition of Terms
==========

"Purchaser" # Hydro One Networks Inc.
"Consultant"# Power System Engineering

RFP 7000005911
Title: Dx. Total Factor Productivity (TFP) Study

Summary of Instruction Notice(s) # Purchase Order Revision(s)

This Instruction Notice number 1 # Purchase Order Revision number 001, dated September 14, 2015.

The purpose of this instruction notice is to amend the purchase order as follows #

1. Revise the SOW and Pricing Matrix.

All other terms and conditions remain the same.

Vendor:
POWER SYSTEM ENGINEERING INC

Purchase order

PO Number:	4500439074
Version:	3
Release Date:	09/14/2015
Contract Number:	

Acceptance of Purchase Order
==========

Immediately upon receipt and review of this Instruction Notice to Purchase Order, please sign, date and return the attached acceptance form to acknowledge your agreement to all the terms and conditions.

Return, via email to:

Hydro One Networks Inc.
Attention: Lynnette Harris
lynnette.harris@hydroone.com

PURCHASE ORDER (PO)

DEFINITION OF TERMS;

"Purchaser" - the corporation (either Hydro One Inc. or one of its subsidiary corporations) designated as the Purchaser in this Purchase Order;

"RFx" - the documents issued by the Purchaser calling for tenders, quotations, responses, or proposals for the supply of the Equipment or for the prequalification to supply the Equipment as further stated in the said document;

"Terms of Payment" - the terms under which the Purchaser will pay the Contract price provided that the Vendor is carrying out its obligations;

"Purchase Order" # a detailed document authorizing a Vendor to furnish goods to a Purchaser;

"Contract" - the Contract establishes the legal relationship between Hydro One and the Vendor and contains the terms and conditions;

"Contract Standard" # a Contract Standard is considered Hydro One's "Standard Commercial Condition" and/or Terms and Conditions for the requirement. The Contract Standard establishes the legal relationship between Hydro One and the Vendor;

"Purchaser's Contact" # the purchasing individual or buyer who is representing the Purchaser and is identified as the contact for this requirement;

"Vendor Acceptance Form" # a form that is sent together with the Purchase Order that the Vendor is required to duly sign and return it via fax or electronically to the buyer immediately upon receipt of the Purchase Order;

"Instruction Notice" # means a document issued by the Purchaser to amend the Purchase Order and agreed to by the Company through its acknowledgement;

"Contractor" # the person, firm or corporation to whom the Purchaser has awarded the Contract;

"Subcontractor" - a person, firm or corporation having a Contract with the Company for any part of the Equipment;

"Project Site" - the land or actual place designated by the Purchaser for the performance of the work;

"Services" # the labour, effort and/or work that is required by the Purchaser as described in the Purchaser's RFx documents;

"Bidder" - the company making a submission in response to the Purchaser's RFx documents. The Bidder may also be referred to in the Contract

Vendor:
POWER SYSTEM ENGINEERING INC

Purchase order
PO Number: 4500439074
Version: 3
Release Date: 09/14/2015
Contract Number:

documents as the Company, Contractor, Tenderer or Vendor.

"Equipment" # the required materials, machinery, assemblies, instruments, devices, items or articles, as the case may be, or components thereof, required by the Purchaser as described in the Purchaser's RFx documents.

"Vendor" # the successful Bidder who submitted a response to the Purchaser's RFx documents. The Vendor may also be referred to in the Contract documents as the Contractor, Company, Tenderer or Bidder.

"Consultant" # means the individual, partnership or corporation who has been retained by the Purchaser to provide consulting and/or professional services;

Capitalized terms not defined herein shall have the same meaning ascribed to them in Contract Standard A-29-2011 (October 2011).

This e-mail transmission will serve as the Purchase Order. If you require any assistance please contact the Purchaser's Contact.

