Elson Advocacy

January 16, 2023

Ms. Nancy Marconi
Registrar
Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, Ontario
M4P 1E4

Dear Ms. Marconi:

Re: Enbridge Gas Inc. 2024 to 2028 Rates Application
EB-2022-0200

I am writing pursuant to Procedural Order #1 to describe and provide a cost estimate for the evidence that the Green Energy Coalition ("GEC") and Environmental Defence ("ED") propose to jointly commission from Chris Neme of Energy Futures Group.

Overview

The proposed evidence would examine whether Enbridge has appropriately accounted for the ongoing energy transition driven by the decarbonization of our energy systems in relation to Enbridge's proposed capital spending and the other approvals it seeks. There would be a particular focus on the risk that infrastructure built pursuant to its application may ultimately be underutilized or stranded due to market forces and/or policy relating to decarbonization. The evidence would then propose steps that can be taken during the rate period to mitigate those risks to consumers, such as reduced capital spending, adjusted depreciation periods, a segregated fund for site restoration costs, and other steps described below.

Experience of Chris Neme

Mr. Neme is a leading expert on the options for and implications of decarbonization for gas customers and best practices to address those customer risks and opportunities. Mr. Neme and his firm have prepared reports, comments to regulators and expert testimony specifically on this topic in jurisdictions across North America.[1] Mr. Neme and his firm have also critically reviewed numerous gas utility decarbonization studies across a wide range of jurisdictions. A summary of Mr. Neme's work on this topic is attached.

Over the past three decades, Mr. Neme has worked for energy regulators, utilities, government agencies and other organizations in more than 30 states, 7 Canadian provinces and several European countries. He has defended expert witness testimony in approximately 70 cases before

[1] Including in Massachusetts, Vermont, Delaware, Michigan, Illinois, Washington, Oregon, and British Colombia.

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regulatory commissions in 13 different jurisdictions. He has also testified before several state legislatures.

Mr. Neme also has decades of experience specific to Ontario and its gas system. Mr. Neme served on the Enbridge and Union natural gas demand side management audit/evaluations committees since their inception approximately two decades ago and currently sits on the gas DSM Evaluation Committee and gas Integrated Resource Planning (IRP) technical working group. He has also previously served as an external reviewer of efficiency potential and carbon pricing studies. He has earned broad respect and trust from the Ontario regulatory community and has been elected to these committee roles by other intervenors and/or appointed by the OEB. Mr. Neme has provided expert testimony in approximately 25 OEB cases. Mr. Neme's CV is attached.

Proposed Evidence – Details

As noted above, the proposed evidence would examine whether Enbridge has appropriately accounted for the ongoing energy transition driven by the decarbonization of our energy systems in relation to Enbridge's proposed capital spending and other approvals it seeks, particularly in relation to the costs and risks to gas customers associated with the potential for the assets built pursuant to this application becoming stranded. The evidence would be particularly relevant to issue 3 (energy transition impacts on load, depreciation rates, capital expenditures, etc.), issue 5 (rate base), issue 12 (depreciation), and issue 13 (segregated Site Restoration Cost fund). The evidence would assess the decarbonization costs, risks, and opportunities for gas customers relating to this specific application and discuss steps to mitigate those risks.

Enbridge does not account for decarbonization risk in its infrastructure planning cost-benefit analysis. It implicitly assumes in its cost-benefit analysis that there is a 0% chance that its assets will be underutilized or stranded due to decarbonization.[2] It appears to support this assumption in this case with more than 400 pages of evidence on the topic of energy transition.[3] This evidence also underpins the approvals it seeks on topics such as depreciation, capital budget, load forecast, renewable natural gas, customer addition forecasts, and, ultimately, its proposed rates. It is critical that the OEB have a balanced record on the implications of decarbonization as they specifically relate to the approvals sought by Enbridge in this case.

Assess Decarbonization Costs and Risks for Gas Customers

The evidence would discuss and assess the possibility that gas facilities built pursuant to Enbridge's application could be underutilized or stranded due to market forces and/or policy relating to decarbonization. This would assist in assessing the risks to gas customers, the appropriateness of the proposed spending, potential actions to mitigate costs and risks for gas customers, and the importance of implementing those actions. These risks and costs would be assessed in light of the relative cost-effectiveness and feasibility of various decarbonization pathways. This would include, but not be limited to, an assessment of Enbridge's decarbonization pathways study.

