

**Hydro One Networks Inc.**

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**Joanne Richardson**

Director – Major Projects and Partnerships  
Regulatory Affairs



BY COURIER

April 18, 2016

Ms. Kirsten Walli  
Board Secretary  
Ontario Energy Board  
P.O. Box 2319  
2300 Yonge Street  
Suite 2700  
Toronto, ON, M4P 1E4

Dear Ms. Walli:

**EB-2016-0013 – Union Gas Ltd. Application to Construct a Pipeline in the Municipality of Leamington – Hydro One Networks' Witness Panel Curricula Vitae**

Please find attached Hydro One Networks' ("Hydro One") witness panel curricula vitae for the above-noted proceeding in preparation for the oral hearing on April 19, 2016.

- Bing Young - Director, System Planning
- Luis Marti - Director, Reliability Studies Strategies and Compliance
- Mehrgan Mazaheri - Project Manager, Project Delivery
- Patricia Staite - Senior Environmental Planner, Environmental Engineering and Project Support

A copy of this cover letter along with the CV's have been filed in electronic form through the Ontario Energy Board's Regulatory Electronic Submission System.

Sincerely,

ORIGINAL SIGNED BY JOANNE RICHARDSON

Joanne Richardson

c. Parties to EB-2016-0013 (electronic mail)

## **CURRICULUM VITAE OF BING YOUNG**

### **EDUCATION**

*University of Toronto*, Toronto, Ontario (1993)  
Master of Engineering

*University of Toronto*, Toronto, Ontario (1986)  
Bachelor of Applied Science

### **PROFESSIONAL REGISTRATION**

*Professional Engineers Ontario*

### **INDUSTRY EXPERIENCE**

2009 – Present	Hydro One Networks Inc. Director, System Planning Director, Transmission System Development
2006 – 2009	Ontario Power Authority Director, Transmission Integration
1986 – 2006	Hydro One Networks Inc./ Ontario Hydro Services Company / Ontario Hydro
2004 – 2006	Manager, Transmission System Development
1998 – 2004	Senior Network Management Engineer, Investment Planning
1998 – 2000	Senior Engineer, System Development
1994 – 1998	Systems Engineer, Grid System Strategies and Plans
1991 – 1994	Engineer, Power System Operations Division
1988 – 1991	Assistant Engineer, Power System Operations Division
1986 – 1987	Engineering Trainee

### **INDUSTRY REPRESENTATION**

North American Electric Reliability Corporation (NERC) Planning Committee

### **APPEARANCE(S) BEFORE THE ONTARIO ENERGY BOARD:**

EB-2013-0421:	s92 SECTR – Technical Conference
EB-2010-0002:	2011-2012 Transmission Revenue Requirement & Rates Application
EB-2007-0707:	Ontario Power Authority Integrated Power System Plan
EB-2002-0001:	Sithe Energies Canadian Development s92 Application

## **CURRICULUM VITAE OF LUIS MARTI**

Address: 483 Bay St.  
Hydro One Networks Inc.  
Toronto, ON M5G 2P5

phone: (416) 345-5317  
e-mail: [Luis.Marti@HydroOne.com](mailto:Luis.Marti@HydroOne.com)

### **Current Position:**

Director, Reliability Studies Strategies and Compliance  
Hydro One Networks Inc.

Primary accountabilities include specialized system studies in all areas of power system analysis, coordination of large customer power quality initiatives, regulatory and compliance posture for reliability standards, oversight of corporate standards and operational policies, management of research and development programs.

### **Experience:**

Twenty years of experience in management positions and technical supervision.

Over thirty years of experience in the development and implementation of models and the simulation of electromagnetic transient phenomena in power systems.

### **Expertise:**

Modelling of the effects of Geomagnetic Disturbances and Geomagnetically Induced currents in power systems for steady-state and real time applications.

Simulation of electromagnetic transient phenomena for the design and insulation co-ordination of HV underground cable systems.