PURCHASER'S CONTACT
Purchaser's Contact - Lynnette Harris
E-mail at: lynnette.harris@HydroOne.com
Phone: #416-345-5481
Or by mail:

Hydro One Networks Inc.
Attn: Lynnette Harris
483 Bay Street, 6th Floor, South Tower,
Toronto, Ontario M5G 2P5

DESCRIPTION OF WORK: Distribution Total Factor Productivity (TFP) Study

AWARDED TO: Power System Engineering, Inc.
ATTN: Steve Fenrick

CONTRACT DOCUMENTS AND ORDER OF PRECEDENCE

All in accordance with:
(1) This Purchase Order # PO 4500439074 ("Purchase Order" or "PO") including Vendor Acceptance Form attached herein;
(2) Insurance Requirements detailed in Request for Proposal Document Number: 7000005911, Part 2: Terms and Conditions;
(3) Insurance Requirements detailed in Request for Proposal Document Number: 7000005911, Part 2: Terms and Conditions;
(4) Contract Standard A-29-2011 (October 2011);
(5) The Consultant's Proposal dated August 5, 2015;
(6) The Request for Proposal documents (other than those listed above): Document Number: 7000005911.

These Contract documents shall, to the extent of any inconsistency or conflict, take precedence in the order in which they are named.

Appendices and addenda to any Contract document shall be considered part of such document. The Contract documents form this Contract.

This Purchase Order is subject to amendments in the form of Instruction Notices which shall take precedence over the documents amended thereby.

Vendor:
POWER SYSTEM ENGINEERING INC

Purchase order

PO Number:	4500439074
Version:	3
Release Date:	09/14/2015
Contract Number:	

Any changes affecting the scope, price, source of supply or any terms and conditions of this Purchase Order will be contractually binding only when issued by the Purchaser, by way of an Instruction Notice.

THE PROJECT MANAGER

All reports and documentation relative to the Work shall be addressed to:

Name: Maxine Cooper
Desk: (416) 345- 5703
E-mail: maxine.cooper@HydroOne.com
483 Bay St. TCT07, South Tower
Toronto, Ontario
M5G 2P5

DURATION/WORK SCHEDULE (CONTRACT TERM)

The contract term shall begin August 20, 2015 and will conclude upon meeting the outlined deliverables contained within the Terms of Reference, including participation in the regulatory proceedings. The exact work schedule is to be arranged between the Purchaser's Project Manager and Power System Engineering, Inc.

The Purchaser reserves the right to extend the Contract term if required.

PRICING SUMMARY

Total cost of the Study is [redacted] upset maximum (not to exceed), with potentially additional costs associated with regulatory proceedings. Actual fees are to be substantiated at time of invoicing. Regulatory proceeding costs are in accordance with rates in Part B (Pricing Matrix). GST/HST is applicable and QST (if applicable) is extra. The upset maximum does not include GST/HST or QST.

Charge-out rates are as follows (Note: Charge-out rates do not include GST/HST or QST):

Price includes:
- All labour, work equipment, materials and special materials necessary to perform the Services.
- All applicable freight, insurance, WSIB/workers' compensation and all other charges of every kind attributable to the work.

Pricing/rates are in CDN dollars and are not subject to adjustment. Pricing/rates are firm for the duration of the Purchase Order.

TERMS OF PAYMENT

The Terms of Payment are in accordance with Contract Standard A-29-2011 (October 2011).

Payment will be made 45 days after receipt of an acceptable invoice after receipt and acceptance of the Material and or Equipment.

Vendor:
POWER SYSTEM ENGINEERING INC

Purchase order

PO Number:	4500439074
Version:	3
Release Date:	09/14/2015
Contract Number:	

INVOICING INSTRUCTIONS

Hydro One has implemented a supplier portal, powered by Taulia, to save suppliers time, reduce errors, and streamline suppliers' business process when submitting invoices. This easy-to-use online platform provides complete visibility into suppliers' Purchase Order(s), invoices and payment details.

All Hydro One suppliers will be expected to adopt and use the Taulia Supplier Portal for:
PO Status
Invoice Submission
Invoice Status
Questions related to PO, Invoice, and Payment Details

If you are already enrolled on the Taulia Supplier Portal as a supplier please submit your invoices via the Taulia Supplier Portal at http://portal.taulia.com, using your company ID and Password, do not submit a paper copy invoice through the address below.