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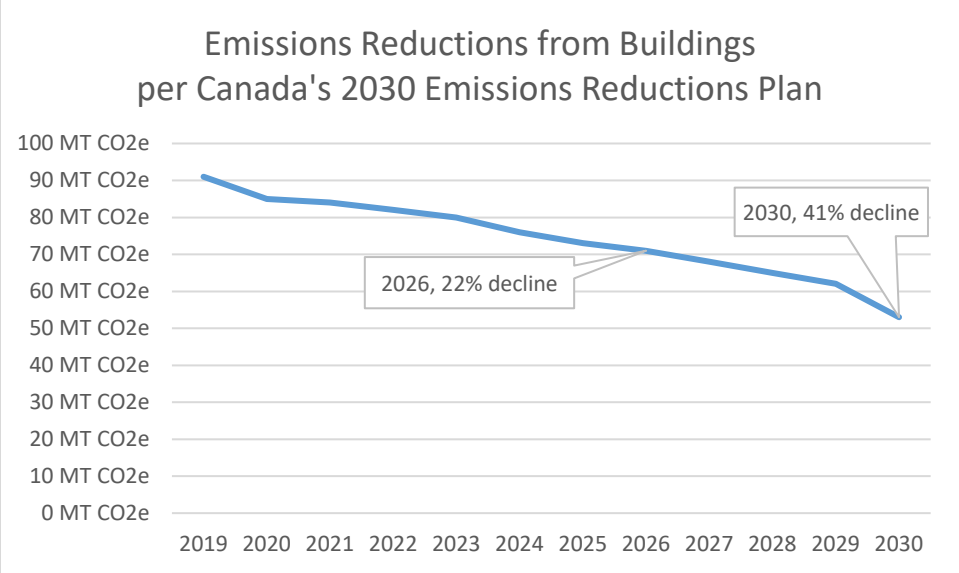
[2] See e.g. EB-2020-0293, Transcript, March 4, 2022, p. 105; Environmental Defence Submission, p. 5 (link).
[3] See e.g. Exhibit 1, Tab 10.

This topic is central to the OEB's customer-protection mandate. Although we do not wish to pre-empt the evidence of Mr. Neme, we note that there are strong indications that both market forces and government policy will have a significant impact on the demand for the assets that Enbridge would build pursuant to its application. For instance, electric heat pumps are now cheaper than gas heating due to recent improvements in efficiency, improved cold-climate performance, and increasing carbon and gas costs.[4]

In addition, if the federal government's legislated carbon reduction targets and 2030 Emissions Reduction Plan are implemented, or come even close to being met, this will have a major impact on the long-lived assets that Enbridge would build pursuant to this application. The main elements of the legislation and plan that could impact gas demand are as follows:

- **Carbon reductions from buildings:** Canada's 2030 Emissions Reduction Plan includes targets for carbon emissions from buildings to decline by 22% by 2026 and by 41% by 2030.[5] The federal targets for emissions reductions from buildings are shown in the figure below.



- **Net-zero power generation by 2035:** Canada has committed to net-zero emissions from electricity generation by 2035, and re-affirmed its commitment in its 2030 Emissions Reduction Plan.[6] Gas power generation is a critical component of gas demand in Ontario.

[4] EB-2021-0002, Exhibit KP1.7, p. 5 (link).
[5] Exhibit I.ED.3(a), (f), & (g); see also: *2030 Emissions Reduction Plan – Canada's Next Steps for Clean Air and a Strong Economy* (link); for the full plan see https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf. This is based on a reduction from 91 CO_2e in 2019 to 71 CO_2e in 2026 and 53 CO_2e in 2030.
[6] *Ibid.*

- **Economy-wide net zero by 2050:** Canada has committed to net-zero across all sectors by 2050.[7]

These and other factors suggest that it is important to assess the risk that the relevant assets will be underutilized or stranded before the end of their useful and economic lifetime before approving the many billions of dollars that Enbridge seeks.

Actions to Address Decarbonization Costs, Risks, and Opportunities

The proposed evidence would discuss potential actions to address decarbonization costs, risks, and opportunities for gas customers in relation to the application and rate period. Inappropriate spending during the rate period could contribute to a spiral of higher rates as customers switch from gas to more affordable options. Customers who face difficulty switching (e.g. low income households) could be saddled with undue costs. Accordingly, it is exceedingly important to protect such ratepayers by timely changes now to avoid undue risks and rate burdens. We do not wish to pre-empt Mr. Neme's analysis, but based on initial discussions and Mr. Neme's experience in other jurisdictions, we anticipate that his evidence could address issues such as the following:

1. **Decreased capital spending:** There is a risk that customers could end up paying increasing rates if demand and customer numbers decrease significantly. Reductions in capital spending could mitigate this risk. This could be achieved in a variety of ways, such as deferring investments where appropriate and integrated resource planning.

2. **Deferring replacements where appropriate:** Replacing aging pipelines creates a risk of stranded assets because the new infrastructure will be long-lived (50+ years). That risk can be mitigated by choosing to repair aging pipelines where it is safe and cost-effective to do so. Properly accounting for the risk of underutilized or stranded assets can tip the scales between a repair and a replace option.

3. **Better integrated resource planning implementation:** There is a risk that a new pipeline could be underutilized or stranded over its long lifetime. This can be mitigated with better integrated resource planning. Note, however, that any comments on integrated resource planning would be high-level and the evidence will not duplicate work on topics already addressed in the recent integrated resource planning case.

