REDACTED VERSION

Matter 07718 Maritime Link Interim Cost Assessment

Joint Direct Testimony of Robert Fagan and Tyler Comings, Synapse Energy Economics

Prepared on Behalf of NS UARB Board Counsel
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1. Introduction

Qualifications

Q Please state your names and occupations.

A We are Robert M. Fagan and Tyler Comings, respectively Principal Associate and Senior Associate at Synapse Energy Economics.

Q Please describe Synapse Energy Economics.

A Synapse Energy Economics is a research and consulting firm specializing in electricity industry regulation, planning, and analysis. Synapse works for a variety of clients, including consumer advocates, regulatory commissions, and environmental advocates.

Q On whose behalf are you testifying in this case?

A We are testifying on behalf of the Nova Scotia Utility and Review Board Counsel ("Board Counsel").

Q Mr. Fagan, please summarize your qualifications.

A I am a mechanical engineer and energy economics analyst, and I've analyzed energy industry issues for more than 30 years. My activities focus on many aspects of the electric power industry, in particular: production-cost modeling of electric power systems, general economic and technical analysis of electric supply and delivery systems, wholesale and retail electricity provision, energy and capacity market structures, renewable resource alternatives, including wind and solar PV, and

assessment and implementation of energy efficiency and demand response alternatives. I hold an M.A. from Boston University in energy and environmental studies and a B.S. from Clarkson University in mechanical engineering. My resume is included as Attachment 1 hereto.

Q Mr. Comings, please summarize your qualifications.

A I have 11 years of experience in economic research and consulting. At Synapse, I have worked extensively in the energy planning sector, including work on integrated resource plans, costs of regulatory compliance, and economic impact analyses. I have provided consulting services for many clients including: U.S. Department of Justice, District of Columbia Office of the People's Counsel, District of Columbia Government, Hawaii Division of Consumer Advocacy, Maryland Office of the People's Counsel, New Jersey Division of Rate Counsel, West Virginia Consumer Advocate Division, Illinois Attorney General, Nevada State Office of Energy, Sierra Club, Earthjustice, Citizens Action Coalition of Indiana, Consumers Union, Energy Future Coalition, American Association of Retired Persons, and Massachusetts Energy Efficiency Advisory Council. I have provided testimony on electricity planning issues and economic impacts in the District of Columbia, Hawaii, Indiana, Kentucky, Ohio, Oklahoma, Maryland, and New Jersey. Prior to joining Synapse, I performed research in consumer finance for Ideas42 and economic analysis of transportation and energy investments at Economic Development Research Group. I hold a B.A. in Mathematics and Economics from Boston University and an M.A.

in Economics from Tufts University. My resume is included as Attachment 2 hereto.

Q Please summarize Synapse's participation in M054191 with respect to the Maritime Link Project application.

A Synapse was retained as one of the Nova Scotia Utility and Review Board Counsel's consultants in 2013 to provide an economic analysis of the Maritime Link Project, in particular as it compared to two defined alternatives, Indigenous Wind and Other Imports. Synapse filed a report on behalf of Board Counsel in April of 2013.[2]

Purpose and Structure

Q What is the purpose of your testimony?

A The primary purpose of our testimony is to address a subset of the issues set out in the Board's Final Issues List as they pertain to NSPML's Interim Cost Assessment application.[3] In particular, we address the economic effect of the forthcoming delay of energy and capacity delivery associated with the Nova Scotia Block (NS Block), related Supplemental Energy, and Surplus Energy availability.[4] We also address the extent to

[1] In the Matter of an Application by NSP Maritime Link Incorporated (NSPML) for Approval of the Maritime Link Project, original filing January 28, 2013.

[2] Synapse Energy Economics, Economic Analysis of Maritime Link and Alternatives: Complying with Nova Scotia's Greenhouse Gas Regulations, Renewable Energy Standard, and Other Regulations in a Least-Cost Manner for Nova Scotia Power Ratepayers, April 17, 2013.

[3] NS UARB, Final Issues List, January 11, 2017.

[4] The NS Block is the energy from Muskrat Falls to be delivered during peak hours (16 hours per day) 365 days/year. Supplemental Energy is delivered in the first five years only, 8 hours/day, 7 days/week during the winter only (November through March). Additionally, Surplus Energy is market-priced energy available to NSPI at costs in addition to the revenue recovery requirements for the overall Maritime Link Project (which includes NS Block and Supplemental Energy transactions).

which the Maritime Link Project[5] approved by the Board in 2013 will not be "used and useful"[6] come January 1, 2018.

Q What documents do you rely upon in your analysis?

A We rely upon NSPML's Interim Cost Assessment Application (December 16, 2016) and NSPML's Interim Cost Assessment Application Supplemental Evidence (February 15, 2017). We rely upon responses by NSPML to discovery requests from various parties in this matter. We also rely on material available in the 2017–2019 Fuel Stability Plan Application docket, M07348; and we rely upon material available during the Maritime Link Project case (M05419) in 2013.

Q How is your testimony structured?

A After this introductory section we summarize the issues we address. This is followed by a section reporting on our analysis of the impact of the projected delay (at least 30 months)[7] of energy and capacity delivery from the NS Block, Supplemental Energy delivery, and availability of Surplus Energy. Next, we describe the extent to which the

[5] The Maritime Link Project is the combination of the energy transactions for delivery of energy to Nova Scotia from the Muskrat Falls generation plant, and the design, construction, and operation of the Maritime Link itself to flow these transactions to Nova Scotia; and related transmission agreements for flow of energy through Nova Scotia.

[6] "Used and useful" is both an accounting term and a regulatory term of art concerning the extent to which an asset is in use and providing useful service to NSPI ratepayers.

[7] The original Maritime Link Project application assumed deliveries of the Nova Scotia Block (on-peak hours) commencing in October 2017, Supplemental Energy (winter off-peak) commencing in November of 2017, and Surplus Energy availability in October 2017. NSPML response to Synapse IR-11 (M05419), attachment 3, page 1 and attachment 4, pages 1 and 2. Current information indicates NS Block commencement no earlier than the 2nd quarter of 2020.

Maritime Link Project will not be used or useful for Nova Scotia ratepayers on January 1, 2018. We then outline for Board consideration several alternative approaches to reconciling NSPML's request for full cost recovery of the Maritime Link Project with the fact that the benefits that will begin to accrue to ratepayers upon completion of the Maritime Link Project—i.e., the flow of energy associated with NS Block, Supplemental Energy, and Surplus Energy—will not begin flowing in the third quarter of this year, as first projected. Rather, it will commence no sooner than the second quarter of 2020.

2. Summary of Issues

Q What issues do you address in this testimony?[8]

A Our focus is analysis of the costs to ratepayers of the delay in the commencement of delivery of capacity and energy from the Muskrat Falls Plant to Nova Scotia. Delay of delivery means that NSPI must produce or import sufficient incremental energy to offset the delayed NS Block and delayed delivery of Supplemental Energy. It also means that benefits to ratepayers from the first 30 months of Surplus Energy availability are lost, and those benefits were a critical component of the Board's approval of the Maritime Link Project. NSPML has not conducted an analysis of such costs; they did indicate that NSPI's Fuel Stability Plan application contained an estimate that a one-year delay in

[8] The Final Issues List in this Matter contains 13 items, including the impact of the projected two-year delay of the delivery of the Nova Scotia Block.

commencement of the NS Block would cost $58 million.[9] We note that the actual delay relative to originally-intended flows as analyzed in the Maritime Link Project application in 2013 is currently 30 months, if the NS Block commences flow on April 1, 2020.

Q What else do you discuss?

A We also discuss the extent to which the Maritime Link Project approved by the Board in 2013 is "used and useful." Differentiating between the Maritime Link Project—which includes the transactions that flow energy to Nova Scotia—and the Maritime Link itself, is the critical context in which an assessment of "used and useful" must be made. Utility assets are not generally put into rate base - thus enabling a return on invested equity - until they are considered "used and useful."[10] This standard has been applied to mean that the asset must provide sufficient benefits to ratepayers. The Maritime Link Project was not approved to allow for potential shared savings on economy energy exchange between Newfoundland and Nova Scotia, yet NSPML's application in this case relies primarily on exactly this benefit in requesting commencement of cost recovery for its share of the Maritime Link Project. Thus there exists a disconnection between the request for cost recovery, and the commencement of benefits that should be aligned with such requests.

NSPML is requesting cost recovery of $162 million in 2018 and $164 million in 2019,

[9] Response to Synapse IR-13.