If you are not currently enrolled on the Taulia Supplier Portal you can obtain information about the program at http://supplier.taulia.com/customers/hydroone/. This site contains contact information as well as details on the benefits, how to get enrolled and frequently asked questions.

In the short term traditional paper invoices will continue to be accepted; however the Taulia Supplier Portal / E-invoice process will soon be the only method Hydro One will use to receive and process supplier invoices.

Submit original invoices to:

HYDRO ONE NETWORKS INC.
P.O. BOX 4500
CONCORD, ONTARIO
L4K 5E2
ATTENTION: ACCOUNTS PAYABLE

ACCOUNTS PAYABLE INQUIRY:
Telephone Toll Free: 1-800-352-9297
Telephone Local: 416-345-4146
Website: http://www.onlineservice.hydroonenetworks.com/vss/welcome.html

Forward copies of Invoices (including all supporting documentation) to the Project Manager stipulated above.

Payment will be made from an ORIGINAL invoice only. Fax copies will not be processed. Statements can be accepted only with original invoices attached.

IMPORTANT:

The following is mandatory:

Invoices MUST be submitted in accordance with the Contract documents' Terms of Payment and Invoicing requirements and in a format corresponding to the items listed on the face of this Purchase Order. Invoices MUST match the Purchase Order in price and quantity.

Vendor:
POWER SYSTEM ENGINEERING INC

Purchase order

PO Number:	4500439074
Version:	3
Release Date:	09/14/2015
Contract Number:	

All invoices must clearly show:

- Invoice number and date;
- Consultant's name, address, phone number and contact name;
- 'Remit' address, if different than mailing address;
- This Purchase Order number and Purchase Order line number(s) including location of the Work and a short description of the Work the charges relate to;
- Quantity 1 lot price;
- Service master number, if provided;
- Applicable tax treatment must be shown separately;
- Where GST/HST/QST is billed, the registration tax number(s) must be noted on the invoice;
- The Purchaser's Project Manager/site contact name;
- Reimbursable expenses (if applicable) shall be shown separately on all invoices and be substantiated with receipts at time of invoicing. All GST/HST and QST paid on reimbursable expenses that is recoverable by Consultant must be deducted from the amount of the expense to be claimed for reimbursement from Hydro One;
- Currency (if not Canadian dollars);
- Terms of Payment as per the Purchase Order;
- Invoices shall detail the hours by individual, their charge out rates, expenses (if applicable) and the Work that the fees relate to.

NOTE:

1. Invoices not conforming to the above instructions/format will be returned to the Consultant.
2. Payments will be made to the "Remittance" address only. Cheques may not be picked up.
3. Do not include charges from more than one Purchase Order on an invoice.

INSURANCE COVERAGE INCLUDING WORKPLACE SAFETY INSURANCE BOARD

If the required insurance coverage expires during the Contract term the Consultant shall ensure that replacement insurance coverage as required in the Contract documents shall be in place immediately so that coverage shall be continuously maintained; and the Consultant shall provide a renewal certificate to the Purchaser's Contact within 14 days of expiration evidencing continued compliance with all terms of the Contract documents.

WORK PERFORMANCE

Your Work performance is constantly being monitored and recorded. Accordingly, it is important that you complete the Work in accordance with the requirements and meet the specified Work schedule within the timelines dictated by the Purchaser and inform the Purchaser promptly of any changes thereto. Failure to meet such requirements and Work schedule dates will adversely affect your performance rating in the Purchaser's evaluation of your company on future business opportunities.

Item	Material Quantity	Description Unit	Price per unit	Net value
10		total prod. fact.- expenses		
	1	Activ.unit		

hydro one

PROPRIETARY

Vendor:
POWER SYSTEM ENGINEERING INC

Purchase order

PO Number: 4500439074
Version: 3
Release Date: 09/14/2015
Contract Number:

Item	Material Quantity	Description Unit	Price per unit	Net value
	Delivery Date : 08/21/2015			
20		total prod.fact.- labour		
	1	Activ.unit		
	Delivery Date : 08/21/2015			

Lynnette Harris
Buyer's Signature
Sept 14/15

Statement of Work
for the
Dx Total Factor Productivity (TFP) Study
RFP Number 7000005911

PSE POWER SYSTEM ENGINEERING

hydro one

[MMMM DD, YYYY]

Document History			
Version	State / Changes	Date	Author

1 Hydro One – Dx TFP Study Project

This document provides an overview of the tasks to be completed by Power System Engineering, Inc. (PSE) in the Scope of Work (SOW) for the successful completion of the Dx TFP Study project.