4. **A segregated pipeline abandonment fund:** Enbridge currently collects funds to abandon pipelines at end of life, holds those funds, and records them as a liability as part of Site Restoration Costs ("SRC"). This creates a risk for customers that could be mitigated by requiring a segregated fund for these dollars, as is done in other jurisdictions.

5. **Cost-effective strategic system pruning:** Customer costs and risks could be reduced through strategic decisions to retire portions of the system where that is cost-effective. For instance, it may be cost-effective when continued service to a neighbourhood would

[7] *Ibid*.

require an expensive pipeline replacement and the neighbourhood can be cost-effectively electrified instead.

6. **Approach to new developments:** There is a risk that long-lived capital investments driven by new residential developments could become stranded or underutilized. New developments also present an opportunity to save energy costs by avoiding retrofit costs. In the very least, there should be no bias in favour of gas infrastructure over electricity infrastructure for new residential developments (e.g. requiring the developer to pay for one kind of infrastructure up-front but not the other). Other risk mitigation and risk allocation measures could be considered.

7. **Adjusting the depreciation period:** The gas pipelines being put in the ground today will not be fully depreciated until the 2070s and beyond.[8] There is a risk that they could be stranded or underutilized long before that time. This could result in spiraling rates and intergenerational inequalities. Adjustments to shorten the depreciation periods could help to mitigate this risk.

8. **Clarify risk allocation:** Risks associated with overinvestment in gas pipelines could be mitigated by allocating them to the party that would earn a profit from those investments.

Each of the above relate back to the application and Enbridge's proposed spending. The above list is not exhaustive. It is simply intended to provide the OEB with more details on the likely content of Mr. Neme's report if it is approved by the OEB. Although Mr. Neme's evidence will consider whether Enbridge has appropriately accounted for decarbonization-related risks to consumers in its capital spending and capital plans, it will not be addressing the appropriateness of each individual capital project or line item contained in the evidence as this would go beyond what is possible in the allotted time.

Interplay with Other Experts

We have conferred with Board Staff and have determined that there is unlikely to be any significant overlap with the expert evidence they propose to put forward.

Although a proposed expert for the Industrial Gas Users Association would also address energy transition issues, Dr. Hopkins and Mr. Neme have agreed to work together to avoid overlap. In addition, the scope and content of each proposed report is different. For instance, as we understand it, Dr. Hopkins would not attempt to assess the likelihood of stranded asset risk to gas customers from decarbonization in relation to the proposed spending. That would be a major component of Mr. Neme's evidence. In addition, Mr. Neme would address a broader array of risk-mitigation measures that Dr. Hopkins will not be studying, such as adjustments to the depreciation periods. Further, we understand that Dr. Hopkins would be addressing Enbridge's equity thickness proposal which is not a matter Mr. Neme's report would assess.

Mr. Neme and Dr. Hopkins are put forward by significantly different intervenor interests. While both experts would provide independent, objective and non-partisan evidence, the scope of their

[8] See e.g. EB-2020-0293, Exhibit I.ED.5.

reports would be determined in part by the scope of the questions asked to them by the intervenor group retaining their services. There is value to having both of these different approaches to the issues.

There would also be no overlap with IGUA's proposed evidence from Mr. Madsen. Although he and Mr. Neme would both touch on Site Restoration Costs, their analysis would be distinct. Mr. Madsen is a depreciation expert and would approach the issue primarily from a financial perspective. Mr. Neme is an expert in the implications of decarbonization on gas customers/systems, and would approach the issue primarily from that perspective. Mr. Neme's evidence will primarily assess why it is important to have a segregated fund for Site Restoration Costs by shedding light on the likelihood that decarbonization could result in serious financial troubles for pipeline companies and potential stranded assets. We have confirmed with IGUA that Mr. Madsen would not undertake that kind of analysis.

We have also spoken with Mr. Jarvis regarding the evidence that BOMA plans to submit as prepared by Enerlife Consulting. We understand that this will not duplicate Mr. Neme's evidence. BOMA proposes to submit data-driven evidence specifically relating to the commercial sector. This evidence will address whether the load and load profile figures underpinning Enbridge's, such as its capital spending plans, accurately reflects the best information about the commercial sector. BOMA's evidence will largely be based on the BPS and EWRB datasets. Mr. Neme will not be conducting that kind of analysis. Mr. Neme's and Mr. Jarvis' evidence would be complementary and not duplicative. In addition, Mr. Jarvis has agreed to be in touch with Mr. Neme to ensure that that remains the case.

Finally, the costs, risks, and opportunities for gas customers associated with decarbonization may be the most important and complex gas regulatory issue facing the OEB. The potential risks and opportunities are great. There are a number of possible future scenarios, but none involve the status quo. Those scenarios range from the end of gaseous pipelines through full electrification, to a major reduction in the role of gas pipelines (e.g. for green hydrogen for hard-to-decarbonize industry only), to Enbridge's scenario involving massive investments in economy-wide gas-based solutions, including carbon capture and fossil-fuel-derived hydrogen. There would be a great deal of value in multiple perspectives on this issue, especially seeing as Mr. Neme has agreed to work together with others to avoid overlap, the scope of each is very different, and they are sponsored by intervenors with very different perspectives.

