

# Curriculum Vitae

## William K Marshall, P.Eng

Born May 16, 1946, Saint John, New Brunswick

### Positions

President, WKM Energy Consultants Inc since July 1, 2008  
President and CEO, New Brunswick System Operator, Oct 2004 – June 2008  
Director - Strategic Planning, NB Power Corporation, 1996-2004  
Manager - Power Supply Planning, NB Power Corporation, 1991-1996  
Senior Engineer – Power Supply Planning, NB Power Corporation, 1983-1991

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### Education

BSc (Electrical Engineering) from University of New Brunswick in 1968  
BEd (High School & Post-Secondary) from Mount Allison University in 1971  
MScE (Power Systems) from University of New Brunswick in 1972  
Several courses in Accounting and Finance, UNB, 1978-1983

### Work Experience

Eight (8) years as a professional educator at the high school, community college and university levels.

Eight (8) years as a private engineering consultant with work related to energy policy development, computer systems, educational services and power systems planning, tariffs and market issues.

Twenty eight (28) years as a professional engineer in the electric utility industry with NB Power Corporation (24 yrs) and with New Brunswick System Operator (4 yrs) with responsibilities involving:

- power system analysis, planning and development
- renewable energy procurement and wind power integration,
- integrated resource planning and procurement,
- electricity market rules and operations,
- environmental strategies and compliance,
- cost/benefit analysis of T,D&G equipment upgrades
- reliability standards development, enforcement and compliance,
- energy policy development,
- electric industry restructuring and deregulation,
- cost of service and industrial interruptible rate design,
- transmission tariffs and ancillary services rate design,
- regulatory approvals of tariffs, rates and policies,
- financial forecasting and budgeting,
- end use load control and “smart grid” evolution.

## Related Experience

Memberships and participation in various committees, work groups and task forces at the company, provincial, regional, national and international levels as follows:

- Province of New Brunswick
  - Energy Policy Committee
  - Electricity Market Design Committee
- East Coast Regional Transmission Organization Development Group
- Government of Canada
  - Forecast Working Group of Climate Change Task Group
  - Inter Provincial Electricity Trade Working Group
  - Atlantic Energy Gateway Resource Development and Transmission Planning Technical Committees
- Northeast Power Coordinating Council (NPCC)
  - Load and Capacity Task Force
  - Capacity Planning Work Group 5 – Interconnection Reliability
  - Reliability Coordination Committee
- Maritime Provinces Utility Planning Committee and the Atlantic Electricity Working Group
- Canadian Electricity Association (CEA)
  - Operations and Reliability Section
  - Climate Change Steering Committee
  - Fossil Utilities Climate Change Work Group
- CIDA sponsored Bhutan Project administered through University of New Brunswick
- CIGRE Task Force 38-03-10 on Composite Reliability (Co chairman)

Participation as a witness before hearings of various administrative boards and government committees including

- Crown Corporation Committee of the NB Legislature
- Select Committee on Energy of the NB Legislature
- Select Committee on Wood Supply of the NB Legislature
- Board of Commissioners of Public Utilities of New Brunswick (PUB)
- Energy and Utilities Board of New Brunswick (EUB)
- National Energy Board of Canada (NEB)
- Régie de l'énergie of Québec including recognition as an expert in power systems regulation, planning and transmission tariffs
- Maine Public Utilities Commission

Writing and presentation of various technical papers, courses and seminars before various groups including

- Institute of Electrical and Electronic Engineers (IEEE)
- Canadian Electricity Association (CEA)
- Canadian Nuclear Association (CAN)
- Canadian Pulp and Paper Institute (CPPI)

- Atlantic Power Summit
- Atlantic Energy Conference
- Québec Electricity Forum
- Ontario Power Symposium
- Northeast Power Coordinating Council (NPCC)
- Canadian Association - Members of Public Utility Tribunals (CAMPUT)
- Association of Professional Engineers of New Brunswick (APENB)
- Comité international des grands réseaux électriques (CIGRE)
- Point Lepreau Operator Training Program
- ClickSoftware Global Utility Summit
- International T&D Summit
- St Thomas University Public Forum on NB Power/Hydro-Quebec Deal
- University of New Brunswick Public Forum on Future of NB Power
- Atlantic Renewable Energy Conference
- Canadian Wind Energy Association Atlantic Caucus Conference
- Atlantic Provinces Economic Council Conference

**Experience specifically related to power system planning and operations issues associated with the Application of Hydro Québec Distribution before the Régie de l'énergie of Québec and wind integration**

While at NB Power:

- Integrated Resource Planning Studies for NB Power in 1991, 1995 and 2001 that included distribution, transmission and end use demand side management (DSM) resources as well as conventional generation supply resources
- Development of an RFP for New Brunswick's first wind farm, subsequent evaluation of submitted proposals and selection of a winning bid (2003)
- Economic evaluations of various power systems projects including:
  - Distribution transformer replacements and 25 kV upgrades to 12 kV distribution circuits,
  - Major transmission projects including the NB-HQ Madawaska HVDC interconnection, the NB-NE second 345 kV interconnection and various projects internal to NB,
  - Economic dispatch of generation including optimization of system losses and provision of ancillary services.
  - Environmental emission upgrades of generators.
- Participation on NB policy committees since 1996 regarding utility and market restructuring, open non discriminatory transmission access and reciprocity requirements of FERC Order 888 that lead to NB White Paper Energy Policy (2001), NB Open Access Transmission Tariff (2003), NB Electricity Act (2003) and NB Market Rules (2004)
- Interventions regarding HQ TransEnergie's OATT Application to the Régie de l'énergie of Québec (2001)
- Design and development of the NB Open Access Transmission Tariff (OATT) and Lead witness before the NB Public Utilities Board for its approval (2002-2003)

While with New Brunswick System Operator (2004-2008):

- Administration of the NB OATT and the NB Electricity Market
- Direction of wind power integration studies and regional transmission studies
- Negotiation of Coordination Agreements with NS Power and ISO-NE, etc
- Implementation of NBSO as Reliability Coordinator of the Maritimes Area
- Administration, approval and compliance of NERC standards and NPCC criteria
- Development of transmission planning standards, consultations and procedures
- Initiation of “Smart grid” project for water heater control with UNB and SJEnergy

As an independent consultant (2008-2013):

- Witness before NB regulator for amendments to NB OATT
- Completion of a discussion paper for NB Energy in 2008 outlining a sustainable energy development strategy for the Atlantic region involving transmission expansion and new hydro, nuclear and large scale wind generation.
- Extensive stakeholder consultation for NB Energy regarding the NB Electricity market and the structure of NB Power
- Report to a western Canadian utility regarding the transmission and operational challenges of integrating a large nuclear station into the western power grid
- Assist Ontario Energy Board in development of filing guidelines for Transmission and Distribution planning (Sub contract to Power Advisory LLC)
- Assist the NB government in the analysis, negotiation and implementation of the proposed sale of NB Power to Hydro Quebec
- Advisory consultant to the Government of Canada (through Atlantic Canada Opportunities Agency and Natural Resources Canada) for power systems studies under the Atlantic Energy Gateway project.
- Negotiating consultant to the Prince Edward Island Energy Corporation to assist in the evaluation of long term power supply offers from different regional suppliers, to assist the PEI Energy Commission in its review of the electricity sector on PEI and review of the potential for natural gas fired generation on PEI.
- Testimony before, and recognition as an expert witness by, the Régie de l'énergie of Québec regarding amendments to the HQ TransEnergie OATT (2011)
- Advice to a large Maritimes paper mill regarding the use of its flexible load to increase interconnection transfer capabilities and to provide load following assistance to support integration of wind generation (2013)
- Testimony before, and recognition as an expert witness by, Nova Scotia Utilities and Review Board regarding the delivery issues and costs of a Hydro Québec purchase by NS Power as an alternative to the development of the Maritime Link with accompanying purchase from Nalcor (2013)

### **Papers and Presentations Specific to Wind Integration**

Marshall,WK, Barriers to Wind Development - A Maritimes Perspective, presented to NRCan Renewable Energy Working Group Workshop, Ottawa, May 4, 2005

Marshall,WK Wind Integration & Tariff Issues, presented to Ontario Power Conference, Toronto, June 15, 2006

Marshall,WK et al, Maritimes Area Wind Integration Issues, submitted to CIGRE CANADA Conference on Power Systems, Montreal, Oct1-4, 2006

Marshall,WK, NBSO Activities, NB-Maine MOU and Wind Policy Considerations, presented to NBSO Annual Conference, Fredericton, April 23, 2007

Marshall,WK, Wind Integration Issues in Atlantic Canada, presented to All Energy Conference, Aberdeen Scotland, May 24, 2007

Marshall,WK, Wind Policy Considerations For Maritimes Area, presented to Atlantic Power Symposium, Halifax, June 5, 2007

Marshall,WK, Hydro and Wind Development Issues in the Northeast, presented to Canadian Dam Association Conference, St. John's NL, September 24, 2007

Marshall,WK, Greening the Grid - Considerations For Maritimes Area, presented to CEA Transmission Council, Toronto, February 7, 2008

Marshall,WK Sustainable Electricity for Atlantic Canada, presented to Atlantic Canada Power Summit, Saint John, NB, September 10, 2008

## **Papers and Presentations related to Regulation, Planning and Operations**

Marshall,WK and Smolinski,Walter, Field Tests of the Dynamic Performance of a Synchronous Machine, presented to IEEE Meeting, New York, February, 1973.

