

FORM A

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Proceeding:

Ontario Energy Board

Enbridge Gas Distribution Inc.

EB-2015-0049

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is Cory Welch. I live at Crested Butte, in the State of Colorado, USA.
2. I have been engaged by or on behalf of Enbridge Gas Distribution Inc. to provide evidence in relation to the above-noted proceeding before the Ontario Energy Board.
3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:
 - (a) to provide opinion evidence that is fair, objective and non-partisan;
 - (b) to provide opinion evidence that is related only to matters that are within my area of expertise; and
 - (c) to provide such additional assistance as the Board may reasonably require, to determine a matter in issue.
4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date August 26 2015

Cory Welch
Signature

Cory J. Welch

Cory J. Welch
Director

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Professional History

- Navigant Consulting, Inc. -- Director
- Navigant Consulting, Inc. – Associate Director
- Summit Blue Consulting – Managing Consultant
- National Renewable Energy Laboratory – Senior Energy Analyst
- UTC Fuel Cells (now UTC Power) – Program Manager
- US Navy – Fluid Systems Engineer (Mechanical/Nuclear)

Education

- MS, Mechanical Engineering, Massachusetts Institute of Technology
- MBA, Massachusetts Institute of Technology's Sloan School of Management
- BS, Mechanical Engineering, Cornell University (with distinction)

Professional Associations

- Association of Energy Service Professionals (2007-12)
- Systems Dynamics Society (2004-12)
- Tau Beta Pi National Engineering Honor Society (1999-94)

Honors and Fellowships

- US Dept. Of Energy R&D Award for Outstanding Contributions to Hydrogen Analysis and Scenarios (2007)
- NREL Director's Award (2005)
- Leaders for Manufacturing Fellow, MIT (1999-2001)

Cory Welch is the Director of Energy Modeling with Navigant Consulting. He has 20 years of complex system modeling, project management, and engineering experience in fields including fuel cell development, energy efficiency, renewable energy, energy R&D portfolio and policy analysis, and power plant engineering. Mr. Welch brings expertise in efficiency portfolio evaluation, efficiency potential estimation, system dynamics, stochastic analysis, discrete choice analysis, optimization, and statistics, which he has applied to various analysis projects for utility clients, regulatory agencies, and the U.S. Department of Energy. He is also a seasoned project manager who has directly managed projects with budgets up to \$30M, including leading potential studies for eight electric and gas utilities. Mr. Welch holds an SM in Mechanical Engineering from Massachusetts Institute of Technology (MIT), an MBA from MIT's Sloan School of Management, and a BS in Mechanical Engineering from Cornell University. Additionally, he completed a rigorous 6-month graduate-level curriculum in mechanical and nuclear engineering while serving as an officer in the U.S. Navy.

Professional Experience

Navigant Consulting, Inc., Boulder, CO office – Director

» Developed Navigant Consulting's Demand Side Management Simulator (DSMSim™) to simulate the adoption of energy-efficient technologies in efficiency potential studies and program design. DSMSim™ is a bottom-up technology diffusion model grounded in the principles of System Dynamics (stock/flow modeling). Led projects estimating energy-efficiency potential analyses for ten electric/gas utilities. Acted as senior modeling advisor on potential studies for eleven additional utilities, including the four large IOUs in California.

- » Led the re-development of a nonlinear stochastic optimization model for the Northwest Power and Conservation Council. This model calculates optimal electric generation and demand side management resource strategies with explicit consideration of uncertainty and risk. It is currently being used in the Council's creation of its seventh power plan for the NW region.
- » Developed a highly transparent, web-capable model for Pacific Gas & Electric to estimate the impact on customers and utility economics of changes to Net Energy Metering policies in California. The model analyzed probability distributions of historic payback times for solar PV installations under various NEM grandfathering and rate scenarios.
- » Developed Navigant's Renewable Energy Market Simulator (RE-Sim™) model. Applied this model in strategic advisory engagements with four major electric utilities looking to better understand the dynamics and drivers of adoption of distributed solar PV. This model includes calculation of the levelized cost of electricity (LCOE) of distributed solar to better reflect market adoption dynamics associated with third-party ownership.
- » Managed a \$6M project to evaluate the energy efficiency savings achieved from five Maryland electric utilities.
- » Developed the optimization portion of an energy-efficiency portfolio optimization tool for DTE Energy. The model used linear programming techniques to maximize energy savings for target cost levels under various constraints including low-income participation, low-income spending, maximum and minimum measure-level participation, sector spending targets, etc.
- » Managed a \$4M portfolio impact evaluation for five Maryland utilities to estimate kW and kWh savings from their energy efficiency programs and to permit bidding peak demand reductions achieved through efficiency programs into the PJM forward capacity market.
- » Acted as the deputy project manager for the evaluation of 56 Local Government Partnership energy efficiency programs for the California Public Utility Commission (CPUC), a multi-year, multi-million dollar portfolio impact evaluation.
- » Developed a stochastic model estimating the probabilistic benefits and costs of Smart-Grid technologies for Bonneville Power Administration. This model is currently being used to shape Smart-Grid policy and strategy in the Northwest U.S.
- » Developed a nonlinear optimization model for NV Energy to optimize dispatch of Demand Response (DR) resources and to forecast DR savings. Provided model to the client with a user-friendly graphical user interface.
- » Estimated the remaining useful life of residential appliances for a California utility using established Weibull regression methods as well as a novel method involving a stock/flow model using System Dynamics.