Budget

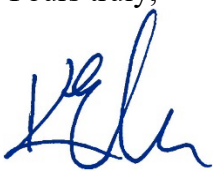
Mr. Neme estimates that his expert report will cost between $55,000 to $75,000 to prepare. The range in part represents the difference in the amount of work that will be required depending on the content and completeness of Enbridge's interrogatory responses. The cost for interrogatory responses on Mr. Neme's evidence, a technical conference, and hearing testimony will be in addition to the cost of the report. It is impossible to predict such additional costs with certainty because they depend primarily on the actions of other parties. In some cases the questions asked of Mr. Neme have been very minimal, while in other cases they have been very extensive. In ballpark terms, we would expect that the time for such additional steps beyond the preparation of evidence may add an additional 40% to the costs, subject to the caveats noted above.

Mr. Poch and I estimate the incremental counsel costs required in relation to the preparation of Mr. Neme's evidence will be between $6,000 and $12,000.

Conclusion

We believe the OEB and intervenors would greatly benefit from the proposed evidence. Enbridge is seeking approval of a 2024 revenue requirement of $3.051 billion (excluding gas costs).[9] Held constant, that would amount to over $15 billion over the period covered by the application. Mr. Neme's evidence on ways to protect customers and mitigate the risks that these investments be underutilized or stranded will be extremely good value-for-money in light of the overall sums at stake and risks and opportunities facing gas customers.

Yours truly,



Kent Elson

cc: Parties to the above proceeding

[9] Exhibit 1, Tab 1, Schedule 1, p. 3.

EFG Experience with Energy Transition Issues

Decarbonization Pathways Studies

- EFG has led or played major roles in the conduct of several decarbonization studies
    - **Massachusetts 2050 Decarbonization Roadmap**. EFG was part of the Cadmus team that analyzed economy-wide decarbonization pathways for the state's Executive Office of Energy and Environmental Affairs.
    - **Vermont Pathways Analysis Report**. EFG was part of Cadmus team that analyzed economy-wide decarbonization pathways for the Vermont Agency of Natural Resources and the Vermont Climate Council. EFG led the buildings/thermal sector work.
    - **Vermont Thermal Sector Decarbonization Analysis**. EFG is currently under contract to the Vermont Agency of Natural Resources to assess the emission reduction, cost, and other trade-offs between different policy approaches to decarbonizing buildings and industry in the state.
    - **Delaware Comprehensive Energy Plan**. EFG is currently leading analysis of decarbonization pathways for the Delaware Department of Natural Resources and Environmental Control.
- EFG has helped clients critically review decarbonization studies performed by other parties, particularly those sponsored by gas utilities.
    - **Massachusetts Gas Utilities Study**: EFG helped Sierra Club participate in a year-long utility-stakeholder collaborative process for assessing and modeling options for decarbonization. This included drafting numerous comments on the utilities' consultants' proposed analysis scenarios, draft modeling assumptions, and draft reports. EFG has also supported drafting of comments to regulators critiquing the gas utilities' study and policy/planning proposals in subsequent regulatory proceeding.
    - **Assessment of Common Biases in Gas Utility Decarbonization Studies**. EFG helped the Natural Resources Defense Council review and critique numerous gas industry-funded decarbonization studies across a range of different U.S. states.

Renewable Gas Potential

- EFG recently was part of a consultant team that critiqued a Michigan RNG potential study on behalf of the Natural Resources Defense Council.

Building Decarbonization Policy and Economics

- **Vermont Clean Heat Standard**. EFG Principal Chris Neme was one of two authors of the Vermont Energy Action Network's 2021 white paper on the concept of a Clean Heat Standard, which was born out of a nearly year-long multi-stakeholder working group that Chris also co-led (and included the CEO of Vermont Gas). The concept was subsequently turned in to legislation, passed out of both the Vermont House and Vermont Senate, and came within on vote of over-riding the Governor's veto. The legislation was recently reintroduced in the current legislative session, with several modifications on which Mr. Neme provided input, as Vermont Senate Bill 5.
- **Other Vermont climate policy whitepapers**. EFG co-led the development of a "Weatherization at Scale" proposal which followed a year of work by a multi-stakeholder working group which EFG Principal Richard Faesy co-led with the CEO of Vermont Gas. We also drafted a whitepaper

for the Vermont Energy Action Network on the concept of a heating and water heating equipment "fee-bate" (sliding scale sales tax based on carbon emissions intensity).