Marshall,WK and Hill, EF, Power System Reliability Analysis (Volume 2) Composite Power System Reliability Evaluation – A Summary, presented to CIGRE Symposium, Montreal, September 1991.

Marshall,WK, Demand Side Management, presented to Atlantic Regional Thermal Conference, Fredericton, May 1992.

Marshall,WK and Losier, Michel, Non Utility Wood Fired Generation Projects in New Brunswick, presented to CEA conference "Planning Our Electric Future – Now", Montreal, November 1992.

Marshall,WK and Hill,EF, Risk Assessment of Transmission Alternatives by Means of Composite Reliability Analysis, presented to CEA conference "Planning Our Electric Future – Now", Montreal, November 1992.

Marshall, WK and Hill, EF, Matching Electricity Supply and Demand, presented to Canadian Nuclear Association Conference, Saint John, June 1993.

Marshall,WK and Milton, BE, A Monte Carlo Based Method for Establishing Reserve Margin Criteria, presented to CEA Electricity 95 Conference, Vancouver, March 1995

Marshall,WK, Electricity Deregulation in New Brunswick, presented to CEA Electricity 98 Conference, Vancouver, March 1998.

Marshall,WK, Private Industrial Generation in a Competitive Electricity Environment, presented to Canadian Pulp and Paper Industry Association, Montreal, February 2000.

Marshall,WK, Deregulation of the Electricity Industry, presented to Crown Corporations Committee of NB Legislature, Oct 2000

Marshall,WK, New Brunswick Energy Policy, ECTO Stakeholder Meetings, Moncton, April 24-25, 2001

Marshall,WK, NB Power Transmission System, NB Market Design Committee, July 26, 2001

Marshall,WK, Congestion Management Strawman, NB Market Design Committee Presentation, Sept 27, 2001

Marshall,WK, Comments on the Hydro Quebec Transmission Tariff, presented to Quebec Electricity Forum, Montreal, November 2001.

Marshall,WK and Porter, GP, NB Power Transmission Tariff Design, submitted in evidence to NB PUB, June 2002

Marshall,WK, NB Electricity Market, Presented to Atlantic Gas Conference Halifax July 17, 2002

Marshall,WK, NB Electricity Market Seams Issues, presented to Northeast Power Coordinating Council, Albany, Sept 18, 2002

Marshall,WK, Energy in New Brunswick, presented to Association of Professional Engineers of NB Annual Meeting, Saint John, Feb 21, 2003

Marshall,WK, Maritime Canada Electricity Market Issues, Presented to Interjurisdictional Power Transactions Conference, Toronto, March 17, 2003

Marshall,WK, Atlantic Canada Electricity Market Issues, Presented to CAMPUT 2003 Conference, Banff, May 6, 2003

Marshall,WK, Power Deregulation In New Brunswick, presented to Canadian Manufacturers and Exporters Workshop, Fredericton, May 29, 2003

Marshall,WK, Maritimes Area Transmission & Market Issues, presented to Atlantic Power Conference, Halifax, July 15, 2003

Marshall,WK, New Brunswick Transmission & Market Issues, presented to NPCC Annual Meeting, Halifax, Sept 18, 2003

Marshall,WK, Economics of Power Generation for Maritime Canada, presented to Atlantic Power Summit, Saint John, NB., Oct 31, 2003

Marshall,WK, Competition, Restructuring and Markets in Maritime Canada, presented to Alberta Power Summit, Calgary, Feb 13, 2004

Marshall,WK, Competition, Restructuring and Markets in Maritime Canada, presented to ENERCOM Conference, Toronto, March 3, 2004

Marshall,WK, Northeast Reliability Interconnect Project, Pre Application Meeting Maine Public Utilities Commission, March 22, 2004

Marshall,WK, Potential for Regional Integration of Markets, presented to Atlantic Power Conference, Halifax, NS, May 17, 2004

Marshall,WK, Atlantic Provinces Electricity Supply Issues, presented to Atlantic Energy Ministers Meetings, Mill River PEI, June 7, 2004

Marshall,WK, NB Electricity Market Participation, presented to Atlantic Power Conference, Saint John, June 14, 2004