Assessment of grounding, induction co-ordination and EMF impact of power system transmission equipment and facilities to neighbouring equipment, people, etc.  
Major equipment failure investigations.

EMTP and Power System education (training courses at Ontario Hydro, CEA, UBC, University of Wisconsin at Madison, EDF, etc.)

Development of software for power system analysis (mainly in FORTRAN, Visual Basic

and C), including EMTP (Electromagnetic Transients Program), short circuit analysis, underground cable and overhead parameter calculation and simulation, support tools for engineering applications (EMTP input and output processor, etc.).

### **Education:**

Ph.D. (Power Electrical Engineering), The University of British Columbia, Canada, 1986.

M.A.Sc. (Power Electrical Engineering), The University of British Columbia, Canada, 1982.

Electrical Engineering degree (Electrical Power), Central University of Venezuela, Venezuela, 1979.

### **Affiliations:**

Fellow, Power & Energy Society of the Institute of Electrical and Electronic Engineers

National expert network representative, CIGRE System Technical Performance Study Committee

Association of Professional Engineers of Ontario

### **Recent Extracurricular Activities:**

- Adjunct Professor at the University of Waterloo
- Adjunct Professor at the University of Western Ontario
- Adjunct Professor at Ryerson University
- EMTP DCG/EPRI (Development Coordination Group)
- Member Canadian CIGRE SC-C4 Forum
- Member CIGRE WG C4.502 (Analysis of long HV AC cables)
- NERC Geomagnetic Disturbances Task Force, leadership.
- NERC Standard Draft Team member for EOP-010 and TPL-007.
- Technical Committee CSA-C22.3 No. 6 “Principles and Practices of Electrical Coordination between Pipelines and Electric Supply Lines
- *EEE-PES, Transformers Committee GMD Taskforce*
- Chair, IEEE PES Task Force on GIC modelling.
- Transmitter representative, IESO Technical Panel.
- Hydro One representative, CEA Regulatory Development Task Group
- Principal lecturer for “Power System Fundamentals” HONI course
- Coordination of Hydro One’s XSW/GMD preparedness project

## **Work History:**

July 2014 – present

**Director Reliability Studies Strategies and Compliance  
Hydro One Networks Inc.**

December 2010 – July 2014

**Special Studies & Professional Development Manager, Transmission Projects  
Development Network Development and Regional Planning  
Hydro One Networks Inc.**

April 2009 – December 2010

**Special Studies & Professional Development Manager, System Development  
Hydro One Networks Inc.**

October 2006 – March 2009

**Special Studies Manager, System Investment  
Hydro One Networks Inc.**

Key accountabilities include special studies (EMTP, EMF, insulation coordination, short circuit, etc.) to support TSD planners and other staff across Hydro One; managing staffing needs including staff development, adherence to corporate policies, and performance management accountabilities for staff assigned to the Special Studies unit; participating in the development of regulatory and other strategies to add customer value and prosper under current rules, codes, and regulations; and generally provide management support related to the department activities.

Development of graduate and post graduate training curricula for internal and joint university/utility programs

February 2006 – October 2006

**Supervising engineer, Special Studies, Transmission System Development  
Hydro One Networks Inc.**

Responsible for the "Special Studies Group", an elite group of power system engineers that address a broad range of studies and issues company-wide. Studies and projects include EMTP development and system studies, induction coordination, EMF studies, major equipment failure investigations, Health and safety incident investigation, Short circuit assessments and surveys, targeted new technology assessment and development, Hydro One Research and Development program management.

April 2005 - February 2006

**Supervising Engineer, Standards & Technical Studies**

**Hydro One Networks Inc.**

Duties during this time period also included the re-design and management of the corporate research and development program.

