

PROFESSIONAL EDUCATION:

Executive Management Program, Queen's University – 2008
Certified General Accountant – 1984
Bachelor of Commerce Honours, University of Manitoba – 1982

PROFESSIONAL AFFILIATIONS:

Certified General Accountants Association of Manitoba (member)
Certified General Accountants of Canada (member)

EMPLOYMENT HISTORY:

2007 – Present	Division Manager, Power Planning, Manitoba Hydro
2006 – 2007	Manager, Export Strategy & Sales, Power Sales & Operations Division, Manitoba Hydro
2001 – 2006	Manager, Export Power Marketing, Power Sales & Operations Division, Manitoba Hydro
1998 – 2001	Manager, Financial & Purchasing Services, Power Supply Business Unit, Manitoba Hydro
1997 – 1998	Senior Finance Supervisor, Financial Services – Distribution, Transmission & Distribution Business Unit, Manitoba Hydro
1995 – 1997	Management Financial Advisor, Western Region, Customer Service & Marketing, Manitoba Hydro
1984 – 1995	Supervisory and Professional Accounting positions, Corporate Accounting Department, Corporate Controller's Division, Manitoba Hydro
1982 – 1984	General Accountant positions, Corporate Controller's Division, Information Systems Division, and Internal Audit, Manitoba Hydro



EMPLOYEE NAME: T. M. (Terry) Miles

PROFESSIONAL EDUCATION:

Master of Science in Civil Engineering, University of Manitoba – 1993
Bachelor of Science in Civil Engineering, University of Manitoba – 1990

PROFESSIONAL AFFILIATIONS:

Association of Professional Engineers and Geoscientists of the Province of Manitoba

EMPLOYMENT HISTORY:

2008 – Present	Manager, Resource Planning & Market Analysis Department, Manitoba Hydro
2003 – 2008	Manager, Hydraulic Engineering & Operations Department, Manitoba Hydro
1999 – 2003	Water Resources Section Head, Hydraulic Engineering & Operations Department, Manitoba Hydro
1994 – 1999	Hydraulic Studies Engineer, Hydraulic Engineering & Operations Department, Manitoba Hydro
1993 – 1994	Engineer in Training Program, Manitoba Hydro
	- Rehabilitation and Mitigation Construction Department
	- Hydraulic Operations Department

PROFESSIONAL EDUCATION:

Bachelor of Science in Electrical Engineering, University of Manitoba – 1981 to 1985

PROFESSIONAL AFFILIATIONS:

Professional Engineer, Association of Professional Engineers & Geoscientists of Manitoba.
Chair of the Canadian Hydropower Association - Clean Energy Policy Committee
Member of the Canadian Electricity Association - Climate Change Steering Committee
Member of the International Hydropower Association
Past Chair, Canadian Hydropower Association Reservoir Issue Committee
Past member of the Steering Committee for the BIOCAP - National Aquatic Systems and Climate Change Research Network
Past participant in Powering the Plains
Past Chair, Chicago Climate Exchange Offset Committee
Past Member of the Chicago Climate Exchange - Design Committee
Past Member - Tradeable Permits Working Group - Canadian National Climate Change Process.
Past Member of the NRTEE Emission Trading Multi-Stakeholder Expert Group

EMPLOYMENT HISTORY:

2010 – Present	Manager, Energy Policy & Analysis Department, Manitoba Hydro
2004 – 2010	Senior Energy Policy Officer, Energy Policy & Emissions Trading Section, Manitoba Hydro
2003 – 2004	Strategic Issues Officer, Power Planning & Development Division, Manitoba Hydro
1996 – 2002	Resource Evaluation Engineer, Power Resource Planning Department, Manitoba Hydro
1995 – 1996	DSM Planning Officer, Energy Management Department, Manitoba Hydro
1990 – 1995	Resource Evaluation Engineer, Power Resource Planning Department, Manitoba Hydro
1989 – 1990	Engineer-In-Training, Telecontrol Design Department, Manitoba Hydro
1989	Engineer-In-Training, Nelson River Generation Stations, Manitoba Hydro
1985 – 1987	Executive Assistant, Manitoba Government

PROFESSIONAL EDUCATION:

B.Sc. Civil Engineering - 1976

PROFESSIONAL AFFILIATIONS:

Association of Professional Engineers and Geoscientists of the Province of Manitoba

EMPLOYMENT HISTORY:

2001 – Present	Division Manager of Power Sales and Operations Division, Generation Operations, Manitoba Hydro
1996 – 2001	Manager of Energy Supply and Sales Department, Power Supply, Manitoba Hydro
1993 – 1996	Manager of Reservoir and Energy Scheduling, Power Supply, Manitoba Hydro
1983 – 1993	Reservoir and Energy Scheduling Engineer, Power Supply, Manitoba Hydro
1980 – 1982	Hydraulic Studies Engineer, System Operating Department, Manitoba Hydro
1979	Project Engineer, Ducks Unlimited (Canada)
1976 – 1978	Engineer in Training Program, Manitoba Hydro <ul style="list-style-type: none">- System Planning Department- Geotechnical Department- System Operating Department
1973 – 1975	Summer Student - Surveyor on Churchill River Diversion project, Manitoba Hydro Inspector on substation and underground projects, Manitoba Hydro
1971 – 1972	Surveyor on Lake Winnipeg Regulation project, Manitoba Hydro

PROFESSIONAL EDUCATION:

Masters of Science in Structural Engineering, University of Manitoba – 2005
Bachelor of Science in Civil Engineering, University of Manitoba – 1998

PROFESSIONAL AFFILIATIONS:

Registered Professional Engineer in the Province of Manitoba since 2003
Association for Advancement of Cost Engineering since 2008

EMPLOYMENT HISTORY:

2010 – Present	Manager, Project Services Department, New Generation Construction Division, Manitoba Hydro
2009 – 2010	Civil Engineer, Pointe du Bois Redevelopment Project, Major Projects Department, New Generation Construction Division, Manitoba Hydro
2006 – 2009	Project Services Engineer, Wuskwatim Engineering Department, New Generation Construction Division, Manitoba Hydro
2005 – 2006	Structural Engineer, Civil Engineering Department, Engineering Services Division, Manitoba Hydro
1997 – 2005	Wardrop Engineering, Designer/Structural Engineer
1995/1997	Public Works and Governmental Services Canada, Project Assistant



EMPLOYEE NAME: D. A. N. (David) Jacobson

PROFESSIONAL EDUCATION:

Ph.D. in Electrical Engineering, University of Manitoba – 2000
Master of Science in Electrical Engineering, University of Manitoba – 1990
Bachelor of Science in Electrical Engineering (with distinction), University of Manitoba – 1988

PROFESSIONAL AFFILIATIONS:

International Council on Large Electric Systems (Distinguished member CIGRE)
Association of Professional Engineers and Geoscientists of the Province of Manitoba (APEGM)
Institute of Electrical and Electronic Engineers (Senior member IEEE)
Adjunct Professor – University of Manitoba

EMPLOYMENT HISTORY:

2002 – Present	Section Head, Interconnections & Grid Supply, Manitoba Hydro
1995 – 2001	Grid Supply Enhancement Engineer, System Planning Department, Manitoba Hydro
1994 – 1995	Visiting Researcher, System Planning, Siemens (Germany)
1991 – 1993	Professional Engineer, System Planning Department, Manitoba Hydro

Adam Borison

Adam Borison
Director

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Professional History

- Director, Navigant Consulting
- Senior Vice President, NERA Economic Consulting
- Co-Founder, Agni
- Co-Founder, Stratelytics
- Partner, PricewaterhouseCoopers
- Principal, Applied Decision Analysis

Academic History

- Adjunct Associate Professor, Management Science & Engineering, Stanford University
- Visiting Scholar, Judge Business School, University of Cambridge
- Visiting Lecturer, Haas Business School, U.C. Berkeley

Education

- Ph.D., Management Science & Engineering, Stanford University
- M.P.P., John F. Kennedy School of Government, Harvard University
- B.S., Molecular Biophysics and Biochemistry (Summa Cum Laude), Yale University

Thought Leadership

- Authored articles in California Management Review, Electricity Journal, Interfaces, Journal of Applied Corporate Finance, Management Science, Public Utilities Fortnightly and Sloan Management Review.
- Quoted in Business Week, Industry Week, Mergers and Acquisitions Reporter and USA Today.

Dr. Borison is a Director in Navigant's Power Systems, Markets & Pricing Group, where is involved primarily in market assessment, strategy and planning, investment and operational analysis, and risk management in power and fuels. Previously, he was a Senior Vice President in the Energy and Infrastructure Practice at NERA Economic Consulting and CEO of Stratelytics, a consulting firm specializing in the application of advanced analytics to strategy, valuation and risk in the energy industry. Dr. Borison also co-founded AgniEnergy, a venture-funded India-focused biomass energy company, and was a Corporate Value Consulting Partner at PricewaterhouseCoopers (PwC) and leader of PwC's Applied Decision Analysis (ADA) group.

Dr. Borison is an internationally-recognized and widely-published expert in decision analysis, real options, optimization, risk analysis and related methods. He has twenty-five years of direct and advisory experience applying these methods at the senior executive level with a particular focus on electric power, oil/gas and biofuels. Dr. Borison has led a broad range of engagements in investment strategy, M&A, ERM, project planning and evaluation, product design and R&D, capital allocation, regulatory policy and litigation/arbitration. His recent work has focused on major capital, fuel and power issues, ranging from plant acquisition and management to resource planning and valuation to procurement strategy and risk analysis. Dr. Borison has advised clients on billions of dollars of energy transactions and investments – power generation, petroleum E&P, gas transportation, biofuels technology – and has submitted expert testimony on disputes extending from the Gulf of Mexico to Kurdistan.

Dr. Borison has served on the visiting faculty at Stanford University, U.C. Berkeley and the University of Cambridge, teaching both management methods and business strategy. He has worked on dozens of capability-building engagements for clients involving data development, model transfer, results review, training and coaching. Dr. Borison has authored several articles on the application of analytic methods, particularly decision and option analysis, in publications such as the *Electricity Journal*, *Sloan Management Review* and the *Journal of Applied Corporate Finance*.