- **Michigan Healthy Climate Plan**. EFG Principal Chris Neme represented the Natural Resources Defense Council (NRDC) in a couple of working groups organized by the state's Department of Environment, Great Lakes and Energy to develop a state climate plan.
- **Illinois Climate Legislation**. EFG has supported NRDC in developing legislative policy proposals for advancing decarbonization in the state.
- **Customer Economics of Electrification in Chicago**. EFG published a report in November 2022 analyzing the economics and greenhouse gas emission impacts of residential electrification in the city of Chicago. The analysis was based on current and forecast future retail energy prices for gas and electricity; capital costs of heat pumps, heat pump water heaters and other electric and gas appliances; current average gas consumption by end use; performance of high efficiency gas and electric equipment; and various other factors.

Regulatory Testimony

- **White Paper on shorter-term Depreciation of new gas infrastructure investments (Rhode Island)**. EFG drafted a white paper which the Conservation Law Foundation filed with the Rhode Island Public Utilities Commission on the merits of shorter-term (e.g. 20 years) amortization of new gas utility investments to reduce risk of stranded assets in the context of evolving climate policies.
- **Nicor Gas RNG Pilots (Illinois)**. EFG filed testimony on behalf of the Environmental Defense Fund in opposition to proposed RNG pilot projects.
- **Northwest gas pipeline (FERC)**. EFG drafted a report filed with the U.S. Federal Energy Regulatory Commission, on behalf of the Washington state Attorney General, on the lack of demonstrated need for and adverse environmental consequences of a proposed expansion of an interstate gas pipeline by Gas Transition Northwest (GTN).
- **Northwest Natural Gas hydrogen blending pilot (Oregon).** EFG was recently hired to draft testimony for Sierra Club and other parties to critique a proposed hydrogen blending pilot. Testimony to be filed in December 2022.
- **Illinois and Michigan electrification programs**. EFG has supported – in testimony and then from a technical and programmatic perspective – the development of residential electrification programs. The initial programs were launched through energy efficiency program portfolios. More recently, EFG has filed testimony in electric utility rate cases in Michigan to propose electrification pilots funded through electric rates. The testimony analyzed the customer economics and electric rate impacts of such programs.
- **Fortis BC RNG purchases to offset emissions from new construction of gas heated homes**. EFG was hired by the BC Sustainable Energy Association to critique a recent Fortis proposal to meet provincial requirements for net zero emission new construction by contracting for the amount of RNG any new gas homes would consume and socializing the cost of such purchases across all gas customers. As part of its critique, EFG analyzed the relative customer economics of gas consumption under the proposal to the alternative of efficient all-electric new homes.

Chris Neme
Principal

ENERGY FUTURES GROUP

Professional Summary

Chris specializes in analysis of markets for energy efficiency, demand response, renewable energy and strategic electrification measures, as well as the design and evaluation of programs and policies to promote them. During his 25+ years in the industry, he has worked for energy regulators, utilities, government agencies and advocacy organizations in 30+ states, 7 Canadian provinces and several European countries. He has filed expert witness testimony in 60+ cases before regulatory commissions in 13 different jurisdictions; he has also testified before several state legislatures. Chris has authored numerous reports and papers on clean energy policies and programs, including the National Standard Practice Manual for Benefit Cost Analysis of Distributed Energy Resources (2020), the predecessor NSPM for energy efficiency (2017), and several reports on electric non-wires and gas non-pipe alternatives.

Experience

2010-present: Principal, Energy Futures Group, Hinesburg, VT

1999-2010: Director of Planning & Evaluation, Vermont Energy Investment Corp., Burlington, VT

1993-1999: Senior Analyst, Vermont Energy Investment Corp., Burlington, VT

1992-1993: Energy Consultant, Lawrence Berkeley National Laboratory, Gaborone, Botswana

1986-1991: Senior Policy Analyst, Center for Clean Air Policy, Washington, DC

Education

M.P.P., University of Michigan, 1986

B.A.., Political Science, University of Michigan, 1985

Selected Projects

- Natural Resources Defense Council (Illinois, Michigan and Ohio). Critically review efficiency, demand response, electrification, distribution system investment and integrated resource plans filed by IL, MI and OH utilities. Draft/defend regulatory testimony on critiques. Represent NRDC in regular stakeholder-utility engagement processes. Represent NRDC in collaborative development of non-wires solution pilots. Support development of Illinois clean energy legislation. (2010 to present)
- E4TheFuture. Co-authored National Standard Practice Manual Benefit Cost-Analysis of Distributed Energy Resources (2020) and NSPM for efficiency (2017). Present the NSPM to audiences across the U.S. and Canada; helping several to assess how to use it to refine current practices. (2016-present)
- Vermont Agency of Natural Resources. Supported EFG/Cadmus team in analysis of pathways for achieving the state's Global Warming Solutions Action emission reduction requirements, including marginal abatement cost curve development (2022). Supporting new assessment of emissions and cost tradeoffs between policy options for decarbonizing buildings and industry sectors (2023).