February 1999 – March 2005

**Senior Advisor/Team Leader , Special Studies PI&SS, Investment Planning**

**Hydro One Networks Inc.**

June 1999 – February 1999

**Supervising Engineer, Investment Planning**

**Ontario Hydro Services Company**

January 1999 – June 1999

**Acting Manager Analytical Methods and Specialized Studies**

1996 – 1998

**Supervising Engineer, Section Head, Electromagnetic Transients, Technical Support**

**Ontario Hydro Services Company**

Responsible for management of a team of professional engineers and technologists performing insulation co-ordination studies for the bulk electrical system; developing analytical methods for overvoltage calculations; power system software development and maintenance.

Responsible for the development of digital models for transient simulations in the EMTP. Responsible commercialization and distribution of the DCG/EPRI version of the EMTP, as well as the EMTP User Support and Maintenance Centre.

Project manager for CEA projects such as the development of a Graphical User Interface for the DCG/EPRI version of the EMTP, and Ontario Hydro's contribution to the re-structuring of the EMTP, phase II.

1989 – 1996

**System Studies Engineer, Technical Support, GSS&P**

**Ontario Hydro Services Company**

Responsible for the development of digital models for transient simulations in the EMTP. Specific projects have included the modelling of underground cables, overhead lines and power transformers. Analysis of transient phenomena and system studies.

Principal investigator in CEA and EPRI-funded projects.

Project manager for the development of a Graphical User Interface for the DCG/EPRI version of the EMTP.

1987 – 1989

**Post-Graduate Fellow**

**University of British Columbia**

Development and implementation of Frequency-dependent underground cable models for the EMTP. Work performed at Ontario Hydro under DCG contract.

1980 – 1987

**Teaching Assistant in the Department of Electrical Engineering**

**University of British Columbia**

Supervision and design of projects in the Power Systems Laboratory, and various substitute teaching duties.

**Publications:**

- [45] Marti, L., "Effects of Series Compensation Capacitors on Geomagnetically Induced Currents," in *Power Delivery, IEEE Transactions on* , vol.29, no.4, pp.2032-2033, Aug. 2014
- [44] Marti, L.; Yiu, C.; Rezaei-Zare, A.; Boteler, D., "Simulation of Geomagnetically Induced Currents With Piecewise Layered-Earth Models," in *Power Delivery, IEEE Transactions on* , vol.29, no.4, pp.1886-1893, Aug. 2014
- [43] Luis Marti, Afshin Rezaei-Zare, David Boteler, "Calculation of Induced Electric Field during a Geomagnetic Storm using Recursive Convolution", *IEEE Transactions on Power Delivery, Vol. 29, No. 2, April 2014*.
- [42] K. Zheng, D. H. Boteler, R. Pirjola, L. G. Liu, R. Becker, L. Marti, S. Boutilier and S. Guillon, "Effects of System Characteristics on Geomagnetically Induced Currents" , *IEEE Transactions on Power Delivery, Vol PP, No.99, 2013*.
- [41] Afshin Rezaei-Zare, , Luis Marti, "Generator Thermal Stress during a Geomagnetic Disturbance" , *IEEE PESGM, Vancouver 2013*.
- [40] *Geomagnetic Disturbances: Their Impact on the Power Grid, Power and Energy Magazine, IEEE Volume: 11 , Issue: 4 , pp. 71-78, 2013*
- [39] Marti, L.; Rezaei-Zare, A.; Yan, A., "Modelling considerations for the Hydro One real-time GMD management system," in *Power and Energy Society General Meeting (PES), 2013 IEEE* , vol., no., pp.1-6, 21-25 July 2013