Professional Expertise

Navigant Consulting, Inc, Director, 2011 - Present

- Market assessment – commodities, technologies, regions
- Strategy and planning – fuels, generation, transmission, distribution
- Investment and procurement analysis – M&A, corporate
- Risk management – assessment, remediation, transfer

Representative Projects

- Midwest US Gas and Power Strategy. A large diversified energy company had a strong position in both gas and power in much of North America. Given the “shale gas revolution” and the challenges faced by incumbent players, management was becoming increasingly interested in opportunities in changing Midwest US markets where it had only a modest presence. Dr. Borison led the Navigant team that developed a strategy for this new business. We first conducted an extensive assessment of the economic and regulatory situation in specific Midwest states and locales, examining demand growth, supply infrastructure, competition and market structure. We then provided a detailed quantitative evaluation of market size and growth. Our analysis revealed precisely where opportunities were best (and worst) by both customer type and locale. This analysis has served successfully as a guide for the company’s expansion strategy.
- West Coast US Utility Diversification Strategy. A mid-sized West Coast electric utility was considering a major effort to expand beyond its core power business into related retail services. This interest was driven in part by the fact that similar firms were expanding into these services and technology in this area was improving rapidly. The company’s “default” plan was to move strongly in this direction. We worked closely with the client to understand the needs and preferences of their customers, their internal capabilities, and the competitive landscape. We then analyzed business plans involving a variety of service offerings. Our analysis revealed clearly that the “default” plan for expanding into this new business, despite its apparent attractiveness, involved extraordinary risks and would almost certainly lead to substantial losses. It also revealed that other plans were considerably superior – involving better return and lower risk. To quote top management, *“The analysis revealed the pros and cons of alternative plans much more clearly than before. The default plan turned out to be among the least preferred - expensive and risky. And a previously-controversial plan turned out to be preferred - most cost effective and least risky. We and our Board enthusiastically adopted this preferred plan. In hindsight, this saved our customers millions of dollars.”*
- East Coast Utility Environmental Compliance Strategy. A very large East Coast electric utility had a large and diverse coal fleet, including plants of various sizes, vintages and designs. These plants were subject to a complex and changing set of environmental regulations involving air emissions of various types, solid waste, cooling water and the like. Management was faced with making expensive environmental compliance decisions in a challenging environment of declining demand, volatile fuel prices, uncertain regulation, and increasing public scrutiny. Working with a range of experts within the utility, Dr. Borison led the team that conducted a thorough analysis of the environmental compliance alternatives across the fleet including emissions control technology, fuel

conversion and operational changes. We helped the utility develop a comprehensive, flexible strategy that ensured regulatory compliance, addressed key stakeholder concerns and saved money. The utility has successfully adopted this strategy.

- **Haiti Bioenergy Strategy.** With funding from the Inter-American Development Bank (IDB), the Government of Haiti (GoH) is developing and implementing a bioenergy strategy. The energy situation in Haiti represents both a substantial opportunity and a substantial challenge. Dr. Borison led a diverse international team to conduct an assessment of the current and potential situation in Haiti for the supply and demand of bioenergy, and to develop policy/regulatory recommendations and an action plan for implementing these policies. IDB and GoH have both received the recommendations with great enthusiasm, and are now embarking on the suggested roadmap for achieving important bioenergy goals.
- **UK Power Market Entry Strategy.** A major diversified Asian energy firm was considering entry into the UK power market. Dr. Borison led the Navigant team to research the current and likely future situation with respect to this market, including evolving commodity and power prices and changing regulations. We then developed a detailed financial model of potential UK power investments, and analyzed the risk and return. To the surprise of our client...who had been planning on moving forward, the analysis revealed that the proposed investment in this market was not advisable. Our client tabled its investment plans, and subsequent events have confirmed the accuracy of our analysis.

NERA Economic Consulting, Senior Economist and Senior Vice President, 2009-2011

- Asset and fuel strategy
- Oil/gas field valuation
- Energy and transportation risk management
- Renewable energy development and risk assessment

Agni, Founder (with two colleagues) and Advisor, 2006-2008

- Conceived bioenergy business idea, and secured more than \$15M in venture and private equity funding
- Helped transform bench-scale concept into commercial business

Stratlytics, Founder (with two colleagues) and CEO, 2004-2005

- Asset/contract strategy and valuation
- Flexible resource planning in the face of climate and other uncertainties
- Stochastic commodity and power price forecasting
- Clean energy project development and investment evaluation

Xamplify, Executive Vice President, Market Strategy and Business Development, 2002-2003

- Helped refocus business, develop new products and markets and secure investor funding

PricewaterhouseCoopers, Partner and ADA Group Leader, 1998-2001

- Market strategies for telecom, health care, retail and pharma firms

- R&D strategies for life sciences firms
- M&A valuations for energy and mining assets
- New product development strategies for high-tech and manufacturing firms
- Real options analysis for energy, manufacturing and service firms

Applied Decision Analysis, Analyst to Principal and Board Member, 1982-1997

- Founder and leader, Investment Strategy/Real Option Valuation practice
- Supply-side and demand-side strategies for power companies
- Upstream, midstream and downstream strategies for oil/gas firms
- Environmental compliance strategies for energy and chemical firms
- Market entry strategies for consumer and industrial product firms
- Decision analysis for energy, manufacturing and services firms