Marshall,WK, Atlantic Provinces Electricity Supply Issues, presented to Atlantic Gas Symposium, Halifax, NS, July 20, 2004

Marshall,WK, New Brunswick Electricity Market, presented to IEEE LESCOPE Conference, Halifax, NS, August, 2004

Marshall,WK, NB Market Implementation, presented to NPCC Annual Meeting, Montreal, Sept 29, 2004

Marshall,WK, NB Market Update, presented to Atlantic Power Summit, Saint John, NB, Nov 1, 2004

Marshall,WK, NBSO Regional Initiatives, presented to NBSO Annual Conference, Moncton, NB, April 10, 2006

Marshall,WK, Supply/Demand Outlook and Other Issues, presented to Atlantic Power Symposium, Halifax, NS, June 5, 2006

Marshall,WK, Tariff, Market and Transmission Issues in Atlantic Canada, presented to Atlantic Power Summit, Saint John, NB, October 30, 2006

Marshall,WK, Transmission Development Issues, presented to T&D Summit, Santa Ana Pueblo, NM, November 6, 2006

Marshall,WK, Market Seams Issues, presented to CEA/CAMPUT Workshop, Toronto, Feb 14, 2007

Marshall,WK, Transmission Development Issues, presented to Emerging Energies Conference, Calgary, May 28, 2007

Marshall,WK, Greening of Electricity Consumption in Canada, presented to Standing Committee on Natural Resources of Canadian Parliament, June 4, 2007

Marshall,WK Electricity Opportunities and Challenges, presented to Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP), PEI, June 26, 2007

Marshall,WK, Leveraging New Infrastructure Northeast View, presented to CEA Power Marketer's Council, Gatineau PQ, October 4, 2007

Marshall,WK, Generation and Transmission Issues, presented to National Energy Board Energy Futures Seminar, Ottawa, January 22, 2008

Marshall,WK, Issues Affecting the Electricity T&D System in North America, presented to Global Utility Summit, Los Angeles, Nov 17, 2008

Marshall, WK, NB Power-Hydro Quebec Deal, presented to Renewable Energy Conference, Halifax, April 27, 2009

Marshall, WK, NB Power's Future???, presented to University of New Brunswick Energy Symposium, June 10, 2009

Marshall, WK Future Directions?, presented to U.S. – Canada Clean Energy Dialogue Increasing Trade in Clean Electricity, Chicago, May 20, 2010

Marshall, WK Failure of the NB Power-Hydro Quebec Deal Opens Atlantic Hub Opportunities, presented to Atlantic Power Symposium, Halifax, June 2, 2010

Marshall, WK, HYDRO QUÉBEC TARIFF RELATIVE TO FERC ORDER 890, SUBMITTED TO THE RÉGIE DE L'ÉNERGIE DU QUÉBEC, JUNE 10, 2009

Marshall, WK, Imbalance Pricing and Related Issues Relative to FERC Order 890, SUBMITTED TO THE RÉGIE DE L'ÉNERGIE DU QUÉBEC, JUNE 18, 2009

Marshall, WK, Regional Collaboration and Transmission, presented to Energy Stakeholder Retreat, June 13-14, 2010, Moncton, NB

Marshall, WK Imbalance Pricing And Related Issues Relative To Ferc Order 890 Submitted to the RÉGIE DE L'ÉNERGIE DU QUÉBEC, September 28, 2010



Marshall, WK Atlantic Electricity Sector Opportunities and Challenges, presented to APEC Annual Outlook Conference, Charlottetown, Nov 5, 2010

Marshall, WK, Atlantic Electricity Sector Challenges and Opportunities, presented to Ideas Festival, St Andrews by the Sea, NB, Nov 26, 2010

Marshall, WK Atlantic Electricity Sector Opportunities and Challenges, presented to ACEC(NB) Annual Meetings, Saint John, April 28, 2011

Marshall, WK, Regional Electricity Cooperation Opportunities and Challenges, presented to Atlantic Business Summit, Toronto, June 2, 2011

Marshall, WK, Lower Churchill Falls Project Opportunities and Challenges, presented to Atlantic Power Symposium, Halifax, June 14, 2011

Marshall, WK, Regional Electricity Cooperation Opportunities and Challenges presented to Canadian German Wind Energy Conference, Halifax, February 23, 2012

Marshall, WK, Lower Churchill Issues, Opportunities and Challenges, presented to UNB HVDC Class, January 30, 2013

Marshall, WK, An Assessment of the Costs and Issues Associated with the Delivery of a Purchase from Hydro Quebec, submitted as evidence to the NSUARB by NSPML, January, 28, 2013