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- Connecticut Energy Efficiency Board. Part of team providing on-going review and input on utility efficiency program planning and related policy issues. Lead role in providing input on New England Avoided Energy Supply Cost study and cost-effectiveness screening policy issues. (2019-present)
- Ontario Energy Board. Appointed to serve on provincial gas DSM Evaluation Advisory Committee, providing input on multi-year evaluation plans, scopes of work for evaluation studies and independent evaluator assessments of utilities' annual gas savings claims. Also serve on gas IRP committee, providing input on non-pipe alternatives, including cost-effectiveness analyses and selection of pilot projects. Previously also appointed to advisory committees on gas and electric efficiency potential studies and advisory committee on carbon price forecast studies. (2015-present)
- Green Energy Coalition (Ontario). Represent coalition of environmental groups in regulatory proceedings, utility negotiations and stakeholder meetings on DSM policies, utility proposed DSM Plans, integrated resource planning and rules governing non-pipe alternatives. (1993 to present)
- Energy Action Network (Vermont). Co-authored a white paper on the concept of a "Clean Heat Standard" – a kind of renewable portfolio standard that would impose increasing obligations on Vermont Gas and wholesale suppliers of fuel oil and propane to reduce greenhouse gas emissions from burning of fossil fuels in homes and businesses, consistent with the state's Global Warming Solutions Act requirements (e.g., 40% reduction by 2030). Co-leading related voluntary working group of interested parties providing input on the design of the policy. Testified before Vermont House Energy and Technology Committee on Clean Heat Standard legislation. (2020-present)
- Sierra Club (Massachusetts). Supported Sierra Club's participation in an year-long process in which the Massachusetts' gas utilities engaged with stakeholders to discuss and consider the future of the gas industry in the context of decarbonization policy goals. Reviewed draft inputs to technical study of options for decarbonizing the gas industry presented to the group and assisted in drafting regulatory comments on final study results as well as gas utility policy proposals. (2021-2022).
- Environmental Law and Policy Center. Filed expert witness testimony supporting AEP Ohio's initial proposal to run a portfolio of efficiency programs and in opposition to a proposed rate case settlement agreement to eliminate such programs. (2021)
- Sierra Club (Maryland). Provided strategic support on testimony on cost-effectiveness and other rules governing expansion of gas infrastructure to connect additional customers. (2021)
- New Jersey Board of Public Utilities. Served on management team responsible for statewide delivery of New Jersey Clean Energy Programs. Led strategic planning; support regulatory filings, cost-effectiveness analysis & evaluation work. (2015 to 2020). Served on management team for start-up of residential and renewables programs for predecessor project. (2006-2010)
- Regulatory Assistance Project - U.S. Provided guidance on efficiency policy and programs. Lead author on strategic reports on program options for decarbonizing Vermont buildings, achieving 30% electricity savings in 10 years, using efficiency to defer T&D system investments, & bidding efficiency into capacity markets. (2010 to 2020)
- Energy Efficiency Alberta. Assisted EEA in providing input to Alberta Utilities Commission on the role efficiency resources can play in reducing electric system costs. (2019 to 2020)

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- Consumers Association of Canada (Manitoba) and Winnipeg Harvest. Critically reviewed and filed regulatory testimony on Efficiency Manitoba's first three-year plan (2020-2023), with particular emphasis on the extent to which the plan supported advanced heat pump technology as both an electric efficiency measure and a key to future building electrification. (2019-2020).
- Citizens Action Coalition of Indiana. Critically reviewed how energy efficiency resources were modeled in utility IRPs, as well as the design of energy efficiency program portfolios. (2018 to 2020)
- Efficiency Vermont. Provided technical support in review of avoided cost assumptions, as well as related policies on cost-effectiveness analyses of efficiency resources (2019).
- Earth Justice and Southern Alliance for Clean Energy. Helped critically review Florida utilities' efficiency potential studies and proposed 2020-2024 energy efficiency savings targets. (2019)
- New Hampshire Office of the Consumer Advocate. Drafted expert witness testimony on the merits of utilities adding a pilot non-wires solution project to their efficiency program plans. (2018)
- Regulatory Assistance Project - Europe. Provide on-going support on efficiency policies and programs in the United Kingdom, Germany, and other countries. Reviewed draft European Union policies on Energy Savings Obligations, EM&V protocols, and related issues. Drafted policy brief on efficiency feed-in-tariffs and roadmap for residential retrofits. (2009 to 2018)
- Green Mountain Power (Vermont). Supported development and implementation of GMP's first compliance plan for Vermont RPS Tier 3 requirement to reduce customers' direct consumption of fossil fuels, with significant emphasis on strategic electrification strategies. Also developed 10-year forecast of sales that could result from three different levels of policy/program promotion of residential electric space heating, electric water heating and electric vehicles. (2016 to 2018)
- Alberta Energy Efficiency Alliance. Drafted white paper how treatment of "efficiency as a resource" could be institutionalized in Alberta. The paper followed several presentations to government agencies and others on behalf of the Pembina Institute. (2017 to 2018)
- Southern Environmental Law Center. Assessed reasonableness of Duke Energy's historic efficiency program savings claims, as well as the design of their efficiency program portfolios for 2019. Filed expert witness testimony on findings in North Carolina dockets (2018).
- Toronto Atmospheric Fund. Helped draft an assessment of efficiency potential from retrofitting of cold climate heat pumps into electrically heated multi-family buildings (2017).
- Northeast Energy Efficiency Partnerships. Helped manage Regional EM&V forum project estimating savings for emerging technologies, including field study of cold climate heat pumps. Led assessment of best practices on use of efficiency to defer T&D investment. (2009 to 2015)
- Ontario Power Authority. Managed jurisdictional scans on leveraging building efficiency labeling/disclosure requirements and non-energy benefits in cost-effectiveness screening. Supported staff workshop on the role efficiency can play in deferring T&D investments. Presented on efficiency trends for Advisory Council on Energy Efficiency. (2012-2015)
- Vermont Public Interest Research Group. Conducted comparative analysis of the economic and environmental impacts of fuel-switching from oil/propane heating to either natural gas or efficient, cold climate electric heat pumps. Filed regulatory testimony on findings. (2014-2015)