Publications

- “Lessons from the Gulf Oil Spill: Black Swan or Black Sheep?” (& Gregory Hamm), Risk Management Magazine, April 2011.
- “Biocoal Options: A New Future for Small Coal-Fired Plants,” (& Gregory Hamm & Philip Narodick), Public Utilities Fortnightly, December 2010.
- “How To Manage Risk (After Risk Management Has Failed)” (& Gregory Hamm), Sloan Management Review, Fall 2010.
- “Prediction Markets: A New Tool for Strategic Decision Making,” (& Gregory Hamm), California Management Review, Summer 2010.
- “The Rush to Coal: Is the Analysis Complete?” (& Gregory Hamm), The Electricity Journal, January 2008.
- “Dirty, Old Coal Plants: Silk Purse or Sow’s Ear?” (& Gregory Hamm), The Electricity Journal, April 2007.
- “Forecasting Long-Run Electricity Prices,” (& Gregory Hamm), The Electricity Journal, Aug-Sep 2006.
- “Better Power Contracts: Using Flexibility to Increase Value,” (& Gregory Hamm), The Electricity Journal, Nov-Dec 2005.
- “Real Options: Where Are the Emperor’s Clothes?,” Journal of Applied Corporate Finance, Spring 2005.
- “Real Options: State of the Practice” (& Alex Triantis), Journal of Applied Corporate Finance, Sum 2001.
- “The Future of Electric Power” (& Gregory Hamm), Energy Decisions, Sep 2001.
- “Risk-Based Decision-Making: Integrating Risk Management into Business Planning” (& D. Brooks) in R.V. Kolluru (ed.) et al., Risk Assessment and Management Handbook for Environmental, Health and Safety Professionals, New York, McGraw-Hill, 1995.
- “Oglethorpe Power Corporation Decides About Investing in a Major Transmission System,” Interfaces, Mar-Apr 1995.

Speeches, Presentations and Reports

- "Biomass without Borders: Lessons from International Ventures" (& Liliana Diaz) presented at Biomass 2012, Washington, DC, July 10, 2012.
- "Managing Energy Risk: Going Beyond the Market" presented at Energy Risk USA, in Houston, TX, May 19, 2009.
- "Clean Energy: An In-Depth No-Hype Introduction" presented in San Diego, Cambridge UK, Washington DC, and Singapore.
- "Green Business Strategy," presented at Rotterdam School of Management, November 2007.
- "Valuing Energy Companies as a Portfolio of Real Options" and "Real Option Valuation: A Practitioner's Overview" presented at various conferences, 1996-2001.

DEAN M. MURPHY

Principal

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Dr. Dean Murphy is an engineer and economist with expertise in energy economics, competitive and regulatory economics and finance, as well as a background in quantitative modeling and risk analysis. His work centers on the electric industry, encompassing issues such as resource and investment planning (including power and fuel price forecasting), valuation for contract disputes and asset transactions, climate change policy and analysis, competitive industry structure and market behavior, and market rules and mechanics. He has addressed these issues in the context of business planning and strategy, regulatory hearings and compliance filings, litigation and arbitration. Dr. Murphy has examined these matters from the perspectives of investor-owned and public electric utilities, independent producers and investors, industry groups, regulators, system operators, and consumers.

Dr. Murphy holds a Ph.D. in Industrial Engineering and Engineering Management and an M.S. in Engineering-Economic Systems, both from Stanford University, and a B.E.S. in Materials Science and Engineering from the Johns Hopkins University. Prior to joining *The Brattle Group* in 1995, Dr. Murphy worked as an associate with Applied Decision Analysis, Inc.

AREAS OF EXPERTISE

- Resource Planning, Investment, and Forecasting
- Valuation for Energy Contract Disputes and Energy Asset Transactions
- Climate Policy Analysis
- Market Structure and Competitiveness
- Electricity Markets: Energy, Capacity, and Ancillary Services
- Procurement and Restructuring

EXPERIENCE

Resource Planning, Investment, and Forecasting

- Dr. Murphy assisted the investor-owned utilities and regulators in Connecticut in complying with a legislative mandate to develop annual resource and procurement plans for the state, over several annual cycles. He focused particularly on the development of a set of scenarios against which alternative resource plans were evaluated, in order to illuminate the risks that might be associated with such plans. Key issues were potential federal climate legislation, natural gas prices, electricity demand, and demand side management strategies, as well as the complex interplay between these factors. He also evaluated energy security issues, including interactions

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between natural gas availability and electric reliability, as well as the potential role of nuclear power and emerging technologies, and their impacts on energy security.

- For a consortium in the initial stages of developing a major long-distance offshore DC transmission link designed to integrate multiple thousands of megawatts of new wind generation into several electric markets, Dr. Murphy performed a preliminary evaluation of the potential energy and capacity value of the project, and the approximate customer cost impact. These analyses were designed to assist in securing FERC approval for incentive rate treatment and abandoned cost recovery.
- For an electric company considering large additions of hydroelectric capacity for off-system sales, Dr. Murphy developed a set of future scenarios based on the possible future evolution of several key market drivers, and forecast long-term market prices of power for each scenario. The scenario drivers included fuel prices, climate policy, coal plant retirements, renewable energy portfolio standards, and load levels, which are affected by changes in power prices and active demand management programs. This assignment was repeated several times in subsequent years to understand how changing market drivers have influenced the potential range future of power prices.
- For a merchant electric generator contemplating renewing or replacing an expiring output contract for a gas-fired generator, Dr. Murphy used a power market simulation model to forecast potential long-term power price trends under several scenarios involving fuel costs, generator retirements and renewable additions. Using the forecasts of potential long-term trends, he simulated the plant's short-term operations and its resulting financial performance. A key factor that had a significant effect on the plant's value in this analysis was characterizing the short-term volatility of power prices and the plant's ability to respond to capture short periods of attractive prices.
- Dr. Murphy developed a long-term forecast of Renewable Energy Credit (REC) prices across multiple states and interconnected electricity markets for a renewable generation developer. He considered state-level Renewable Portfolio Standard (RPS) requirements over time, as well as potential federal renewable requirements, looking at the cost and geographic availability of several potential renewable resource types and incorporating the effect of in-state requirements and alternative compliance payments.
- Dr. Murphy worked with a manufacturer of an energy storage technology to estimate its value on several dimensions across a range of potential applications. He used simulated charge-discharge cycles with historical prices in several markets to demonstrate not only the technology's energy and capacity value, but also its potential ancillary service and reliability benefits.