[10] E.g., Nova Scotia Power Accounting Policy. Rate Base – 1520: "The components of rate base should include: Cost (gross historical cost less capital contributions) less accumulated depreciation of *used and useful* plant in service;" (emphasis added).

based on NSPML's estimated 20 percent cost share for the Maritime Link Project. The basis for those amounts originated in an application for approval of the entire Maritime Link Project. The capital costs for the Maritime Link itself are on the order of $1.58 billion, roughly the same as NSPML's 20 percent share of the larger Maritime Link Project (as intended). NSPML is asserting that because the Maritime Link itself is anticipated to be complete and in-service as a transmission connection between Nova Scotia and Newfoundland on January 1, 2018, it should therefore be granted full cost recovery for its 20 percent share of the cost of the Maritime Link Project.

Q What is the difference between the Maritime Link Project, and the Maritime Link?

A The Maritime Link Project includes not only the transmission infrastructure that comprises what is known as the Maritime Link, but also includes the transactions for delivery of energy to Nova Scotia.

> (c) "Maritime Link Project" means the design, construction, operation and maintenance of the Maritime Link**,** *together with the related transactions involving the delivery of energy,* the provision of transmission services over the Maritime Link and the enabling of transmission service through the Province, as set out in a term sheet between Emera Incorporated and Nalcor Energy dated November 18, 2010;"[11] [*emphasis added*]

The Maritime Link facilities themselves include the submarine cable, the converter stations, related transmission work (exclusive of the Labrador Island Link and the Labrador

[11] An Act Respecting the Maritime Link, Section 2, Interpretation. 2013.

Transmission Assets), project management, and "other costs."[12]

Q Are there other issues the Board must consider in this application?

A Yes. Besides those issues on the Final Issues List that we do not directly address in this testimony, the Board also needs to consider how to implement any resolution of the cost recovery policy issues at stake.

3. Impact of Projected Delay of NS Block

Q What do you address in this section?

A We address the cost impact to NSPI ratepayers of the delay in delivery of NS Block and Supplemental Energy, and the delay in availability of Surplus Energy. We first summarize the quantities involved (which can be thought of as "replacement power"), and we then compute the additional costs to ratepayers. Those costs arise because the energy that would otherwise have been delivered if the Maritime Link Project was complete and the NS Block commenced on time (originally, October 2017), will instead need to be produced or imported by NSPI until the time the NS Block commences.

We note that some of these additional costs are already reflected in the 2017–2019 Fuel Stability Plan, but not all of them; and we note that this could affect both true-up requirements under the Fuel Adjustment Mechanism (FAM), and the parameters for a potential subsequent Rate Stability Plan period (post January 1, 2020) if the current arrangements under the

[12] Maritime Link Project Application, pages 76 and 97.

Electricity Plan Implementation Act (2015) continue to that period. We also place a "present value" on the future delivery of NS Block energy in the extended periods (i.e., the periods after the original year in which the NS Block was to end, 2052)[13] over which the NS Block would flow, and net this out from the additional (present value) costs to ratepayers due to generating or importing the "replacement power." In addition, we also address the potential benefits to ratepayers from the energy flows that may arise during 2018–2019, and up to the second quarter of 2020, based on NSPML's estimate of this benefit. Lastly, we address the additional impact of unavailability of Surplus Energy under the original Energy Access Agreement terms, noting that this unavailability also contributes to an overall lessening of the value to ratepayers.[14]

Q Please summarize the NS Block, Supplemental Energy, and Surplus Energy attributes.

A The NS Block, Supplemental Energy, and Surplus Energy will be available after the Muskrat Falls Plant comes online, currently projected for the second quarter of 2020.[15] The NS Block is 895 GWh per year of on-peak period energy (16 hours/day for 365 days/year). Supplemental Energy is 240 GWh per year of off-peak energy (winter season off-peak periods) for the first five years of operation after commencement of the NS Block. Surplus energy is available for up to 1,800 GWh per year, available throughout

[13] Based on a NS Block commencement in the 2nd quarter of 2020 (assuming April 1, 2020 start), this implies 30 months of "extended period" deliveries of NS Block energy, beginning after the original end month of September 2052 and continuing through the end of March 2055.

[14] Surplus energy amounts made up more than 50 percent of the originally intended flows over the Maritime Link.

[15] Response to NS UARB IR-55.

the year during peak and off-peak periods, at market prices.[16]

Q When was the Nova Scotia Block, Supplemental Energy, and Surplus Energy availability originally contemplated for first delivery?

A At the time of the Board's approval in the Maritime Link application docket, July 2013 (Decision) and November 2013 (Supplemental Decision), NS Block power flow was to commence in October of 2017, Supplemental Energy was to commence in November of 2017, and Surplus Energy was available and was estimated to flow to NSPI starting in October 2017.[17]

Q Was the Board's 2013 approval based on an economic analysis that assumed delivery of energy starting in October of 2017?

A Yes. In all of the analyses reviewed by the Board in 2013, the energy flows begin in the fall of 2017. While the Board recognized some uncertainty of the overall value of the Maritime Link Project depending on input assumptions and considered scenarios,[18] and at minimum there was discussion at the hearing concerning the potential for a delay of some "upstream" aspects of the Maritime Link Project,[19] there was no explicit economic analysis of the alternatives[20] that assumed a delay in commencement of the delivery of

[16] Surplus energy is available based on the prices and availability as described in the Energy Access Agreement between Nalcor and Emera and NSPI, April 13, 2015.

[17] Response to Synapse IR-11, Attachment 3 and Attachment 4. M05419.

[18] Decision, Section 6.1 paragraphs 74 through 231. More specifically, Section 6.1.51., paragraphs 170-173.

[19] Board Decision, pages 105-107, paragraphs 333 through 338.

[20] I.e., Indigenous Wind, Other Import, or Hybrid Option.

NS Block, Supplemental Energy, and Surplus Energy. There was certainly no analysis that considered what NSPML is asking for in this Interim Cost Application: a delay in commencement of the NS Block and Supplemental Energy while recovering the full costs of the Maritime Link Project from NSPI ratepayers starting January 1, 2018. At the time of the original application in 2013, NSPML stated that it did not expect there would be a delay until 2020.[21]

Q What quantities of energy are included in the Commercial Agreements that are part of the Maritime Link Project and were included in the 2013 modeling of the costs and benefits for the Maritime Link Project?

A NS Block and Supplemental Energy flows are guaranteed as part of the overall Maritime Link Project agreement at essentially fixed prices, at the levels noted above (NS Block at 895 GWh/year for 35 years, Supplemental Energy at 240 GWh/year for just the first five years). In 2013 NSPML modeled a fixed quantity of NS Block and Supplemental Energy in all analyses that included the Maritime Link Project.

Surplus Energy is to be available under market prices according to the terms of the Energy Access Agreement,[22] and varying amounts of Surplus Energy were assumed to flow depending on different assumptions used by NSPML to show the sensitivity of the overall

[21] E.g., response by NSPML to Canadian Wind Association information request IR-113.2 in M05419, "The RES obligations imposed on NS Power for 2020, as they relate to the Maritime Link, are contingent on Muskrat Falls and related transmission infrastructure being completed and in normal operation. There is no expectation that Muskrat Falls or the other projects will be delayed to 2020".

[22] April 13, 2015 final version. In general, NSPI is able to procure Surplus Energy at New England market prices less the costs of transmitting and delivering energy to New England through New Brunswick from a Nova Scotia location. There are also provisions that could increase the market price above New England's benchmark price.

economic analysis to different factors.[23] For the baseline scenarios assuming either "base load" or "low load," NSPML's application in 2013 modeled two different levels of Surplus Energy flowing across the Maritime Link, depending on which of the two load forecasts were considered. NSPML modeled Surplus Energy delivery ranging from 1,281–1,732 GWh per full year (varying across the 2018–2040 "planning period" portion of the agreements) under its "base load" assumption, and 1,081–1,297 GWh per year under its "low load" scenario for the same timeframe. Different amounts of Surplus Energy were seen to flow under the two price sensitivities tested by NSPML, high power and gas price, and low power and gas price. Both of these were analyzed only for the "base load" forecast scenario.[24] The Board's approval of the Maritime Link Project included an explicit assumption that NSPI ratepayers would obtain the value associated with the projected Surplus Energy flows noted here.

Q What are the amounts of Maritime Link Project energy that will not be available to NSPI ratepayers in the periods before eventual commencement of NS Block flow?

[23] E.g., high and low power and gas price sensitivities.

[24] Those scenarios resulted in a range of Surplus Energy flow of 1,204 to 1,732 between 2018 and 2020. NSPML response to Synapse IR-11 in M05419, attachment 4 page 2 of 2.

A Table 1 below summarizes the flow quantities for the periods when the Maritime Link Project was originally expected to provide energy.