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- New Hampshire Electric Co-op. Led assessment of the co-op's environmental and social responsibility programs' promotion of whole building efficiency retrofits, cold climate heat pumps and renewable energy systems. Presented recommendations to the co-op Board. (2014)
- National Association of Regulatory Utility Commissioners (NARUC). Assessed alternatives to 1st year savings goals to eliminate disincentives to invest in longer-lived savings. (2013)
- California Investor-Owned Utility. Senior advisor on EFG project to analyze 10 leading U.S. utility portfolios to determine if there are differences in the cost of saved energy related to utility spending in specific non-incentive categories, including administration, marketing, and EM&V. (2013)
- DC Department of the Environment (Washington DC). Part of VEIC team administering the DC Sustainable Energy Utility (SEU). Helped characterize the DC efficiency market and supporting the design of efficiency programs that the SEU will be implementing. (2011 to 2012)
- Ohio Sierra Club. Filed and defended expert witness testimony on the implications of not fully bidding all efficiency resources into the PJM capacity market. (2012)
- Regulatory Assistance Project – Global. Assisted RAP in framing several global research reports. Co-authored the first report – an extensive "best practices guide" on government policies for achieving energy efficiency objectives, drawing on experience with a variety of policy mechanism employed around the world. (2011)
- Tennessee Valley Authority. Assisted CSG team providing input to TVA on the redesign of its residential efficiency program portfolio to meet aggressive new five-year savings goals. (2010)
- New York State Energy Research and Development Authority (NYSERDA). Led residential & renewables portions of several statewide efficiency potential studies. (2001 to 2010)
- Ohio Public Utilities Commission. Senior Advisor to a project to develop a web-based Technical Reference Manual (TRM). The TRM includes deemed savings assumptions, deemed calculated savings algorithms and custom savings protocols. It was designed to serve as the basis for all electric and gas efficiency program savings claims in the state. (2009 to 2010)
- Vermont Electric Power Company. Led residential portion of efficiency potential study to assess alternatives to new transmission line. Testified before Public Service Board. (2001-2003)
- Efficiency Vermont. Served on Sr. Management team. Supported initial project start-up. Oversaw residential planning, input to regulators on evaluation, input to regional EM&V forum, development of M&V plan and other aspects of bidding efficiency into New England's Forward Capacity Market (FCM), and development and updating of nation's first TRM. (2000 to 2010)
- Long Island Power Authority Clean Energy Plan. Led team that designed the four major residential programs (three efficiency, one PV) incorporated into the plan in 1999. Oversaw extensive technical support to the implementation of those programs. This involved assistance with the development of goals and budgets, development of savings algorithms, cost-effectiveness screening, and on-going program design refinements. (1998 to 2009)

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Selected Publications and Reports