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- For the Tennessee Valley Authority (TVA), Dr. Murphy assisted in the development of TVA's long-range Strategic Plan to deal with the development of competitive markets and a changing regulatory environment. He organized and performed numerous operational and financial analyses to understand TVA's performance under a wide variety of scenarios, and integrated the results into a strategic framework, considering numerous potential outside influences (e.g., fuel price scenarios) and TVA responses (e.g., product unbundling or changes to TVA's pricing structure).
- For a utility client interested in building a merchant transmission line, Dr. Murphy evaluated the benefits of the line, designed and implemented an auction for the rights to use the line once constructed, and evaluated the bids received in the auction.
- For an entrepreneurial client investigating the opportunities for an electric storage technology in the deregulated electric market, Dr. Murphy developed a model that optimizes facility operations with respect to a set of forecasted electric commodity price profiles. The model was used to evaluate the technology's potential profitability on several different electricity systems. Commodity price profiles for each system were projected by integrating historical real-time system marginal cost data with the projected cost of additional capacity.

Valuation for Energy Contract Disputes and Energy Asset Transactions

- In a major arbitration dispute, Dr. Murphy assisted a merchant generating company in determining the value lost when the government agency with whom it had contracted to develop a gas-fired power plant decided to terminate the contract before the plant was completed. A key contributor to the value lost was the potential riskiness of the contract revenues. The contract's unusual structure insulated the merchant generating company from many of the risks normally associated with electricity markets, transferring these risks to the government agency over the contract's twenty-year term. This transfer of risk had a major effect on the value of the contract and thus on the magnitude of the arbitration claim.
- Dr. Murphy calculated the damages that resulted from several partial derates of a nuclear plant. The plant's owner had a unit-contingent output contract with a regional utility, and during the derate events, the plant delivered less power than it would have if it had operated normally. The utility had to replace the missing power (or equivalently, in some hours lost the opportunity to resell the power) at higher market prices, and also lost some of the capacity value of the plant in the regional capacity market.
- For an investor exploring the acquisition of several gas-fired generators in markets without retail deregulation, Dr. Murphy helped to analyze the potential profitability of the assets under a range of assumptions about future natural gas and CO₂ allowance prices. Building on simulation results developed by another consultant, Dr. Murphy and the Brattle team were able to investigate several factors specific to the individual assets in question but not captured by a broad market simulation model.

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- Dr. Murphy advised a committee of bondholders of a foreign subsidiary of a U.S. merchant power company that was undergoing restructuring. He advised regarding the value of several power contracts and assets in which the subsidiary had an interest, including a potential damage claim for a terminated long-term contract.
- In a dispute related to a terminated long-term power contract for an electric generating facility, the original contract contained clauses that may be triggered in the event of a default, based on the value of available replacement opportunities. For a group of bondholders of the facility, Dr. Murphy prepared an affidavit regarding the market value of the available replacement opportunities, and how they related to the facility's debt and operating costs.
- For an independent power producer, Dr. Murphy supported expert testimony to value damages due to termination of a long-term electric generator tolling contract, requiring power market forecasting and finance valuation techniques. Key to this case was the increase in risk caused by the loss of the contract, in an environment (following the collapse of the power sector in 2001) in which it was not possible to obtain a long-term replacement contract.
- For a bondholder of a power marketing company, Dr. Murphy evaluated the likely outcome of an arbitration hearing regarding damages due as a result of the termination of a long-term generation contract.
- For an independent power producer forced into bankruptcy by the rejection of a long-term power contract by its counterparty, Dr. Murphy assessed the economic damages due to the loss of the contract.
- In the context of a dispute over damages in a terminated gas supply contract, Dr. Murphy analyzed and provided written testimony regarding the potential to resell contracted natural gas that could not be utilized by the purchaser.
- For a utility client attempting to acquire a partially completed generating station to be held as a utility affiliate, Dr. Murphy analyzed the acquisition and affiliate transaction to determine whether there would be any violation of market power regulations.

Climate Policy Analysis

- Dr. Murphy helped the senior executives of a major coal producer to assess the long-term implications of U.S. climate policy on our electricity generating infrastructure. He characterized the effects of different potential policy structures and stringency on CO₂ prices, the economics of existing and future electric generating technologies, and likely generation expansion and retirement decisions over several decades, in order to forecast power sector costs and CO₂ emissions under these policy approaches. The project also involved estimating the long-term effects on CO₂ emissions in the transportation and other sectors.

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- In seeking regulatory approval for a generation expansion plan, an investor-owned utility engaged Dr. Murphy to help understand the interrelationship between potential climate policy, the cost of natural gas, and the cost of generation technologies. He helped the client to incorporate these interacting factors into existing planning models.
- Dr. Murphy assisted the executives of a major U.S. electric company in developing a proposed policy structure to mitigate greenhouse gas emissions (carbon dioxide) that would be economically efficient, effective, and manageable for industries and the economy. The research evaluated the impact on the electric industry, addressing overall, regional, and company-level effects of alternative policies and stringency of legislation. It also addressed the effects on consumers and other industries.