Power System Engineering, Inc. (PSE) proposes to measure and evaluate Hydro One's total factor productivity (TFP). The study is in accordance with the directive of the Ontario Energy Board found in the Board's March 12, 2015 Decision to EB-2013-0416. The Board states on page 17 of the Decision,

> "The OEB sees value in Hydro One measuring its own total factor productivity over time to be able to demonstrate improvement in productivity to its customers and the OEB. The OEB requires Hydro One to conduct such a study. Given Hydro One's concerns, the OEB leaves it to Hydro One to determine its preferred total factor productivity study method. However, the period of the study should include years at least going back to 2002. The results of the study must be filed as part of Hydro One's next rates application."

PSE's TFP study will satisfy this Board directive and provide the Board with an accurate assessment of Hydro One's own TFP trend.

PSE is well-positioned for this study. We have conducted numerous TFP and efficiency studies for other distribution electric utilities. PSE is also well-versed in presenting TFP and efficiency results to stakeholders in Ontario. Our prior experience working with the CLD during the 4th Generation Incentive Regulation proceeding when the OEB efficiency and TFP assessments were developed will enable PSE to "hit the ground running" on this project.

2 Scope of Work for Dx Total Factor Productivity (TFP) Study

2.1 Scope of Work Description

The scope of work is to conduct an electric distribution TFP study that involves an accurate evaluation of Hydro One's own TFP trend from 2002 to 2022.

PSE will re-do the TFP trend calculations to make them more comprehensive than the calculations performed by Pacific Economics Group (PEG). Currently the "outputs" included in PEG's TFP calculations do not include important outputs, such as service quality, reliability, and regulatory and environmental efforts. Incorporating these outputs will enable the TFP calculation to encompass more relevant and measurable outputs, which in turn will allow us to measure Hydro One's TFP trend in a more accurate and fair manner.

During the study, PSE will have interim progress reports and provide summary updates on the research whenever requested. While we present high-level steps below, our project plan remains flexible and based on the needs of Hydro One. PSE will conduct this research as follows (this is subject to modification based on Hydro One directives and stakeholder session outcomes):

1. Project kick-off phone conference
2. Prepare a draft study proposal for review by Hydro One.
3. Present and explain the proposed TFP study framework and methodology at a stakeholder session.
4. Meet with Hydro One to review suggested changes resulting from the stakeholder consultation.
5. Information and data requests to Hydro One requesting the identification of all possible additional "outputs" impacting TFP and historical and future data elements.
6. Hydro One completes information and data request.
7. Determine list of variables with Hydro One and PSE engineering experts that are theoretically plausible and available for data processing.
8. Gather and process cost, output, and potential service territory variables for an econometric model that may provide weights for the TFP outputs.
9. Estimate econometric model that quantifies the weights for possible outputs.
10. Determine comprehensive "outputs" for Hydro One TFP.
11. Determine appropriate weights for the TFP outputs to be included in the Hydro One TFP study.
12. Calculate Hydro One TFP trend from 2002-2022 (2015-2022 results will only be available once projected data is provided to PSE).
13. Prepare draft TFP study and preliminary study results.
14. Receive feedback from Hydro One.
15. Present a final TFP study.
16. Status update calls.
17. Defend the study during Part B of the project based on the requests of Hydro One.

3 Project Execution Approach

The project execution approach is flexible and will be customized to meet the needs of Hydro One. PSE suggests a kick-off call introducing PSE team members to Hydro One team members. The project manager, Mr. Fenrick of PSE, will also be the liaison between PSE and Hydro One. We recommend that Hydro One designate a contact person for the project as well. All data requests, data submissions, scheduling, and other communications should then be coordinated between the Mr. Fenrick and the Hydro One contact person(s).