- » Assessed the market potential for Demand Response in the Con Edison service territory (New York City). Developed Navigant Consulting's Demand Response Simulator (DRSim™) model to assist in evaluating DR market potential, including assessment of market risk using Monte Carlo techniques.
- » Guided development of a smart-grid benefit/cost model for Tendril networks. Provided model to the client with a user-friendly graphical user interface and trained Tendril staff in its use.
- » Developed a model evaluating the pricing of power purchase agreements for a large renewable installation in Southern California.
- » Developed a model simulating the dispatch of a gas turbine for purposes of assessing the market value of improved startup times and reduced startup emissions.
- » Developed a model simulating the supply/demand balance in the LA Basin load pocket for the California Energy Commission. This model considered environmental and transmission constraints and facilitated scenario analysis associated with shutting down once-through cooling plants due to environmental concerns.

National Renewable Energy Laboratory, Golden, CO - Senior Project Leader, Senior Energy Analyst, Hydrogen Technologies and Systems Center, Strategic Energy Analysis and Applications Center

- » Led a team of six national laboratories in developing a stochastic, dynamic energy-economy model to advise the U.S. Department of Energy (DOE) regarding its R&D portfolio. Developed the modeling framework and template for simulating the adoption and diffusion of various energy efficiency and renewable energy technologies.
- » Co-developed a spatial, dynamic model to advise the U.S. DOE regarding hydrogen transition strategies and policy. Focused the modeling effort on the spatial, temporal diffusion of hydrogen refueling stations and vehicles in southern California. Received an award from the U.S. DOE for "Outstanding Contributions to Hydrogen Scenario Analysis" for this work.
- » Led a team of five consultants (PA Consulting, Knowledge Networks) in a Discrete Choice Analysis project to quantify consumer sensitivity to limited alternative fuel station coverage.
- » Developed a novel statistical method projecting fuel cell engine life for General Motors, Ford, Hyundai, and Chrysler LLC (formerly DaimlerChrysler) fuel cell engines.

UTC Power (formerly UTC Fuel Cells), South Windsor, CT - Program Manager, Project Engineer

- » Led a two-year, \$30M program to develop, manufacture, and deliver freeze-capable fuel cell stacks for Nissan Motor Company.
- » Led a team of 40 engineers in the development of a freeze-capable fuel cell system for Hyundai Motor Company.

U.S. Navy, Lieutenant (Naval Reactors), Arlington, VA - Fluid Systems Engineer (Mechanical/Nuclear)

- » Evaluated and provided final approval of technical recommendations regarding the operation and maintenance of power plant fluid systems in aircraft carriers.

Publications

- » Welch, C. and Richerson-Smith, D. "Incentive Scenarios in Potential Studies: A Smarter Approach" Peer reviewed paper presented at American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. August, 2012. Pacific Grove, CA.
- » Welch, C. and Rogers, B. "Estimating the Remaining Useful Life of Residential Appliances." Peer reviewed paper presented at American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. August, 2010. Pacific Grove, CA.

- » Welch, C. and Stern, F. "Simulation the Adoption of Energy Efficient Technologies." Poster presented at American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. August, 2010. Pacific Grove, CA.
- » Welch, C. and Stern, F. "SolarSIM: A Dynamic Technology Diffusion Model Simulating Adoption of Distributed Solar PV, Solar Hot Water, and Daylighting." Presented at Electric Utility and Environment (EUEC) Conference, February 3, 2009, Phoenix, AZ.
- » Schare, S. and Welch, C. "Estimating Demand Response Potential for Resource Planning." Paper presented at the AESP 19th National Energy Services Conference & Expo, January 2009, San Diego, California.
- » Welch, C. "Estimating Regional and Utility Demand Response Potential - A Case Study at Con Edison." Presented at the Peak Load Management Alliance Conference, Austin, TX, October 28, 2008.
- » Welch, C. "Quantifying Consumer Sensitivity to Hydrogen Refueling Station Coverage." Presented at the U.S. Department of Energy's Annual Hydrogen Program Merit Review, Washington, D.C., 2007. <http://www.nrel.gov/docs/fy07osti/41552.pdf>
- » Welch, C. "Lessons Learned from Alternative Transportation Fuels: Modeling Transition Dynamics." NREL/TP-540-39446. Golden, CO: National Renewable Energy Laboratory., February 2006. <http://www.nrel.gov/docs/fy06osti/39446.pdf>
- » Welch, C. "Discrete Choice Analysis: Hydrogen Fuel Cell Vehicle Demand Potential." Presented at the DOE 2010-2025 Scenario Analysis Meeting, Washington, D.C., January 31, 2007. http://www1.eere.energy.gov/hydrogenandfuelcells/analysis/pdfs/scenario_analysis_welch1_07.pdf
- » Struben, J., Welch, C. and Sterman, J. "Modeling the Co-Evolutionary Dynamics of Hydrogen Vehicles and Refueling Stations." NHA Annual Hydrogen Conference, Long Beach, CA, 2006.
- » Welch, C., Wipke, K., Gronich, S., and Garbak, J. "Hydrogen Fleet and Infrastructure Demonstration and Validation Project: Data Analysis Overview." Paper (<http://www.nrel.gov/hydrogen/pdfs/37845.pdf>) and presentation (<http://www.nrel.gov/hydrogen/pdfs/37811.pdf>) prepared for the National Hydrogen Association Conference, Washington, DC., March 2005.
- » Wipke, K., Welch, C., Thomas, H., Sprik, S., Gronich, S., and Garbak, J. "Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project—Initial Fuel Cell Efficiency and Durability Results." Paper (<http://www.nrel.gov/hydrogen/pdfs/40921.pdf>) prepared for the World Electric Vehicle Association Journal, Vol. 1, 2007., December 2006.