Table 1. Estimate of NS Block, Supplemental Energy, and Surplus Energy Flow—Delayed Quantities

GWh	NS Block	Supplemental Energy	NS Block + Supplemental Energy	Expected Surplus Energy (low load basis)	Total Energy Not Delivered - ML Project
2017 4Q	226	97	323	281	604
2018	895	240	1,135	1,264	2,399
2019	895	240	1,135	1,268	2,403
2020 1Q	221	144	365	103	468
Total 10/1/2017 to 4/1/2020	**2,237**	**721**	**2,958**	**2,916**	**5,874**

Source: Response to Synapse IR-11 Attachment 3 (M05419)

Q How will NSPI provide energy to make up for the absence of the energy from the NS Block, Supplemental flows, and availability of Surplus Energy, in later 2017 through the early part of 2020?

A NSPI will need to provide that energy from its fleet or from imports from New Brunswick. Some portion of the total of this energy is indicated to be potentially available from existing assets in Newfoundland (in 2018) after the Maritime Link becomes available for transactions between Nova Scotia and Newfoundland,[25] but the delivery period of those flows is different from the Maritime Link Project flow guarantees for the NS Block and Supplemental Energy. Also, the pricing for and the volume of those flows is uncertain at this time.[26]

Q Has NSPML analyzed the cost impact of the delay of delivery of the NS Block, Supplemental Energy, and available Surplus Energy?

[25] Response to NS UARB-3.

[26] Response to CA-IR-1 (c).

A No. NSPML has not yet conducted such an analysis.[27]

Q What is your estimate of the near-term cost of the delay in delivery of energy from the Maritime Link Project?

A We estimate an increase in near-term costs of roughly [redacted] million ($2017) to procure replacement energy for the NS Block and Supplemental Energy over the late 2017–early 2020 period. Table 2 shows this estimate, which is based on the quantities of Maritime Link Project energy not delivered, and the marginal costs to generate or import such replacement energy. If NSPML's estimate of a [redacted] million/year (nominal) net benefit to NSPI ratepayers is correct, the net increase in costs to NSPI ratepayers is roughly [redacted]* million ($2017). We note that if the delay period for commencement of the NS Block increases, the costs will continue to rise. This estimate excludes the effect of any loss of value associated with not having Surplus Energy availability, and it also excludes any residual effects of keeping the Lingan 2 unit online longer than originally planned, potentially incurring additional sustaining capital costs that would otherwise have not been needed.

[27] Response to Synapse IR-16 C, IR-13(a), IR-17(a).

Table 2. Replacement Power Cost to Ratepayers of Delayed NS Block and Supplemental Energy Flows

$/MWh, and $ millions	NS Block On-Peak Cost $/MWh (nominal)	Supple-mental Off-Peak Cost $/MWh (nominal)	Cost of NS Block Replace-ment Power $ millions (nominal)	Cost of Supple-mental Replace-ment Power $ millions (nominal)	Total cost, excludes Surplus Energy effects $ millions (nominal)	Inflation Adjusted Total Cost, excludes Surplus Energy effects ($2017 millions)	NSPML - Claimed Value of Increment al Energy, $ millions (nominal)	NSPML - Claimed Value of Incrementa l Energy, Inflation Adjusted, ($2017 millions)	Net Cost to Ratepayers to Replace NS Block and Supplemental ($2017 millions)
2017	[redacted]								
2018									
2019									
2020									
Total 10/1/2017 to 4/1/2020 ($2017 millions)									

Source/Notes:

1. 4th quarter 2017 assumed same prices as 2018. 1st quarter 2020 assumed same prices as 2019.
2. Prices from Response to CA IR-11, Attachment 1.
3. Incremental value from NSPML, Confidential Appendix B. Estimate of value of 1Q 2020 Incremental energy equal to one-quarter of 2019 estimate.
4. Prices from CA IR-11 Attachment 1 assumed to be nominal dollars. 2% inflation, 6.56% nominal discount rate used to value future benefit.
5. The values listed here exclude all additional value erosion arising from the unavailability of Surplus Energy in 2018-2019, early 2020, and late 2017.

Q How did you estimate this range of ratepayer cost?

A We multiplied the volume of NS Block and Supplemental Energy that will not be available by NSPML's estimation of the marginal costs of power for the peak and off-peak periods that correspond to delivery of the NS Block and the Supplemental Energy.[28] We then adjusted the costs for inflation (2%/year), converting them to $2017.

Q What is your estimate of the overall change in costs to ratepayers when considering the present value of the future benefit of extended period delivery of NS Block energy?

[28] Peak and off-peak period marginal costs for 2018 and 2019 are taken from Attachment 1 to the response to CA-IR-11. NS Block amounts are priced at annual average on-peak prices; Supplemental Energy is priced at winter month off-peak average price.

A An estimate of the present value of the future delivery of NS Block energy in 2052 through 2055, for the 30 months after the end of the original NS Block delivery period, is seen in Table 3 below. Assuming a real discount rate of 4.47 percent[29] and constant real costs of power over time, the value of future deliveries is discounted by roughly 80 percent from the current year value. In other words, the future delivery of energy is only worth about 20 percent of the value if it was instead delivered in the current year. If one assumes the real cost of power increases by 1 percent per year instead of remaining constant, and the real discount rate remains at 4.47 percent, then the discount is reduced to roughly 70 percent, or the future delivery has a value of 30 percent of today's value. The late-delivered energy has value, but it's heavily discounted.[30] As a result of shifting the deliveries of energy from the first 30 months of the original period to the 30 months after the 35-year period ends, ratepayers obtain some benefit and the net costs are reduced from [redacted] million[31] to [redacted] million ($2017). Even if using a less discounted value for future deliveries, it is clear that the net costs of the delay of the commencement of the NS Block and Supplemental energy are far from immaterial.[32]

[29] NSPML used a nominal discount rate of 6.56% and an inflation rate of 2.0% in its valuation of the Maritime Link Project energy during the 2013 application. This is equivalent to a real discount rate of 4.47% real discount rate = (1+nominal discount rate)/(1+inflation rate)-1.

[30] NSPML and Mr. Reed provide no support, and no logical basis, for their contention that the real value of power may increase at the **same** rate as the real discount rate. Response to MPA-IR-6.

[31] The net cost of [redacted] million is first reduced to a net present value of [redacted] million by applying the real discount rate of 4.47% to the net cost streams.

[32] Evidence of John J. Reed, December 16, 2016, page 19, lines10-11, "The delay does not materially change the total benefit of the ML Project".

Moreover, including the additional value lost from unavailability of Surplus Energy would show an even greater impact on ratepayers relative to the original value projections by NSPML in the Maritime Link Project application.

Table 3. Net Change in Value to Ratepayers of Delayed NS Block and Supplemental Energy Flows, Inclusive of Future Benefit of Late-Delivered NS Block Energy

	Net Cost to Ratepayers to Replace NS Block and Supplemental Energy ($2017 millions)	Present Value of Net Cost to Ratepayers to Replace NS Block and Supplemental Energy ($2017 millions)	Present Value of Future Benefit of Delayed Delivered of NS Block ($2017 millions)	Present Value of Net Cost to Ratepayers Inclusive of Future Benefit ($2017 millions)
2017	[redacted]	[redacted]	[redacted]	[redacted]
2018				
2019				
2020				
Total ($2017)				

Source: Table 2 and present value computation as noted in text. Note: Real discount rate of 4.47%. Note: The values listed here exclude all additional value erosion arising from the unavailability of Surplus Energy in 2018-2019, early 2020, and late 2017.

Q Does NSPML propose any mitigation of these additional costs that could accrue to ratepayers?

A No. NSPML proposes no change to the recovery of costs of the Maritime Link Project to NSPI ratepayers, even though they are exposed to the replacement power costs noted above.

Q How much energy does NSPML presume could potentially flow across the Maritime Link during 2018–2019?

A NSPML indicates that a relatively sizable amount of power could potentially flow across the Maritime Link. However, this flow is fully towards Newfoundland during the winter season (October through April). All potential purchases are during the non-winter

season, when NSPI generally has lower fuel costs.

A Table 4 summarizes the quantities.

Table 4. Maritime Link Project Energy Not Available Contrasted with Potential Deliveries Over the Maritime Link Prior to NS Block Commencement

		Potential Non-Winter Purchases 2018 Forward				Potential Winter Sale
GWh	**Total Energy Not Delivered - ML Project - Includes Surplus Energy**	**Recapture**	**Pre-FCP**	**Hydro Storage**	**Total Potential Non-Winter Purchases**	**Potential Sales to Nalcor (Holyrood Displacement)**
2017 4Q	604	NA	NA	NA	NA	NA
2018	2,399	[redacted]				
2019	2,403					
2020 1Q	468					
Total 10/1/2017 to 4/1/2020	**5,874**					

Source: Response to NS UARB IR-3. Tabulation by Synapse. Note: 2020 1Q Recapture, Pre-FCP (First Commercial Power), Hydro Storage estimated as 25% of 2019 levels. Note: Surplus Energy delivered for the period shown was 3,083 GWh (low load basis) in NSPML's computation of overall benefits during the 2013 original Maritime Link Project application (see Table 1).