Market Structure and Competitiveness

- Dr. Murphy leads the Brattle team that monitors a set of ongoing daily and hourly energy auctions. The auctions are governed by FERC order, which requires the subject utility to offer its unused capacity at a cost-based rate into the auctions. The Brattle team monitors the utility's offers into every daily and hourly auction to ensure that they comply with the FERC tariff, and monitors the auction's performance to ensure that it functions and clears properly.
- Dr. Murphy participated in a market power analysis in the context of a major electric utility merger, focusing on the analysis of how transmission availability and constraints affect the potential for the exercise of market power. He coordinated the collection and interpretation of transmission data from numerous utilities. To correct for the inherent data weaknesses, he designed and oversaw a separate, integrated transmission modeling effort to determine the ability of the grid to support short-term power transactions.
- Dr. Murphy evaluated the potential anti-competitive effects of a merger between a major regional natural gas company and an electric utility in a region where electric generation is highly dependent on natural gas as a fuel. He examined the potential for the merged company to exercise vertical market power by manipulating the price of natural gas to influence the competitive price of electricity, and what effect that would have on the competitiveness of the electric market.
- In several other cases, Dr. Murphy analyzed whether proposed energy company mergers or acquisitions would create the potential for the exercise of horizontal and/or vertical market power, developing mitigation strategies where appropriate.
- In a proposed merger involving an East Coast electric utility, Dr. Murphy assisted senior management in evaluating the effects of retail access on the financial health of both the client company and the potential merger partner, taking into account projected operating costs, the timing of open access, market prices for power, customer loss, and stranded cost recovery.

Electricity Markets: Energy, Capacity, and Ancillary Services

- For a competitive energy supplier and generation owner, Dr. Murphy analyzed the role of demand-side resources, such as interruptible load, in an ISO-sponsored capacity market. He examined the extent to which demand-side resources could supply capacity needs, and the risk that frequent utilization of such resources might dissuade their participation in the market.
- Dr. Murphy assisted a U.S. electric ISO with understanding the implications of expanding ISO membership on the ancillary service requirements of both existing and proposed new ISO members.
- For a major hydroelectric generator, Dr. Murphy assessed the planning and decision system used to determine when and how to allocate energy (e.g., in spot or forward markets). Both value and risk implications are important, and both are affected by large uncertainties and correlations in forward and spot prices, weather, energy (water) availability, and non-electric restrictions, among other factors. Dr. Murphy developed a number of recommendations for improving the accuracy of the utility's forecasts and models, therefore improving the decisions based on them.
- Dr. Murphy assisted a major Northwest hydroelectric generator in understanding the role of electric ancillary services, including voltage control and reserve generating capacity, in a restructured electric market. Issues included the interaction between the energy market and the ancillary services market, and the implications of embedded cost pricing as compared to competitive market-based pricing of ancillary services. This engagement involved coordinating work across the generation and transmission groups within the client organization to determine appropriate tariff rates for these ancillary services.
- In a series of projects for the Electric Power Research Institute (EPRI), Dr. Murphy has examined the potential for hydroelectric generators to provide reserve generating capacity in a restructured electricity market. (Providing reserve capacity is necessary to support an electrical system. It is particularly important to coordinate reserves in a restructured market made up of many independent generators, as contrasted with the traditional structure where a single utility company controls the entire system.) Dr. Murphy developed an economic framework for understanding how the markets for electric energy and reserve capacity would interact, and whether hydro's technical advantages in providing reserve capacity are likely to make reserves a natural niche market for hydro.
- For EPRI, Dr. Murphy evaluated the probable effect of industry restructuring on the value of hydroelectric power. The changing dynamics of the electricity market, in particular the structure of electricity price, may have significant implications for the value of a technology that can store energy and release it according to market conditions, thereby leading to a premium

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value for such resources. The technical capabilities of hydroelectric generating stations may also allow them to profit from the provision of ancillary services in a deregulated market.

- For a utility client, Dr. Murphy evaluated the effects of pricing structure on demand for electricity, load shape, and revenues. Changes in pricing structure can stimulate electric demand, increasing revenue without increasing the per unit electricity price. This may be a useful mechanism for mitigating a utility's stranded costs as the industry is restructured.

Procurement and Restructuring

- Dr. Murphy assisted an electric utility client with regulatory strategy regarding a state proposal to allow utilities to earn a "premium" on long-term power purchases, in order to account for the risks involved in committing to purchased power contracts.
- Dr. Murphy assisted a California utility in hearings before the California Public Utilities Commission regarding the establishment of a process for the California utilities to resume power procurement in the wake of the western power crisis of 2000-2001.
- In several engagements, Dr. Murphy assisted utility clients facing potential customer loss through municipalization. As part of these analyses, he determined the stranded costs (unrecovered investment) that municipalization would involve.
- Dr. Murphy assisted an electric utility client in planning for industry restructuring by characterizing alternative paths that restructuring could take, and developing potential strategies that respond to a competitive market and regulatory changes. He developed a detailed spreadsheet-based system and financial model to evaluate the effects of various strategies and scenarios on the magnitude of stranded costs and the client's financial performance. This modeling effort required analysis and forecasting of the changes in the structure of the market for electricity, as well as probable regulatory changes and their implications. The model served as the basis for several follow-up studies addressing more specific decisions and issues, performed by the client and by The Brattle Group.