- [38] Marti, L.; Rezaei-Zare, A.; Narang, A., "Simulation of Transformer Hotspot Heating due to Geomagnetically Induced Currents," *Power Delivery, IEEE Transactions on* , vol.28, no.1, pp.320,327, Jan. 2013
- [37] Luis Marti, "Hydro One GMD Preparedness Plan for Cycle 24", Critical Infrastructure Protection and Space Weather Workshop March 28-29, 2012, Ottawa, Ontario, Canada
- [36] Marti, L.; Berge, J.; Varma, R.K., "Determination of Geomagnetically Induced Current Flow in a Transformer From Reactive Power Absorption," *Power Delivery, IEEE Transactions on* , vol.28, no.3, pp.1280,1288, July 2013
- [35] Boteler, D.H.; Lackey, A.J.C.; Marti, L.; Shelemy, S., "Equivalent circuits for modelling geomagnetically induced currents from a neighbouring network," in *Power and Energy Society General Meeting (PES), 2013 IEEE* , vol., no., pp.1-5, 21-25 July 2013
- [34] Yan, A.; Zhou, D.; Marti, L., "Analysis of Geomagnetically Induced Currents," in *Power and Energy Society General Meeting (PES), 2013 IEEE* , vol., no., pp.1-6, 21-25 July 2013
- [33] Debbie Zhou, Andrew Yan, Luis Marti "Load Flow Analysis and Mitigation Considering Geomagnetically Induced Currents", *CIGRE Symposium, Montreal 2012*.
- [32] Luis Marti, "Hydro One GMD Preparedness Plan for Cycle 24", *Space Weather Challenges for Modern Society TIEMS Conference, October 22-24 2012, Oslo, Norway*
- [31] Tang, Lianxiang; Yan, A.; Marti, L.; Fuerth, J., "Determination of distributed generation capacity from a voltage regulation perspective," *Transmission and Distribution Conference and Exposition (T&D), 2012 IEEE PES* , vol., no., pp.1,8, 7-10 May 2012
- [30] Lianxiang Tang; Yan, A.; Marti, L.; Fuerth, J., "Hydro one distribution voltage performance design criteria and power distance test in enabling distributed generation," *Transmission and Distribution Conference and Exposition (T&D), 2012 IEEE PES* , vol., no., pp.1,8, 7-10 May 2012
- [29] J. Berge, L. Marti, R. K. Varma. "Modelling and Mitigation of Geomagnetically Induced Currents on a Realistic Power System Network", *Proc. of 2011 Electrical Power and Energy Conference, Winnipeg, Manitoba, Canada, October 2011*
- [28] J. Berge, R. K. Varma, L. Marti. "Laboratory Validation of the Relationship Between Geomagnetically Induced Current (GIC) and Transformer Absorbed Reactive Power", *Proc. of 2011 Electrical Power and Energy Conference, Winnipeg, Manitoba, Canada, October 2011*



- [27] Boteler, D.H.; Trichtchenko, L.; Pirjola, R.; Parmelee, J.; Souksaly, S.; Foss, A.; Marti, L., "Real-Time Simulation of Geomagnetically Induced Currents," *Electromagnetic Compatibility and Electromagnetic Ecology, 2007 7th International Symposium on* , vol., no., pp.261-264, 26-29 June 2007
- [26] D.H. Boteler, L. Trichtchenko, R. Pirjola, J. Parmelee, S. Souksaly, A. Foss, L. Marti, "Real time simulation of geomagnetically induced currents", *Canadian Conference on Electrical and Computer Engineering, IEEE Canada, Ottawa May 2006*
- [25] E. Shehu, A. Konrad, L. Marti, "Fitting functions for low frequency transformer admittance curves", *ISEF 2005 conference, Baiona, Spain.*
- [24] E. Shehu, A. Konrad, L. Marti, "Optimization algorithm for transformer admittance curves", *IEEE Transactions on Magnetics, Oct 2005.*
- [23] L. Marti, Lianxiang Tang, "Condition Assessment Of HV Cable Sheath Insulation". *North American Transmission and Distribution Conference (NATD), Toronto, May 2005.*
- [22] L. Marti, Chun Li, "Real-Time GIC Monitoring in the Ontario HV Network". *North American Transmission and Distribution Conference (NATD), Toronto, May 2005.*
- [21] L. Marti, Chun Li, "Optimal Placement Of Line Surge Arresters For Improved Line Performance". *North American Transmission and Distribution Conference (NATD), Toronto, May 2005.*
- [20] L. Marti, H Tachick, "A New Power Electronics Device For The Protection Of Hv Cable Sheath Overvoltages".. *North American Transmission and Distribution Conference (NATD), Toronto, May 2005.*
- [19] L. Marti, A. Yan "Introduction to the Electromagnetic Transients Program - Concepts and Applications. Hydro One Networks Inc. EMTP Course material, 3<sup>rd</sup> Edition May 2002.
- [18] D.A.N. Jacobson, L. Marti, R.W. Menzies. "Modelling Ferroresonance in a 230 kV Transformer-terminated Double-circuit Transmission Line", *IPST'99 International Conference on Power System Transients, Budapest June 20-24 1999.*
- [17] L. Martí, H.W. Dommel, "Calculation of Voltage Profiles Along Transmission Lines", *IEEE Transactions on Power Delivery*, Vol 12, No. 2, pp. 993-998, April 1997.
- [16] L. Martí, T.E. Grainger, A.S. Morched, "Sheath overvoltages in HV underground cables", *CIGRE, Paris, 1996.*