PSE will provide project updates to Hydro One regularly, as project milestones approach and whenever requested by Hydro One. Project progress will be tracked and monitored to assure key project timelines are met.

4 Assumptions

The following are assumptions are assumed within this project proposal. They are:

- Stakeholder feedback, including that of Hydro One, will not significantly modify the overall scope of the project. The fixed price quote assumes the final project design will be similar to the proposed design in this SOW.

5 Project Schedule

Please refer to next page.

Anticipated Project Timeline

	Task	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16
		1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4
1	Kick-off call with PSE/Hydro One															
2	Develop Study Plan															
3	Present Study Plan to stakeholders															
4	Meeting between PSE and Hydro One															
5	Information and Data request to Hydro One															
6	Hydro One fills out data request															
7	Determine list of variables that are theoretically plausible and available for data processing															
8	Gather and process North American cost, outputs, and explanatory variable data															
9	Estimate cost driver model															
10	Determine comprehensive "outputs" for Hydro One TFP															
11	Develop appropriate "weights" for comprehensive outputs for TFP															
12	Calculate Hydro One TFP trend from 2002-2022															
13	Prepare draft TFP study and preliminary study results															
14	Receive feedback from Hydro One															
15	Present final TFP study to Hydro One															
16	Status update calls (PSE is always available to provide status update when requested)															
17	Participate in the defense of the TFP Study (Part B)	2017 as requested														

PSE Task
Hydro One Task
Joint Task

PROPONENT'S COMPANY NAME:	RFP # 7000005911 Dx Total Factor Productivity (TFP) Study Power System Engineering, Inc. DATED: July 29, 2015 PRICING MATRIX Appendix 4 PART A	
CATEGORY	DESCRIPTION / NAME	FIXED PROJECT COST
A TFP/Cost Study	Dx Total Factor Productivity (TFP) Study. This price quote is a fixed price that includes all overhead, disbursements, travel, and related expenses. Project quote assumes two trips to Toronto for Mr. Fenrick.	$ [redacted]
	A TOTAL	
D Additional Charges	*insert any additional charges here and describe reason for charge*	$0.00
		$0.00
		$0.00
		$0.00
		$0.00
	D TOTAL	$0.00
	A&D TOTAL	$ [redacted]

PRICES:	▪ Currently @ $0.00 and to be updated with the proponent's unit price. Pricing will be a fixed price model.
PAYMENT TERMS:	▪ Net 45 days after receipt of an acceptable invoice.
INVOICES:	▪ Invoices are to be tied to accepted deliverables or milestones and upon completion and acceptance of the work.

UNDERTAKING – JT 1.6

Undertaking

To provide the draft study proposal.

Response

Please refer to attachment 1 of this undertaking.

Power System Engineering, Inc.

Full-service consultants

Draft Proposal for Hydro One: Distribution Total Factor Productivity Study

September 30, 2015

Draft Proposal for Hydro One:

Distribution Total Factor Productivity Study

Contact: Steve Fenrick

fenricks@powersystem.org

Direct: 608.268.3549

1532 W. Broadway
Madison, WI 53713

www.powersystem.org

Table of Contents

Contents

1 Project Overview

Power System Engineering, Inc. (PSE) will measure and evaluate Hydro One's total factor productivity (TFP), with a start year of 2002 and continuing through 2022. The study is in accordance with the directive of the Ontario Energy Board found in the Board's March 12, 2015 Decision in EB-2013-0416. The Board states on page 17 of that Decision:

> The OEB sees value in Hydro One measuring its own total factor productivity over time to be able to demonstrate improvement in productivity to its customers and the OEB. The OEB requires Hydro One to conduct such a study. Given Hydro One's concerns, the OEB leaves it to Hydro One to determine its preferred total factor productivity study method. However, the period of the study should include years at least going back to 2002. The results of the study must be filed as part of Hydro One's next rates application.