Other Engagements

- In multiple different cases involving a number of nuclear generating plants, Dr. Murphy evaluated the Department of Energy's (DOE) failure to honor its commitment to remove spent nuclear fuel from U.S. nuclear plants. He provided expert witness testimony in one of these cases, and led the analytical effort in all of them to characterize how the government should and would have carried out its contractual obligation. Dr. Murphy simulated a nationwide market for the exchange of spent fuel removal rights, as was enabled by the contract, which made it possible to determine the timing of spent fuel removal from individual plants in the non-breach world. The results of these analyses were used to support the claims of the client nuclear plants for ongoing spent fuel storage costs, which would have been unnecessary had the DOE carried out its obligation.

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- Dr. Murphy assisted in a review of the auction of an ownership share in a nuclear generating plant, in order to determine whether the sale was performed using commercially reasonable means to ensure mitigation of the regulated seller's stranded costs.

PUBLICATIONS AND PRESENTATIONS

"Connecticut 2010 IRP Overview," presentation before the Energy and Technology Committee of the Connecticut General Assembly regarding the Connecticut 2010 Integrated Resource Plan, January 8, 2010.

"Integrated Resource Plan for Connecticut," with Sam Newell, Marc Chupka, Judy Chang, and Mariko Geronimo, The Brattle Group, January 2010.

"Promoting Use of Plug-In Electric Vehicles Through Utility Industry Acquisition and Leasing of Batteries, Chapter 13 of 'Plug-In Electric Vehicles: What Role for Washington?'," with Peter Fox-Penner and Mariko Geronimo, *The Brookings Institution*, 2009.

"When Sparks Fly: Economic Issues in Complex Energy Contract Litigation," Energy 2009 No. 1, The Brattle Group.

"Connecticut 2009 IRP Overview," presentation before the Energy and Technology Committee of the Connecticut General Assembly regarding the Connecticut 2009 Integrated Resource Plan, February 5, 2009.

"Integrated Resource Plan for Connecticut," with Onur Aydin, Judy Chang, Marc Chupka, Mariko Geronimo, Samuel Newell, and Joseph Wharton, The Brattle Group, January 2009.

"Reviving Integrated Resource Planning for Electric Utilities: New Challenges and Innovative Approaches," Energy 2008 No. 1, The Brattle Group.

"Integrated Resource Plan for Connecticut," with Marc Chupka, Ahmad Faruqui, Samuel Newell, and Joseph Wharton, The Brattle Group, January 2008.

"U.S. Climate Policy: Effects on Business and the Environment," presentation before The Conference Board, September 26-28, 2007.

"On Setting Near-Term Climate Policy While the Dust Begins to Settle: The Legacy of the Stern Review," with Gary Yohe and Richard S.J. Tol, *Energy and Environment*, Vol. 18, No. 5, 2007.

"Guest Commentary – U.S. Should Price Carbon, Directly," *Carbon Market North America*, Point Carbon, June 6, 2007.

DEAN M. MURPHY

“Transmission Management in the Deregulated Electric Industry: A Case Study on Reactive Power,” with Frank Graves and Judy Chang, *The Electricity Journal*, October 2003.

“Price-Responsive Electric Demand: A National Priority,” with Peter Fox-Penner, presented at the EPRI International Energy Pricing Conference, Washington, DC, July 26, 2000.

“Opportunities for Electricity Storage in Deregulating Markets,” with Frank Graves and Thomas Jenkin, *The Electricity Journal*, October 1999.

“Competitive Markets for Reserve Services,” presented at the 1999 National Hydropower Association Annual Conference, Washington, DC, March 1999.

“The FERC, Stranded Cost Recovery, and Municipalization,” with Peter Fox-Penner, Gregory Basheda, Darrell Chodorow, Jason Hicks, Eric Hirst, James Mitchell, and Joseph Wharton. *Energy Law Journal*, Vol. 19 (1998): 351-386.

“Ancillary Services in the Restructured Electric Industry,” presented at the EUC Conference on Reliability and Competition, Denver, CO, November 1998.

“Mechanisms for Evaluating the Role of Hydroelectric Generation in Ancillary Service Markets,” (with others), for the Electric Power Research Institute, TR-111707, November 1998.

“The Future of Hydro Resources under Deregulation,” presented at HydroVision ‘98, Reno, NV, July 1998.

“Electricity Price Volatility and Implications,” presented at the Electric Power Research Institute Conference on Technology Directions, Business Opportunities and Success Strategies, San Francisco, CA, December 1997.

“Ancillary Service Benefits of Hydroelectric Power,” presented at the 1997 National Hydropower Association Annual Conference, Washington, DC, March 1997.

“Utility Capital Budgeting Notebook,” (with others), for the Electric Power Research Institute, TR-104369, Palo Alto, California, July 1994.

TESTIMONY

Oral testimony before the United States Court of Federal Claims, on behalf of Wolf Creek Operating Company, (Case No. 04-99C), regarding the removal of spent nuclear fuel, March 2010.

Before the Connecticut Department of Public Utility Control, provided oral testimony to support the 2010 “Integrated Resource Plan for Connecticut”, June, 2010.

Expert report before the United States Court of Federal Claims, on behalf of Wolf Creek Operating Company, (Case No. 04-99C), regarding the removal of spent nuclear fuel, September 15, 2009.