- [15] A.S. Morched, L. Martí, R.H. Brierley, J.G. Lackey "Analysis of internal winding stresses in EHV generator step-up transformer failures", *IEEE Transactions on Power Delivery*, Vol. 11, No. 2, pp. 888-894, April 1996 .
- [14] L. Martí, R.H. Brierley, T.E. Grainger "Analysis of electromagnetic transients in cross-bonded cable systems using frequency dependent cable models", Proceedings of the International Conference of Power Systems Transients IPST'95, Lisbon, Portugal September 3-7 1995.
- [13] A. S. Morched, L. Martí, R.H. Brierley, "Analysis of Transformer Failures and Internal Winding Overvoltages", IPEC95 Singapore, February 3 - March 3 1995.
- [12] Martí L. "Simulation of Electromagnetic Transients in Underground Cables using the EMTP", Proceedings APSCOM 93, Hong Kong, December 1993.
- [11] J.R. Martí, L. Martí, and H.W. Dommel, "Transmission Line Models for Steady-State and Transients Analysis", Invited paper. Proceedings IEEE Joint International Power Conference, Athens Power Tech APT'93, Athens, Greece, Sept. 5-8, 1993, pp. 744-750.
- [10] A.S. Morched, J.H. Ottevangers and L. Martí, "Multi-port Frequency Dependent Network Equivalents for the EMTP", *Paper 92 SM 461-4 PWRD*, Presented at the PES-IEEE 1992 Summer Meeting, Seattle, May 1992.
- [9] A.S. Morched, L. Martí and J.H. Ottevangers, "A High Frequency Transformer Model for the EMTP", *IEEE Trans. on Power Delivery*, vol. 8, No. 3, pp. 1615-1626, July 1993
- [8] L. Martí, "Simulation of Transients in Underground Cables with Frequency-Dependent Modal Transformation Matrices". *IEEE Transactions on Power Delivery*, Vol. 3, No. 3, pp.1099-1110, July 1988.
- [7] J.R. Martí, H.W. Dommel, L. Martí, & V. Brandwajn, "Approximate Transformation Matrices for Unbalanced Transmission Systems". *Transactions for the 9th Power Systems Computation Conference*, pp. 416-422. August-September 1987, Lisbon, Portugal.
- [6] L. Martí, "Transient Voltage Profiles on Overhead Transmission Lines with Frequency-Dependent Parameters". *CEA Engineering and Operating Division Transactions*, Vol. 25, 1986.
- [5] H.W. Dommel, EMTP Theory Book (with contributions from L. Martí, et. al.). University of British Columbia, August 1986.