This draft study proposal is centered on this Decision. A few of the salient points are:

1. The measurement is for Hydro One's "own total factor productivity over time."
2. Measurement is for the stated purpose "to demonstrate improvement in productivity."
3. The OEB "leaves it to Hydro One to determine its preferred total factor productivity study method."
4. Period included should start "at least going back to 2002."
5. The "study must be filed as part of Hydro One's next rates application."

The PSE TFP study will use as a starting point the Board Staff's approach to TFP trend measurement conducted in EB-2010-0379, denoted as 4th Generation Incentive Regulation (4GIR). However, the TFP method developed in that case was for the explicit development of the 4GIR X-Factor, to be used in the escalation formula for the setting of distributor rates. The TFP method was not intended to demonstrate how individual distributors improved their productivity over time.

In order to create a TFP measure that demonstrates how Hydro One's own productivity has transformed over time, a more comprehensive perspective of the "outputs" produced over time by Hydro One will be incorporated within the TFP framework. This study will produce a "comprehensive TFP" measurement of Hydro One's own productivity trend, beginning in 2002, that will more accurately demonstrate the productivity changes of Hydro One.

The Board acknowledged in the 4GIR Decision that negative TFP outcomes may be explainable due to circumstances that drive up costs with no corresponding increase in measured output. On page 17 of the Board's November 21, 2013 Decision in EB-2010-0379, the Board states:

> The Board acknowledges that achieved industry TFP may be negative due to unforeseen events and/or situations in which costs may be incurred with no corresponding increase in output.

The comprehensive Hydro One TFP study will account for these unaccounted-for circumstances and provide an enhanced estimation of the underlying productivity trend of Hydro One.

1.1 Project Objectives

The TFP study will:

- Measure Hydro One's own TFP trend from 2002 through 2022 (Variable projections will be used to calculate TFP projections from 2015 on),
- Build upon and enhance the Board Staff TFP analysis; this enhanced analysis will be used for evaluating Hydro One's performance changes over time,
- Incorporate and adjust the TFP measurement for additional cost drivers that impact TFP,
- Provide and explain the basis for weighting the additional cost drivers into the TFP trend,
- Incorporate, whenever possible, empirical evidence from other utilities on the influence of certain cost drivers onto TFP trends, and
- Provide high-level recommendations or insights that Hydro One can use to inform its future planning process.

2 Empirical Approach

On page 12, in Pacific Economics Group's (PEG's) November 2013 Final Report to the Ontario Energy Board (sponsored by Board Staff) in the 4GIR proceeding, PEG calculates the change in TFP as the difference in the change in an output quantity index and the change in the input quantity index.

$$\Delta TFP = \Delta Output\ Quantity - \Delta Input\ Quantity \qquad \text{[Equation 1]}$$

Both the output quantity and input quantity in Equation 1 are indexes formulated from multiple trends. In the November 2013 report, PEG's output quantity index trend consisted of a weighted average of three outputs (customers, total kWh deliveries, and system capacity peak demand), and the input quantity index trend consisted of capital and OM&A inputs. The output weights were based on PEG's total cost econometric model. The weights sum to one and equal 0.606, 0.106, and 0.289 for customer numbers, kWh deliveries, and system capacity peak demand, respectively. The input weights are based on the individual cost shares of capital and OM&A.

Using an output formulation consisting only of customers, kWh deliveries, and peak demand is logical when determining a TFP trend for a rate-setting application, because distributor revenues are mainly driven by these three outputs. However, this limited output definition is not appropriate for evaluating individual distributor performance because cost trends are a function of a number of other possible outputs, which we will discuss below.

The level of capital quantity and OM&A input quantities can increase for other reasons beyond serving more customers, delivering more kWh, or meeting a higher peak demand. They are also

a function of other cost drivers and outputs. Some of the other possible cost drivers and outputs that the TFP study will investigate are:

- Changes in reliability (SAIFI & SAIDI) over the TFP time period,
- Changes in customer service levels (scorecard metrics),
- Environmental output (distributed generation connections or CDM savings),
- Regulatory costs (regulatory personal, safety regulations, etc…),
- Input price inflation of Hydro One,
- Other cost drivers or outputs as are uncovered during the course of the project.