DEAN M. MURPHY

Oral testimony before the Connecticut Department of Public Utility Control, in support of the “Integrated Resource Plan for Connecticut” and “Supplemental Reports,” June 30, 2009.

Oral testimony before the Connecticut Department of Public Utility Control, in support of the “Integrated Resource Plan for Connecticut” and “Supplemental Reports,” September 22-25, 2008.

Affidavit to the Supreme Court of New York on behalf of Trilogy Portfolio Company LLC, Harbert Distressed Investment Master Fund LTD and Freedom Power Corporation (Index No. 601380/2005), regarding the economic value of the replacement options for a terminated power contract, April 2006.

Expert report before the United States Bankruptcy Court, Southern District of New York, on behalf of Contrarian Funds, LLC (Case No. 01-16034), regarding economic damages due to the termination of a natural gas supply contract, August 19, 2005

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Education

University of Wisconsin Law School, J.D., 1984
University of Wisconsin, B.S., Political Science, 1981



Practice Areas

Appellate Practice
Energy Law
Environmental & Land Use
Health Care
Native American Law
Insurance & Financial Services
Legislative & Regulatory
Telecommunications
Wind Energy Development
Political Law

Experience

Eric F. Swanson joined Winthrop & Weinstine, P.A., in 1999 after a distinguished career at the Minnesota Office of the Attorney General, where his work included directing the Attorney General's litigation, regulatory, appellate and legislative efforts with respect to energy, telecommunications, consumer enforcement and charities matters.

Since joining Winthrop & Weinstine, Eric has focused his practice on representing clients before state and federal regulatory bodies, in the courts and at the legislature in the areas of energy, telecommunications and environmental law. His energy and environmental work has involved representing a wide variety of clients, including investor-owned utilities, independent power producers, wind energy developers and other renewable energy producers and large industrial customers. His energy law work has earned him recognition in *The Best Lawyers in America*® for the past three years. Eric's telecommunications work has included representation of incumbent telephone companies, competitive local exchange carriers and video services providers. In addition to representing his clients in contested proceedings, Eric works extensively with clients to gain all necessary regulatory approvals and to ensure ongoing regulatory compliance.

Eric's specific areas of experience and expertise include:

- All aspects of energy facility permitting and siting, including wind energy, electric, natural gas and petroleum facilities
- Extensive advocacy, including contested case litigation and general rate proceedings, before state agencies such as the Office of Administrative Hearings, the Minnesota Public Utilities Commission, Department of Commerce and before appellate courts
- Representation of energy and telecommunications clients at the Minnesota State Legislature and in agency rulemaking proceedings

Bar Admissions

Minnesota

Minnesota Supreme Court

U.S. District Court for the District of Minnesota

Ho-Chunk Nation Tribal Court

Community Involvement

- American Bar Association—Public Utility, Communications and Transportation Law Section
- Minnesota State Bar Association, involved in the following Sections:
 - Public Utilities, Past Chair
 - Communications
 - Administrative Law, Past Chair
 - Public Law
- Ramsey County Bar Association
- Hennepin County Bar Association

Honors & Awards

- *The Best Lawyers in America*®, 2007-2014
 - Named *Best Lawyers'* 2011 Minneapolis Energy Lawyer of the Year
- *Minnesota Super Lawyers*®, 2004, 2007, 2011-2013
- "Local Litigation Star," *Benchmark Litigation*, 2013–2014
- "Benchmark Appellate," *Benchmark Litigation*, 2012-2014
- Ranked as "AV Preeminent" in LexisNexis Martindale-Hubbell's peer review ratings

Articles

Qtd. Alexander, Steve. "Minnesota suspends tiered-rate plan for natural gas." [Minneapolis] *Star Tribune*. 29 Sept. 2011.



EMPLOYEE NAME: Rene Roy, Ph. D.

PROFESSIONAL EDUCATION:

Ph. D. in Water Sciences (NSERC Fellowship), Scientific Research National Institute, 1993
M. Sc. in Geomorphology (NSERC Fellowship), Université de Montréal, 1985
B. Sc. in Physical Geography, Université de Montréal, 1982

PROFESSIONAL AFFILIATIONS:

Reviewer for the International Panel on Climate Change (IPCC)
Canadian Water resources Association (CWRA) – Board Member of the Quebec Chapter
NordForsk (Nordic Research Cooperation) – Expert Advisor

EMPLOYMENT HISTORY & RESPONSIBILITIES:

2013 – Present	Director, Scientific Programme, Ouranos Consortium and Climate Change Programme Coordinator, Hydro-Québec Research Institute
2012 - 2013	Executive Director, Ouranos Consortium
2002 - 2102	Project Manager, Climate Change, Hydro-Québec and Coordinator of the Water-Energy Resources and Climate Change programme at Ouranos
2001 - 2002	Project Manager, Research in Hydrology and Technology transfer
1997 - 2001	Team Leader Inflow Forecasts, Hydro-Québec Production
1994 - 1997	Special Advisor and Programme Manager of the Institutional Relations Group of Hydro-Québec
1994 - 1996	Senior Project Manager for the E7 Network for the Global Environment
1987 - 1994	Hydrometeorologist for Hydro-Québec Production

SUBJECT MATTER OF TESTIMONY BY WITNESS

Hydro climatic analysis approach and assumptions used to evaluate climate change impact on water supply availability and climate change scenario and uncertainty associated with generation development in its Need For and Alternatives To (NFAT) filing.