- *Cost Savings and CO2 Emission Reductions of Residential Electrification in Peoples Gas Territory*, prepared for the Natural Resources Defense Council, November 2022 (with David Hill & Liz Bourguet)
- *Tip of the Spear: How Efficiency Programs Supporting Cold Climate Heat Pumps in Low Income Multi-Family Buildings Could Help Lay the Foundation for Building Decarbonization in Michigan and Illinois*, 2022 ACEEE Summer Study on Energy Efficiency in Buildings (with Laura Goldberg, Valeria Rincon and Samantha Williams)
- *The Clean Heat Standard*, Vermont Energy Action Network (EAN) White Paper, December 2021 (with Richard Cowart)
- *National Standard Practice Manual for Benefit Cost Analysis of Distributed Energy Resources*, August 2020, (with Tim Woolf and others)
- *Reducing CO_2 Emissions from Vermont Buildings: Potential and Cost-Effectiveness of Select Program Options*, Regulatory Assistance Project, February 13, 2019 (with Richard Faesy)
- *Pumping Energy Savings: Recommendations for Accelerating Heat Pump Adoption in Ontario's Electrically Heated Multi-Residential Buildings*, Toronto Atmospheric Fund, July 2018 (with Devon Calder, Brian Purcell and Judy Simon)
- *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources*, Edition 1, Spring 2017 (with Tim Woolf, Marty Kushler, Steven Schiller and Tom Eckman)
- *The Next Quantum Leap in Efficiency: 30% Electricity Savings in 10 Years*, Proceedings of the 2016 ACEEE Summer Study on Energy Efficiency in Buildings, Volume 9, pp. 1-14 (with Jim Grevatt, Rich Sedano and Dave Farnsworth)
- *The Next Quantum Leap in Efficiency: 30% Electricity Savings in Ten Years*, published by the Regulatory Assistance Project, February 2016 (with Jim Grevatt)
- *Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments*, published by Northeast Energy Efficiency Partnerships, January 9, 2015 (with Jim Grevatt)
- *Unleashing Energy Efficiency: The Best Way to Comply with EPA's Clean Power Plan*, Public Utilities Fortnightly, October 2014, pp. 30-38 (with Tim Woolf, Erin Malone and Robin LeBaron)
- *The Resource Value Framework: Reforming Energy Efficiency Cost-Effectiveness Screening*, published by the National Efficiency Screening Project, August 2014 (with Tim Woolf et al.)
- *U.S. Experience with Participation of Energy Efficiency in Electric Capacity Markets*, Regulatory Assistance Project, August 2014 (with Richard Cowart)
- *The Positive Effects of Energy Efficiency on the German Electricity Sector*, IEPEC 2014 Conference, September 2014 (with Friedrich Seefeldt et al.)

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- *Final Report: Alternative Michigan Energy Savings Goals to Promote Longer Term Savings and Address Small Utility Challenges*, prepared for the Michigan Public Service Commission, September 13, 2013 (with Optimal Energy)
- *Energy Efficiency Feed-in-Tariffs: Key Policy and Design Considerations*, Proceedings of ECEEE 2013 Summer Study, pp 305-315 (with Richard Cowart)
- *Can Competition Accelerate Energy Savings? Options and Challenges for Efficiency Feed-in-Tariffs*, published in Energy & Environment, Volume 24, No. 1-2, February 2013 (with Richard Cowart)
- *An Energy Efficiency Feed-in-Tariff: Key Policy and Design Considerations*, published by the Regulatory Assistance Project, March/April 2012 (with Richard Cowart)
- *U.S. Experience with Efficiency as a Transmission and Distribution System Resource*, published by the Regulatory Assistance Project, February 2012 (with Rich Sedano)
- *Achieving Energy Efficiency: A Global Best Practices Guide on Government Policies*, published by the Regulatory Assistance Project, February 2012 (with Nancy Wasserman)
- *Residential Efficiency Retrofits: A Roadmap for the Future*, published by the Regulatory Assistance Project, May 2011 (with Meg Gottstein and Blair Hamilton)
- *Is it Time to Ditch the TRC?* Proceedings of ACEEE 2010 Summer Study on Energy Efficiency in Buildings, Volume 5 (with Marty Kushler)
- *Energy Efficiency as a Resource in the ISO New England Forward Capacity Market*, in Energy Efficiency, published on line 06 June 2010 (with Cheryl Jenkins and Shawn Enterline)
- *A Comparison of Energy Efficiency Programmes for Existing Homes in Eleven Countries*, prepared for the British Department of Energy and Climate Change, 19 February, 2010 (with Blair Hamilton et al.)
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- *Playing with the Big Boys: Energy Efficiency as a Resource in the ISO New England Forward Capacity Market*, Proceedings of ACEEE 2008 Summer Study Conference on Energy Efficiency in Buildings, Volume 5 (with Cheryl Jenkins and Blair Hamilton)
- *Recommendations for Community-Based Energy Program Strategies, Final Report*, developed for the Energy Trust of Oregon, June 1, 2005 (with Dave Hewitt et al.)
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- *Assessment of Economically Deliverable Transmission Capacity from Targeted Energy Efficiency Investments in the Inner and Metro-Area and Northwest and Northwest/Central Load Zones", for Vermont Electric Power Company, Final Report: April 2003* (with John Plunkett et al.)
- *Residential HVAC Quality Installation: New Partnership Opportunities and Approaches*, Proceedings of ACEEE 2002 Summer Study Conference on Energy Efficiency in Buildings, Volume 6 (with Rebecca Foster, Mia South, George Edgar and Put Murphy)
- *A Modified Delphi Approach to Predict Market Transformation Program Effects*, Proceedings of ACEEE 2000 Summer Study Conference on Energy Efficiency in Buildings, Volume 6 (with Phil Mosenthal et al.)
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- *Energy Savings Potential from Addressing Residential Air Conditioner and Heat Pump Installation Problems*, American Council for an Energy Efficient Economy, February 1999 (with John Proctor and Steve Nadel)
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