One of the possible cost drivers listed above is input price inflation. PSE will examine Hydro One's specific input price inflation. Getting the proper level of input price inflation for Hydro One is critical to providing an accurate estimate of TFP change. This is mathematically illustrated below.

Economic production theory states that total cost equals input prices multiplied by input quantities.

$$Cost = Input\ Prices * Input\ Quantity \quad \text{[Equation 2]}$$

Therefore, the change in input quantities can be calculated as the difference in the change in cost and the change in input prices.

$$\Delta Input\ Quantity = \Delta Cost - \Delta Input\ Prices \quad \text{[Equation 3]}$$

Putting Equation 1 and Equation 3 together, we see that TFP trends are function of the change in costs, input prices, and output.

$$\Delta TFP = \Delta Output\ Quantity + \Delta Input\ Prices - \Delta Cost \quad \text{[Equation 4]}$$

Therefore, proper adjustment for the output-related cost drivers that are not incorporated into the output quantity index, and estimating the input price inflation of Hydro One is required for a customized and comprehensive TFP estimate. The other possible cost drivers listed above also require testing, for similar reasons.

3 Incorporating Key Cost Drivers into the TFP Measure

The study will investigate two possible methods for incorporating new outputs into Hydro One's TFP calculations: (1) Empirical modeling, and (2) Hydro One added cost estimates.

Whenever possible, modeling using empirical data will be used to incorporate new outputs. PSE will use empirical data as the basis to adjust Hydro One's TFP trend for additional outputs. For

example, reliability improvement and its impact on TFP may be quantified using econometric modeling. The developed model can then be used as a basis for weighting reliability and adjusting the TFP trend for that additional output.

PSE will use our expert judgment on estimating and developing models that best incorporate these outputs into the TFP analysis for Hydro One. The econometric models will be developed using industry data from the largest possible sample containing the relevant data necessary. No arbitrary exclusions will be made. However, it is possible that different outputs may require a different sample due to the availability of data.

If an empirical model cannot be developed, but PSE is convinced the variable in question is crucial to an accurate depiction of Hydro One's TFP trend, we will request that Hydro One provide estimates of the added costs of a given cost driver. An example of this may be the added costs of meeting more stringent environmental or regulatory requirements. Costs in this category can then be subtracted from all time periods to develop a consistent TFP trend.

3.1 Working Assumptions on Cost Drivers

PSE's working assumptions are that there are additional outputs that distributors provide to customers are positively correlated with cost. Additionally, higher input prices are also positively correlated with cost. These assumptions will be empirically-tested, quantified and inserted into the TFP analysis, if possible. Some of the specific assumptions are:

1. Providing improved reliability over time will tend to increase cost and lower the TFP estimate if the reliability output is not adjusted for in the TFP estimate.
2. Providing improved customer service over time will tend to increase cost and lower the TFP estimate if the customer service output is not adjusted for in the TFP estimate.
3. Meeting more stringent environmental or regulatory requirements will tend to increase cost and lower the TFP estimate if these requirements are not adjusted for in the TFP estimate.
4. Costs are linearly related to input prices. In economic parlance, cost is homogeneous of degree one in prices. Example: a 2% increase in all input prices will cause a 2% increase in costs.

4 Project Next Steps

The project next steps include:

1. **Modify TFP study plan based on stakeholder feedback, if warranted.**
2. **Data and Information gathering**
    a. Hydro One interviews on cost drivers
    b. Hydro One data and information gathering
    c. Dataset data gathering for industry

3. **Empirical and Qualitative Analysis**
    a. Reliability
    b. Customer service
    c. Environmental & Regulatory
    d. Input price investigation
    e. Other outputs as they arise
4. **Finalize TFP estimates and provide final report to be filed in Hydro One's next rate case**

UNDERTAKING – JT 1.7

Undertaking

To provide, or prepare and provide, a list of variables that were considered, or to advise if neither is possible.

Response

There was no list of variables prepared for Hydro One's review in step 7.