Q What is the magnitude of the incremental benefits NSPML claims will be available to NSPI ratepayers upon commissioning of the Maritime Link portion of the overall Maritime Link Project?

A NSPML states that a "reasonably conservative estimate" of the benefits is [redacted] million per year, from potential flows seen in

A Table 4. They note that this estimate arises from apportioning the actual net benefits that may occur from transport of energy between the Provinces between Nalcor and

NSPI,[33] and they note that the benefit "is not guaranteed and is subject to negotiations with Nalcor." This benefit arises primarily from the purchase of off-season energy from Newfoundland, and secondarily from winter season exports to Newfoundland.

Q How does that potential benefit compare to the benefits associated with flow of the NS Block, Supplemental Energy, and Surplus Energy?

The value of the power flow from the NS Block and Supplemental Energy Flows that would otherwise have flowed across the Maritime Link in, e.g., 2018, is [redacted] million (see Table 3). Surplus Energy amounts of 1,264 GWh (as seen in

[33] Response to Synapse IR-31 (j). This apportionment has not yet been determined, as it is subject to completion of negotiations between the parties.

A Table 1) in 2018 were valued at roughly $21 million in the analysis conducted by NSPML in 2013, based on a difference in costs of $16.87/MWh.[34] Even if the eventual Surplus Energy value was less than NSPML indicated in 2013, the magnitude of the claimed "incremental benefits" is less than would have been seen under the original timeline for the Surplus Energy alone.

Q To what extent are the costs associated with generating or importing power already included in current rates?

A The current Rate Stability Plan quantified the cost of an assumed delivery of Maritime Link Project energy commencing in 2019, and thus already included the costs necessary to generate or import energy to replace the NS Block and Supplemental Energy for the last quarter of 2017, and all of 2018 for some classes. It also includes, fully at this time, the fixed costs of the Maritime Link Project for 2018 and 2019.

Q What does this imply for ratepayers if some portion of the funds indicated to be available to pay for the fixed costs of the Maritime Link Project are not approved for cost recovery?

A It indicates that the amount being recovered from customers to pay for fixed costs associated with the Maritime Link Project would be notionally available to "cover" energy needs in 2019 that were presumed to come from the Maritime Link Project, commencing in 2019. We would anticipate that the Fuel Adjustment Mechanism would

[34] M05419, Strategist output for Maritime Link Low Load run, 2018. This is the difference in costs between NS system marginal costs, and costs for purchases.

remain the vehicle to ensure that sufficient funds are available to generate "replacement energy" during the 2019 periods that the RSP assumes the Maritime Link Project would be flowing NS Block and Supplemental Energy to NSPI. True-up of fuel costs and purchase costs for the 2017–2019 RSP period, along with potential subsequent rate plans for the post-January 1, 2020 period would need to account for the actual cost recovery allowed. It would also need to account for the actual generating and import costs incurred by NSPI to serve ratepayers.

4. Used and Usefulness of the Maritime Link

Q What do you analyze in this section of your testimony?

A In this section, we analyze whether the Maritime Link Project should be considered "used and useful." This is a common phrase in utility regulation that is used by regulators in determining which assets should be in rate base, and as result, which costs should be passed through to ratepayers. Subject to the Public Utilities Act, the Board establishes what is in rate base in Nova Scotia based on the "the value of the physical assets of the utility which are 'used and useful' in furnishing a particular service to the public."[35] This is different from a prudence determination whereby a utility was deemed to have made a reasonable investment decision—at the time of that decision. Determining if an asset is used and useful depends on whether it is providing sufficient benefits to ratepayers. There is ambiguity and leeway in the phrase. As one review of

[35] NSURB Electricity Mandate. "General Rate Applications."

"used and useful" precedent claimed:

> Used and useful, as a legal demarcation, rests upon judgments about the appropriate timing of benefits relative to the incurrence of costs and the eligibility of certain types of investments for rate base or cost of service treatment.[36]

After a review of the Interim Assessment and estimate of the additional costs to ratepayers due to the Maritime Link Project's delay, we conclude that the Maritime Link Project will not be used and useful until the NS Block is available—2020 at the earliest. In the next section, we discuss possible policies that the Board could adopt to mitigate harm to ratepayers that would arise from prematurely charging them for an asset that is not used and useful, while simultaneously exposing them to significantly increased near-term costs to generate or import replacement power.

Q But NSPML says the Maritime Link will be used and useful.[37] How do you respond to their assertion?

NSPML points out the relatively small incremental benefit that could arise from economy energy exchange, and they point to the future benefits that would arise from delivery during the extended period (the 2052–2055 timeframe). They provide no support for a finding that the primary asset which is expected to eventually deliver the benefits associated with the Maritime Link Project—energy transactions for generation at Muskrat Falls in the amounts seen in the above

[36] Hoecker, James. "Used and Useful": Autopsy of a Ratemaking Policy. Energy Law Journal. Vol 8:303. 1987.

[37] Application, page 6, lines 4-8.

A Table 1—would begin to be used and useful on January 1, 2018.

Q Please describe the importance of the "used and useful" standard in ratemaking.

A It is generally accepted that an asset should not be included in rate base—thus not earn a rate of return—until it is "used and useful." The standard is meant to ensure that the public pays for a regulated utility asset only if it serves the public's need. One often-cited ruling by the District of Columbia Court of Appeals describes the standard below:

> Although methods for determining values of rate base items have evolved since *Smyth v. Ames*, the precept endures that an item may be included in a rate base only when it is "used and useful" in providing service. In other words, current rate payers should bear only legitimate costs of providing service to them.[38]

A determination of prudence does not protect an asset from this standard. One example is from a 1989 ruling from the U.S. Supreme Court on Duquesne Light Company vs. Barasch. The Court found that an investment initially determined to be prudent could be deemed not used and useful later:

> But adoption of the "prudent investment" rule as the single constitutional standard of valuation would be inconsistent with the view of the Constitution that this Court has taken since *Hope Natural Gas*, and would unnecessarily foreclose alternatives that could benefit both consumers and investors. The Constitution, within broad limits, leaves the States free to decide what ratesetting methodology best meets their needs in balancing the interests of the utility and the public.[39]

This ruling cites a critical case in utility regulation, *U.S. Federal Power Commission vs. Hope*

[38] U.S. District of Columbia Circuit Court of Appeals. 606 F. 2d 1094. Tennessee Gas Pipeline Company v. FERC.

[39] U.S. Supreme Court. 488 U.S. 299 (1989). Duquesne Light Co. v. Barasch

Natural Gas, in which the U.S. Supreme Court ruled that determining rates involves "a balancing of the investor and the consumer interests."[40]

Q Does Nova Scotia Power have policies in-place addressing whether its assets are not "used and useful"?

A Yes. For instance, Nova Scotia Power defines an asset that is "not used and not useful," "not used but useful for standby purposes" and "not used but useful for future use." The latter has the following criteria:

> a. they do not currently provide service to the consuming public; and
> b. they are expected to be used and useful in providing service in the future or to form part of the normal level of standby capacity in the future.[41]

Of Nova Scotia Power's options for an asset being "not used and useful," the Maritime Link Project comes closest to matching the criteria above. NS Power's treatment on this type of asset states that: "Accordingly, the cost of the asset is to be matched to the future periods in which the asset will provide value to customers."

Q In this filing, is NSPML assuming the ML Project will be included as an asset in rate base?

A Yes. NSPML's filing includes the recovery of $162 million in 2018 and $164 million in 2019 from Nova Scotia ratepayers. Shown below, these figures include depreciation of the project, operations and maintenance expenses, and financing costs to compensate

[40] U.S. Supreme Court. 320 U.S. 591 (1944). FPC v. Hope Nat. Gas Co.

[41] Nova Scotia Power Accounting Policy. Property, Plant and Equipment: Assets – Not Used and Useful – 6350.

bondholders (i.e. debt) and shareholders (i.e. equity).

Table 5. Figure 2 from NSPML's Application42

Description	2018 ($ Millions)	2019 ($ Millions)
Depreciation	51	51
Operating & Maintenance	14	18
Debt Financing Costs	46	44
Equity Financing Costs	51	51
Total Interim Assessment	162	164

Q To what assets do the values in the figure relate?

A NSPML states in this current filing these costs (shown above as $162 million in 2018 and $164 million in 2019) are tied to only the Maritime Link assets.[43] But in the original application, it was clear that the revenue recovery would be associated with the "20 for 20" Principle.[44] Thus all components are actually associated with NSPML's 20 percent share of the overall Maritime Link Project Costs,[45] which are roughly the same as the cost of the Maritime Link transmission assets in this current filing. The table below

[42] NS UARB, Decision in M07348, July 19, 2016, Page 14.

[43] Response to Synapse IR-9 (c).