- [4] L. Martí, "Low Order Approximation of Transmission Line Parameters for Frequency-Dependent Models". *IEEE Transactions on Power Apparatus and Systems*, pp. 3582-3589, November 1983.
- [3] Martí, L., "Low-Order Approximation of Transmission Line Parameters for Frequency-Dependent Models," in *Power Engineering Review, IEEE* , vol.PER-3, no.11, pp.35-35, Nov. 1983
- [2] L. Martí, "Limitations of Frequency-Dependent Transmission Line Models in the EMTP". *EMTP Newsletter*, Vol. 4, No. 4, pp. 50-53, November 1983.
- [1] K.C. Lee, J.H. Sawada and L. Martí, "Comparison of Various EMTP Transmission Line Models". *EMTP Newsletter*, Vol.2, No.4, pp.58-69, May 1982.

#### **Other Present and Past Activities:**

- Member of CIGRE WGC4.502 working group on “Modelling and analysis of the technical performance of electrical power networks with very long/large number of high voltage AC cable lines”. Brochure published in 2013.
- Canadian member of CIGRE joint 21/33 working group on HVAC Insulated cables (1996-1998)
- Project manager for the DCG/EPRI EMTP96 commercialization project (1995-2004)
- Course co-ordinator and teaching staff of a number of EMTP courses worldwide
- Hydro One Networks representative of PSPOIG (Canadian Electricity Association special interest group)
- Member of IEEE working group IEEE PES WG on Modelling and Analysis of System Transients,
- E. Shehu, MAsc thesis co-supervisor (with E. Konrad), 2003-2005, University of Toronto
- J. Berge, PhD thesis co-supervisor (with R. Varma), University of Western Ontario ,2009-2012
- Licensed professional engineer in the Province of Ontario

**Prizes and Awards:**

- |         |   |
|---------|---|
| 2015    | IEEE Fellow, for contributions to modeling and simulation of electromagnetic transients   |
| 2012    | Hydro One President's Award<br>Excellence in innovation, Extreme Space Weather Preparedness (XSWP) Project  |
| 2008    | Hydro One President's Award<br>Excellence in the community, Hydro One Fellowship Program.   |
| 2008    | Hydro One President's Award<br>Excellence in the workplace, transient recovery voltages and the Richview double circuit breaker failure incident. |
| 1992    | Ontario Hydro's New Technology Award for the development of a comprehensive transformer model for the EMTP.                                       |
| 1982-84 | University of British Columbia Graduate Fellowship.   |
| 1979    | Melchor Centeno Award, for scholastic excellence.   |

## **CURRICULUM VITAE OF MEHRGAN MAZAHARI**

### **INDUSTRY EXPERIENCE**

2004 – Present	Hydro One Networks Inc. Project Manager, Project Delivery
2003 – 2004	Hydro One Networks Inc. Proposal Manager, Engineering and Construction Services
1997 – 2003	Satcon Power Systems (formerly Inverpower Controls) Application Engineer and Project Manager
1993 – 1997	Monenco Iran (subsidiary of Agra Monenco Inc., Canada) Project Engineer
1989 – 1993	Moshanir Power Engineering Consultants Project Engineer

### **EDUCATION**

**Schulich School of Business, York University**  
Toronto, Ontario (2007) Masters Certificate in  
Project Management

**Shahid Chamran University**  
Ahwaz, Iran (1988) Bachelor of Engineering

### **PROFESSIONAL REGISTRATION**

Professional Engineers Ontario

### **APPEARANCES BEFORE ONTARIO ENERGY BOARD**

None

**CURRICULUM VITAE OF  
PATRICIA STAITE**

**EDUCATION**

*University of Waterloo*, Waterloo, Ontario  
Bachelor of Environmental Studies

**INDUSTRY EXPERIENCE**

1998 - Present	Hydro One Networks Inc. & Ontario Hydro, Toronto, Ontario
2005 –present	Environmental Planner primarily working on Environmental Assessments
1998 - 2005	Environmental Specialist working on various environmental programs
1994 – 1998	Staite Environmental Consulting Inc. Toronto Ontario
1979 – 1999	Ontario Hydro - Environmental Specialist