[44] Maritime Link Project Application, "The principle is that NSPML will pay 20 percent of the LCP Phase I and the Maritime Link facilities' estimated total capacity and operating costs, and will receive 20 percent of the estimated energy and capacity from Muskrat Falls". Page 32. "The Regulations provide that NSPML may recover as Project Costs, once the **Maritime Link Project** is approved, 20 percent of the LCP Phase I and the Maritime Link facilities' costs". Page 74. "Consistent with the 20 for 20 Principle discussed earlier in the context of capital costs, since NSPML is receiving 20 percent of the total energy that Muskrat Falls provides, NSPML has conceptually agreed to pay 20 percent of the total O&M costs for the LCP Phase 1 and the Maritime Link facilities." Page 88-89. "The Regulations clearly direct that once the Board has approved the Project **and upon first commercial power**, NSPML will be entitled to recover all Project Costs from NS Power [Regulations, Subsection 4(2).] That process involved NSPML setting an assessment against NS Power for the recovery of such costs, and making a further application to the Board for approval of that assessment under the *Public Utilities Act*. In turn, NS Power will then be entitled to recover that approved assessment from time to time **in respect of the Maritime Link Project** through its rates [Regulations, Section 8.]." **Emphasis added**.

[45] As estimated at Decision Gate 3. NSUARB M07348, NSPML Response to NSURB IR-17.

shows NSPML's cost estimates from the 2017–2019 Fuel Stability Plan (M07348[46]).

Table 6. NSPML's Maritime Link Project Cost Estimate from the 2017–2019 Fuel Stability Plan

Costs ($M)	2017	2018	2019	2020
Maritime Link (NS & Supplemental)	$ -	$ 162.0	$ 164.0	$ 164.0
Maritime Link Surplus	$ -	$ 11.7	$ 21.6	$ 45.0
	$ -	**$ 173.7**	**$ 185.6**	**$ 209.0**

Source: NSPI Response to NS UARB IR-17 Attachment 1 Page 1 of 1 in Fuel Stability Plan Application (M07348).

The "costs" above are listed by NSPML as for the Maritime Link Project, including the NS and Supplemental Blocks. These costs in 2018 and 2019 match the revenue requirements that are being presented for the Maritime Link itself in the current filing.

Q Would NSPML shareholders be "made whole" under this assessment?

A Yes. NSPML shareholders would get a 9 percent return on their investment which translates to $51 million a year for each of 2018 and 2019. This means that despite the Maritime Link Project failing to produce its intended benefits in these two years, shareholders would be well-insulated from this delay.

Q According to the filing, is the return to NSPML shareholders affected by the delay in the ML Project?

A No. According to NSPML, its shareholders will still receive a return on equity of $51 million per year in the next two years. From the perspective of NSPML shareholder, it is as if the Maritime Link Project were operating as originally planned.

Q Are Nova Scotia ratepayers directly affected by the delay in the ML Project?

[46] *Id*. Attachment 1, p.1.

A Yes. As we have discussed previously, ratepayers are exposed to replacement energy costs in the near-term of roughly [redacted] million or a net cost exposure of roughly [redacted]* million if you directly consider the potential incremental benefit of economy energy exchange with Newfoundland (Table 3). The present value of this net cost exposure value for replacement energy is somewhat lower ([redacted] million) if you account for the discounted value of future deliveries of NS Block energy after September 2052. In addition, ratepayers are still being asked to shoulder the costs of the Maritime Link Project as if it were fully in-service.

Q When the Board approved the Maritime Link Project, did it try to mitigate the risks?

A Yes. The Board discussed the prospect of delay in its 2013 decision, citing to Mr. Colaiacovo's hypothetical scenario where:

> [T]he Maritime Link is built on time and budget; however, for whatever reason, an upstream portion of the overall project is not completed on time, whether it's the Muskrat Falls facility or the transmission facilities running between Muskrat Falls and Newfoundland.[47]

Mr. Colaiacovo predicted the present situation regarding the Muskrat Falls facility. In such an event, he went on to say that "the Nova Scotia ratepayer has no tools with which to manage that risk."[48] The Board took heed of this argument, stating that with the proposal as-filed "these risks fall entirely on Nova Scotian ratepayers" but that this was "an unreasonable

[47] NS UARB, Decision in M05419, July 22, 2013, Page 105.

[48] NS UARB, Decision in M05419, July 22, 2013, Page 105.

allocation of risk for this project."[49] As a result, the Board limited the accumulation of construction financing costs (i.e. AFUDC or allowance for funds used during construction) through the end of 2017—at the latest.[50]

Q Should NSPML have delayed the construction of the Maritime Link?

A Not necessarily. In its Supplementary Evidence filing, NSPML developed an estimated cost of delay of the construction of the Maritime Link to better match the availability of Muskrat Falls. We are not taking a stance on whether NSPML prudently handled the construction of the Maritime Link. However, we take issue with the expectation that the delay in the ML Project (not construction of the Maritime Link itself) should disproportionately harm ratepayers.

Q Did NSPML confuse the delay in construction of the Maritime Link with the delay in the availability of the Maritime Link Project?

A It appears so. NSPML claims that the views of Mr. Colaiacovo:

> [s]eemed to assume that delaying the completion of the ML might be an effective way to manage the 'construction cost risk' associated with the circumstance in which the ML is completed on time and on budget, but the upstream Nalcor generation assets to be built for use in conjunction with the ML are delayed.[51]

However, it appears Mr. Colaiacovo was discussing the delay of the ML Project in its entirety, not construction of the Maritime Link. The Chairman then asked him to agree that if:

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[49] *Id.* p.106.

[50] *Id.* See also the Evidence of Morrison Park Advisors in this case.

[51] NSPML Interim Cost Assessment Application: Supplementary Evidence. February 15, 2017. p.18

> The link was built and ready to receive power and energy but it couldn't get it because some portion of the project wasn't done—we could, for example, say no AFUDC would accumulate for that period.

NSPML uses its estimate of the costs of construction delay to argue against Mr. Colaiacovo's concern about the delay of entire ML Project. These are two different events and should not be confused or conflated. Again, our concern is that the Maritime Link Project will not be fully in-service by January 1, 2018.

Q Did the Board's Decision in the most recent Fuel Stability Plan application indicate that the Maritime Link Project or the Maritime Link would be used and useful on January 1, 2018?

A No. The Board's decision stated that:

> Nothing in this finding confirms the amount or prudence of the Maritime Link costs of the commencement date for paying the assessment which will be the subject of a future proceeding to be brought by NSP[ML] anticipated in 2017.[52]

Q Should the Maritime Link Project be considered used and useful as of January 1, 2018?

A No. The ML Project includes the Muskrat Falls plant, which is not providing power until 2020 at the earliest. However, even this date is not certain. A further delay in the NS Block—the critical benefit of the ML Project—would further delay a determination of whether the Project should be considered "used and useful." Therefore, an assessment at this time should be considered preliminary and subject to change given the timing of the NS Block.

[52] NS UARB, Decision in M07348, July 19, 2016, Page 14.

Q What is the minimal annual revenue recovery requirement needed to maintain NSPML's Debt Service Reserve Account (DSRA) and abide by the DSCR covenant?

A The minimum requirement to satisfy the requirements is $77.7 million for 2018 and $81.7 million for 2019.[53] This illustrates that there exists room for the Board to reduce the total cost recovery in 2018 and 2019 (from the requested $162 and $164 million annually in 2018 and 2019 respectively) to account for the absence of benefits from the Muskrat Falls Plant accruing to NSPI ratepayers, and to recognize that ratepayers will already have to pay additional costs for replacement power.

5. Conclusions and Approaches to Protect Ratepayers from Unfair Harm

Q Please summarize your conclusions.

A Based on the analysis and observations in the body of our testimony, we conclude the following:

1. NSPI ratepayers are unfairly exposed to the full harm of the Maritime Link Project delay if cost recovery proceeds based on NSPML's application. Ratepayers would pay full Maritime Link Project costs in 2018 and 2019 while receiving no benefit from Muskrat Falls generation, as was agreed upon with Maritime Link Project approval.
2. The little benefit that might be available to ratepayers in 2018-2019, and early 2020 would be based on uncertain price and volumes for economy energy exchange with Newfoundland, and at a very small fraction of the overall value that originally was

[53] Response to Synapse IR-29 (b).

expected to be delivered in 2018 and 2019 and early 2020.

3. The costs of replacement power for late 2017, 2018, 2019, and early 2020 are substantial, on the order of at least [redacted] million (net present value) even accounting for the value of future delivery of delayed project energy and including the uncertain benefit of the potential for economy energy exchange with Newfoundland. These costs are in addition to the requested recovery amounts sought by NSPML in this application.
4. These replacement power costs exclude the additional costs associated with delayed benefit for Surplus Energy, which was estimated as on the order of $21 million for 2018 alone during the original 2013 Maritime Link Project application case.
5. The Maritime Link Project will not be fully used and useful on January 1, 2018.
6. Numerous mechanisms exist to share the pain of the costs of delay between NSPML and NSPI ratepayers.

Q What actions can be taken to reduce costs to ratepayers arising from the delay in the commencement of the NS Block, Supplemental Energy, and availability of Surplus Energy?

A There are a number of alternatives available whose implementation would depend on both the policy approach the Board takes to mitigating potential harm to ratepayers, and the regulatory accounting means available. Any of these approaches would have the effect of denying cost recovery for a portion of the total cost recovery requested by NSPML. Such an action could be taken while still meeting the minimum requirements to meet the Federal Loan

Guarantee requirements for debt service. This type of alternative would allow the Board to weigh the more than [redacted] million of additional costs for replacement energy that ratepayers may have to bear, against NSPML's request to receive $102 million in return on equity for shareholders in 2018 and 2019 prior to the first increment of NS Block energy delivery.

Q Do you recommend any particular mechanisms for the Board to implement?

A No. The overall regulatory accounting framework needs to be considered in detail in order to implement a specific solution that is fair for NSPI ratepayers.

Q Does this conclude your testimony?

A Yes.

Robert M. Fagan, Principal Associate

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SUMMARY

Mechanical engineer and energy economics analyst with over 30 years of experience in the energy industry. Activities focused primarily on electric power industry issues, especially economic and technical analysis of transmission, wholesale electricity markets, renewable resource alternatives and assessment and implementation of demand-side alternatives.

In-depth understanding of the complexities of, and the interrelationships between, the technical and economic dimensions of the electric power industry in the US and Canada, including the following areas of expertise:

- Wholesale energy and capacity provision under market-based and regulated structures; the extent of competitiveness of such structures.
- Potential for and operational effects of wind and solar power integration into utility systems; modeling of such effects.
- Transmission use pricing, encompassing congestion management, losses, LMP and alternatives; transmission rights; and transmission asset pricing (embedded cost recovery tariffs).
- Physical transmission network characteristics; related generation dispatch/system operation functions; and technical and economic attributes of generation resources.
- RTO and ISO tariff and market rules structures and operation, and related FERC regulatory policies and initiatives, including those pertaining to RTO and ISO development and evolution.
- Demand-side management, including program implementation and evaluation; and load response presence in wholesale markets.
- Building energy end-use characteristics, and energy-efficient technology options.
- Fundamentals of electric distribution systems and substation layout and operation.
- Energy modeling (spreadsheet-based tools, industry standard tools for production cost and resource expansion, building energy analysis, understanding of power flow simulation fundamentals).
- State and provincial level regulatory policies and practices, including retail service and standard offer pricing structures.
- Gas industry fundamentals including regulatory and market structures, and physical infrastructure.

PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. *Principal Associate*, 2004 – Present.

Responsibilities include consulting on issues of energy economics, analysis of electricity utility planning, operation, and regulation, including issues of transmission, generation, and demand-side management. Provide expert witness testimony on various wholesale and retail electricity industry issues. Specific project experience includes the following:

- Analysis of New England region electric capacity need issues, including assessment of the effects of energy efficiency and small scale solar resources on net load projections, and implications for carbon emissions based on regional supply alternatives.
- Analysis of California renewable energy integration issues, local and system capacity requirements and purchases, and related long-term procurement policies.
- Analysis of air emissions and reliability impacts of Indian Point Energy Center retirement.
- Analysis of PJM and MISO wind integration and related transmission planning and resource adequacy issues.
- Analysis of Nova Scotia integrated resource planning policies including effects of potential new hydroelectric supplies from Newfoundland and demand side management impact; analysis of new transmission supplies of Maritimes area energy into the New England region.
- Analysis of Eastern Interconnection Planning Collaborative processes, including modeling structure and inputs assumptions for demand, supply and transmission resources. Expanded analyses of the results of the EIPC Phase II Report on transmission and resource expansion.
- Analysis of need for transmission facilities in Maine, Ontario, Pennsylvania, Virginia, Minnesota.
- Ongoing analysis of wholesale and retail energy and capacity market issues in New Jersey, including assessment of BGS supply alternatives and demand response options.
- Analysis of PJM transmission-related issues, including cost allocation, need for new facilities and PJM's economic modeling of new transmission effects on PJM energy market.
- Ongoing analysis of utility-sponsored energy efficiency programs in Rhode Island as part of the Rhode Island DSM Collaborative; and ongoing analysis of the energy efficiency programs of New Jersey Clean Energy Program (CEP) and various utility-sponsored efficiency programs (RGGI programs).
- Analysis of California renewable integration issues for achieving 33% renewable energy penetration by 2020, especially modeling constructs and input assumptions.
- Analysis of proposals in Maine for utility companies to withdraw from the ISO-NE RTO.
- Analysis of utility planning and demand-side management issues in Delaware.

- Analysis of effect of increasing the system benefits charge (SBC) in Maine to increase procurement of energy efficiency and DSM resources; analysis of impact of DSM on transmission and distribution reinforcement need.
- Evaluation of wind energy potential and economics, related transmission issues, and resource planning in Minnesota, Iowa, Indiana, and Missouri; in particular in relation to alternatives to newly proposed coal-fired power plants in MN, IA and IN.
- Analysis of need for newly proposed transmission in Pennsylvania and Ontario.
- Evaluation of wind energy "firming" premium in BC Hydro Energy Call in British Columbia.
- Evaluation of pollutant emission reduction plans and the introduction of an open access transmission tariff in Nova Scotia.
- Evaluation of the merger of Duke and Cinergy with respect to Indiana ratepayer impacts.
- Review of the termination of a Joint Generation Dispatch Agreement between sister companies of Cinergy.
- Assessment of the potential for an interstate transfer of a DSM resource between the desert southwest and California, and the transmission system impacts associated with the resource.
- Analysis of various transmission system and market power issues associated with the proposed Exelon-PSEG merger.
- Assessment of market power and transmission issues associated with the proposed use of an auction mechanism to supply standard offer power to ComEd native load customers.
- Review and analysis of the impacts of a proposed second 345 kV tie to New Brunswick from Maine on northern Maine customers.

Tabors Caramanis & Associates, Cambridge, MA. *Senior Associate*, 1996 – 2004.

- Provided expert witness testimony on transmission issues in Ontario and Alberta.
- Supported FERC-filed testimony of Dr. Tabors in numerous dockets, addressing various electric transmission and wholesale market issues.
- Analyzed transmission pricing and access policies, and electric industry restructuring proposals in US and Canadian jurisdictions including Ontario, Alberta, PJM, New York, New England, California, ERCOT, and the Midwest. Evaluated and offered alternatives for congestion management methods and wholesale electric market design.
- Attended RTO/ISO meetings, and monitored and reported on continuing developments in the New England and PJM electricity markets. Consulted on New England FTR auction and ARR allocation schemes.

- Evaluated all facets of Ontario and Alberta wholesale market development and evolution since 1997. Offered congestion management, transmission, cross-border interchange, and energy and capacity market design options. Directly participated in the Ontario Market Design Committee process. Served on the Ontario Wholesale Market Design technical panel.
- Member of TCA GE MAPS modeling team in LMP price forecasting projects.
- Assessed different aspects of the broad competitive market development themes presented in the US FERC's SMD NOPR and the application of FERC's Order 2000 on RTO development.
- Reviewed utility merger savings benchmarks, evaluated status of utility generation market power, and provided technical support underlying the analysis of competitive wholesale electricity markets in major US regions.
- Conducted life-cycle utility cost analyses for proposed new and renovated residential housing at US military bases. Compared life-cycle utility cost options for large educational and medical campuses.
- Evaluated innovative DSM competitive procurement program utilizing performance-based contracting.

Charles River Associates, Boston, MA. *Associate*, 1992 – 1996.

Developed DSM competitive procurement RFPs and evaluation plans, and performed DSM process and impact evaluations. Conducted quantitative studies examining electric utility mergers; and examined generation capacity concentration and transmission interconnections throughout the US. Analyzed natural gas and petroleum industry economic issues; and provided regulatory testimony support to CRA staff in proceedings before the US FERC and various state utility regulatory commissions.

Rhode Islanders Saving Energy, Providence, RI. *Senior Commercial/Industrial Energy Specialist*, 1987 – 1992.

Performed site visits, analyzed end-use energy consumption and calculated energy-efficiency improvement potential in approximately 1,000 commercial, industrial, and institutional buildings throughout Rhode Island, including assessment of lighting, HVAC, hot water, building shell, refrigeration and industrial process systems. Recommended and assisted in implementation of energy efficiency measures, and coordinated customer participation in utility DSM program efforts.

Fairchild Weston Systems, Inc., Syosset, NY. *Facilities Engineer*, 1985 – 1986.

Designed space renovations; managed capital improvement projects; and supervised contractors in implementation of facility upgrades.

Narragansett Electric Company, Providence RI. *Supervisor of Operations and Maintenance*, 1981 – 1984.

Directed electricians in operation, maintenance, and repair of high-voltage transmission and distribution substation equipment.

EDUCATION

Boston University, Boston, MA
Master of Arts in Energy and Environmental Studies – Resource Economics, Ecological Economics, Econometric Modeling, 1992

Clarkson University, Potsdam, NY
Bachelor of Science in Mechanical Engineering – Thermal Sciences, 1981

ADDITIONAL EDUCATION

- **Utility Wind Integration Group**: Short Course on Integration and Interconnection of Wind Power Plants into Electric Power Systems, 2006
- **University of Texas at Austin**: Short course in Regulatory and Legal Aspects of Electric Power Systems, 1998
- **Illuminating Engineering Society**: courses in lighting design, 1989
- **Worcester Polytechnic Institute and Northeastern University**: Coursework in Solar Engineering; Building System Controls; and Cogeneration, 1984, 1988 – 1989
- **Polytechnic Institute of New York**: Graduate coursework in Mechanical and Aerospace Engineering, 1985 – 1986

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California Public Utilities Commission (Docket No. A.14-06-014): Testimony examining Southern California Edison (SCE) proposals for Marginal Energy and Capacity Costs in Phase 2 of its 2015 General Rate Case (GRC). On behalf of the California Office of Ratepayer Advocate. Jointly, with Patrick Luckow. February 13, 2015.

California Public Utilities Commission (Docket No. A.14-11-014): Testimony examining Pacific Gas and Electric's Marginal Energy Costs and LOLE Allocation among TOU Periods. Jointly, with Patrick Luckow. On behalf of the California Office of Ratepayer Advocate. May 1, 2015.

California Public Utilities Commission (Docket No. A.14-11-012): Testimony reviewing Southern California Edison 2013 local capacity requirements request for offers for the western Los Angeles Basin, specifically related to storage. On behalf of Sierra Club. March 25, 2015.

California Public Utilities Commission (Docket No. A.14-01-027): Testimony examining San Diego Gas & Electric's proposal to change time-of-use periods in its application for authority to update its electric rate design. Jointly, with Patrick Luckow. On behalf of the California Office of Ratepayer Advocate. November 14, 2014.

California Public Utilities Commission (Docket No. R.12-06-013): Rebuttal testimony regarding the relationship between California investor-owned utilities hourly load profiles under a time-of-use pricing and GHG emissions in the WECC regions in the Order Instituting Rulemaking on the Commission's Own Motion to Conduct a Comprehensive Examination of Investor Owned Electric Utilities' Residential Rate Structures, the Transition to Time Varying and Dynamic Rates, and Other Statutory Obligations. On behalf of the California Office of Ratepayer Advocate. October 17, 2014.

California Public Utilities Commission (Docket No. R.13-12-010): Direct and reply testimony on Phase 1a modeling scenarios in the Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. On behalf of the California Office of Ratepayer Advocate. August 13, 2014, October 22, 2014, and December 18, 2014.

New York State Department of Environmental Conservation (DEC #3-5522-00011/000004; SPDES #NY-0004472; DEC #3-5522-00011/00030; DEC #3-5522-00011/00031): Direct, rebuttal, and surrebuttal testimonies regarding air emissions, electric system reliability, and cost impacts of closed-cycle cooling as the "best technology available" (BTA), and alternative "Fish Protective Outages" (FPO), for the Indian Point nuclear power plant. On behalf of Riverkeeper. February 28, 2014, March 28, 2014, July 11, 2014, June 26, 2015, and August 10, 2015.

California Public Utilities Commission (Docket No. RM.12-03-014): Reply and rebuttal testimony on the topic of local reliability impacts of a potential long-term outage at the San Onofre Nuclear Power Station (SONGS) in Track 4 of the Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. On behalf of the California Office of Ratepayer Advocate. September 30, 2013 and October 14, 2013.

Nova Scotia Utility and Review Board (Matter No. 05522): *Filing to the Nova Scotia Utility and Review Board on Nova Scotia Power's October 15, 2014 Integrated Resource Plan, Key Planning Observations and Action Plan Elements*. On behalf of Board Counsel to the Nova Scotia Utility and Review Board, October 20, 2014. With Rachel Wilson, David White and Tim Woolf.

Nova Scotia Utility and Review Board (Matter No. M05419): Direct examination regarding the report *Economic Analysis of Maritime Link and Alternatives: Complying with Nova Scotia's Greenhouse Gas Regulations, Renewable Energy Standard, and Other Regulations in a Least-Cost Manner for Nova Scotia Power Ratepayers* jointly authored with Rachel Wilson, Nehal Divekar, David White, Kenji Takahashi, and Tommy Vitolo. In the Matter of The Maritime Link Act and In the Matter of An Application by NSP MARITIME LINK INCORPORATED for the approval of the Maritime Link Project. On behalf of Board Counsel to the Nova Scotia Utility and Review Board. June 5, 2013.

Prince Edward Island Regulatory and Appeals Commission (Docket UE30402): Jointly filed expert report with Nehal Divekar analyzing the Proposed Ottawa Street – Bedeque 138 kV Transmission Line Project in the matter of Summerside Electric's Application for the Approval of Transmission Services connecting Summerside Electric's Ottawa Street substation to Maritime Electric Company Limited's Bedeque substation. Oh behalf of the City of Summerside. November 5, 2012.

New Jersey Board of Public Utilities (Docket No. GO12070640): Direct testimony regarding New Jersey Natural Gas Company's petition for approval of the extension of the SAVEGREEN energy efficiency programs. On behalf of the New Jersey Division of the Ratepayer Advocate. October 26, 2012.

California Public Utilities Commission (Docket No. RM.12-03-014): Direct and reply testimony regarding the long-term local capacity procurement requirements for the three California investor-owned utilities in Track 1 of the Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. On behalf of the California Office of Ratepayer Advocate. June 25, 2012 and July 23, 2012.

California Public Utilities Commission (Docket No. A.11-05-023): Supplemental testimony regarding the long-term resource adequacy and resource procurement requirements for the San Diego region in the Application of San Diego Gas & Electric Company (U 902 3) for Authority to Enter into Purchase Power Tolling Agreements with Escondido Energy Center, Pio Pico Energy Center, and Quail Brush Power. On behalf of the California Office of Ratepayer Advocate. May 18, 2012.

New Jersey Board of Public Utilities (Docket No. GO11070399): Direct testimony in the matter of the petition of Pivotal Utility Holdings, Inc. D/B/A Elizabethtown Gas for authority to extend the term of energy efficiency programs with certain modifications and approval of associated cost recovery. On behalf of New Jersey Division of Rate Counsel. December 16, 2011.

New Jersey Board of Public Utilities (Docket No. EO11050309): Direct testimony regarding aspects of the Board's inquiry into capacity and transmission interconnection issues. October 14, 2011.

Federal Energy Regulatory Commission (Docket Nos. EL11-20-000 and ER11-2875-000): Affidavit regarding reliability, status of electric power generation capacity, and current electric power procurement policies in New Jersey. On behalf of New Jersey Division of Rate Counsel. March 4, 2011.

New Jersey Board of Public Utilities (Docket Nos. GR10100761 and ER10100762): Certification before the Board regarding system benefits charge (SBC) rates associated with gas generation in the matter of a generic stakeholder proceeding to consider prospective standards for gas distribution utility rate discounts and associated contract terms. On behalf of New Jersey Division of Rate Counsel. January 28, 2011.

New Jersey Board of Public Utilities (Docket No. ER10040287): Direct testimony regarding Basic Generation Service (BGS) procurement plan for service beginning June 1, 2011. On behalf of New Jersey Division of Rate Advocate. September 2010.

State of Maine Public Utilities Commission (Docket 2008-255): Direct and surrebuttal testimony regarding the non-transmission alternatives analysis conducted on behalf of Central Maine Power in the Application of Central Maine Power Company and Public Service of New Hampshire for a Certificate of Public Convenience and Necessity for the Maine Power Reliability Program Consisting of the Construction of Approximately 350 Miles of 345 and 115 kV Transmission Lines, a $1.55 billion transmission enhancement project. On behalf of the Maine Office of the Public Advocate. January 12, 2009 and February 2, 2010.

Virginia State Corporation Commission (CASE NO. PUE-2009-00043): Direct testimony regarding the need for modeling DSM resources as part of the PJM RTEP planning processes in the Application of Potomac-Appalachian Transmission Highline (PATH) Allegheny Transmission Corporation for CPCN to construct facilities: 765 kV proposed transmission line through Loudoun, Frederick, and Clarke Counties. On behalf of Sierra Club. October 23, 2009.

Pennsylvania Public Utility Commission (Docket number A-2009-2082652): Direct and surrebuttal testimony regarding the need for additional modeling for the proposed Susquehanna-Roseland 500 kv transmission line in portions of Luckawanna, Luzerne, Monroe, Pike, and Wayne counties to include load forecasts, energy efficiency resources, and demand response resources. On behalf of the Pennsylvania Office of Consumer Advocate. June 30, 2009 and August 24, 2009.

Delaware Public Service Commission (Docket No. 07-20): Filed the expert report *Review of Delmarva Power & Light Company's Integrated Resource Plan* jointly authored with Alice Napoleon, William Steinhurst, David White, and Kenji Takahashi In the Matter of Integrated Resource Planning for the Provision of Standard Offer Service by Delmarva Power & Light Company Under 26 DEL. C. §1007 (c) & (d). On behalf of the Staff of Delaware Public Service Commission. April 2, 2009.

New Jersey Board of Public Utilities (Docket No. ER08050310): Direct testimony filed jointly with Bruce Biewald on aspects of the Basic Generation Service (BGS) procurement plan for service beginning June 1, 2009. On behalf of the New Jersey Division of the Ratepayer Advocate. September 29, 2008.

Wisconsin Public Service Commission (Docket 6680-CE-170): Direct and surrebuttal testimony in the matter of the alternative energy options available with wind power, and the effect of the MISO RTO in helping provide capacity and energy to the Wisconsin area reliably without needed the proposed coal plant in the CPCN application by Wisconsin Power and Light for construction of a 300 MW coal plant. On behalf of Clean Wisconsin. August 11, 2008 and September 15, 2008.

Ontario Energy Board (Docket EB-2007-0707): Direct testimony regarding issues associated with the planned levels of procurement of demand response, combined heat and power, and NUG resources as part of Ontario Power Authority's long-term integrated planning process in the Examination and Critique of Demand Response and Combined Heat and Power Aspects of the Ontario Power Authority's Integrated Power System Plan and Procurement Process. On behalf of Pollution Probe. August 1, 2008.

Ontario Energy Board (Docket EB-2007-0050): Direct and supplemental testimony filed jointly with Peter Lanzalotta regarding issues of congestion (locked-in energy) modeling, need, and series

compensation and generation rejection alternatives to the proposed line of in the matter of Hydro One Networks Inc.'s application to construct a new 500 kV transmission line between the Bruce Power complex and the town of Milton, Ontario. On behalf of Pollution Probe. April 18, 2008 and May 15, 2008.

Federal Energy Regulatory Commission (Dockets ER06-456, ER06-954, ER06-1271, ER07-424, EL07-57, ER06-880, et al.): Direct and rebuttal testimony addressing merchant transmission cost allocation issues on PJM Regional Transmission Expansion Plan (RTEP) Cost Allocation issues. On behalf of the New Jersey Division of the Ratepayer Advocate. January 23, 2008 and April 16, 2008.

State of Maine Public Utilities Commission (Docket No. 2006-487): Pre-file and surrebuttal testimony on the ability of DSM and distributed generation potential to reduce local supply area reinforcement needs in the matter of the Analysis of Central Maine Power Company Petition for a Certificate of Public Convenience and Necessity to Build a 115 kV Transmission Line between Saco and Old Orchard Beach. On behalf of Maine Office of the Public Advocate. February 27, 2007 and January 10, 2008.

Minnesota Public Utilities Commission (OAH No. 12-2500-17037-2 and OAH No. 12-2500-17038-2; and MPUC Dkt. Nos. CN-05-619 and TR-05-1275): Supplemental testimony and supplemental rebuttal testimony on applicants' estimates of DSM savings in the Certificate of Need proceeding for the Big Stone II coal-fired power plant proposal In the Matter of the Application by Otter Tail Power Company and Others for Certification of Transmission Facilities in Western Minnesota and In the Matter of the Application to the Minnesota Public Utilities Commission for a Route Permit for the Big Stone Transmission Project in Western Minnesota. On behalf of Fresh Energy, Izaak Walton League of America – Midwest Office, Wind on the Wires, Union of Concerned Scientists, Minnesota Center for Environmental Advocacy. December 8, 2006 and December 21, 2007.

Pennsylvania Public Utility Commission (Docket Nos. A-110172 *et al*.): Direct testimony on the effect of demand-side management on the need for a transmission line and the level of consideration of potential carbon regulation on PJM's analysis of need for the TrAIL transmission line. On behalf of the Pennsylvania Office of Consumer Advocate. October 31, 2007.

Iowa Public Utilities Board (Docket No. GCU-07-01): Direct testimony regarding wind energy assessment in Interstate Power and Light's resource plans and its relationship to a proposed coal plant in Iowa. On behalf of Iowa Office of the Consumer Advocate. October 21, 2007.

New Jersey Board of Public Utilities (Docket No. EO07040278): Direct testimony on certain aspects of PSE&G's proposal to use ratepayer funding to finance a solar photovoltaic panel initiative in support of the State's solar RPS. September 21, 2007.

Indiana Utility Regulatory Commission (Cause No. 43114): Direct testimony on the topic of a proposed Duke – Vectren IGCC coal plant and wind power potential in Indiana. On behalf of Citizens Action Coalition of Indiana. May 14, 2007.

British Columbia Utilities Commission: Pre-filed evidence regarding the "firming premium" associated with 2006 Call energy, liquidated damages provisions, and wind integration studies In the Matter of BC Hydro 2006 Integrated Electricity Plan and Long Term Acquisition Plan. On behalf of the Sierra Club (BC Chapter), Sustainable Energy Association of BC, and Peace Valley Environment Association. October 10, 2006.

Maine Joint Legislative Committee on Utilities, Energy and Transportation (LD 1931): Testimony regarding the costs and benefits of increasing the system benefits charge to increase the level of energy efficiency installations by Efficiency Maine before in support of an Act to Encourage Energy Efficiency. On behalf of the Maine Natural Resources Council and Environmental Defense. February 9, 2006.

Nova Scotia Utility and Review Board: Direct testimony and supplemental evidence regarding the approval of the installation of a flue gas desulphurization system at Nova Scotia Power Inc.'s Lingan station and a review of alternatives to comply with provincial emission regulations In The Matter of an Application by Nova Scotia Power Inc. for Approval of Air Emissions Strategy Capital Projects and The Public Utilities Act, R.S.N.S., 1989, c. 380, as amended. On behalf of Nova Scotia Utility and Review Board Staff. January 30, 2006.

New Jersey Board of Public Utilities (BPU Docket EM05020106): Joint direct and surrebuttal testimony with Bruce Biewald and David Schlissel regarding the Joint Petition Of Public Service Electric and Gas Company And Exelon Corporation For Approval of a Change in Control Of Public Service Electric and Gas Company And Related Authorizations. On behalf of New Jersey Division of the Ratepayer Advocate. November 14, 2005 and December 27, 2005.

Indiana Utility Regulatory Commission (Cause No. 42873): Direct testimony addressing the proposed Duke – Cinergy merger. On behalf of Citizens Action Coalition of Indiana. November 8, 2005.

Indiana Utility Regulatory Commission (Causes No. 38707 FAC 61S1, 41954, and 42359-S1): Responsive testimony addressing a proposed Settlement Agreement between PSI and other parties in respect of issues surrounding the Joint Generation Dispatch Agreement in place between PSI and CG&E. On behalf of Citizens Action Coalition of Indiana. August 31, 2005.

Illinois Commerce Commission (Dockets 05-0160, 05-0161, 05-0162): Direct and rebuttal testimony addressing wholesale market aspects of Ameren's proposed competitive procurement auction (CPA). On behalf of Illinois Citizens Utility Board. June 15, 2005 and August 10, 2005.

Illinois Commerce Commission (Docket 05-0159): Direct and rebuttal testimony addressing wholesale market aspects of Commonwealth Edison's proposed BUS (Basic Utility Service) competitive auction procurement. On behalf of Illinois Citizens Utility Board and Cook County State's Attorney's Office. June 8, 2005 and August 3, 2005.

State of Maine Public Utilities Commission (Docket No. 2005-17): Joint testimony with David Schlissel and Peter Lanzalotta regarding an Analysis of Eastern Maine Electric Cooperative, Inc.'s Petition for a Finding of Public Convenience and Necessity to Purchase 15 MW of Transmission Capacity from New

Brunswick Power and for Related Approvals. On behalf of Maine Office of the Public Advocate. July 19, 2005.

Indiana Utility Regulatory Commission (Cause No. 38707 FAC 61S1): Direct testimony in a Fuel Adjustment Clause (FAC) proceeding concerning the pricing aspects and merits of continuation of the Joint Generation Dispatch Agreement in place between PSI and CG&E, and related issues of PSI lost revenues from inter-company energy pricing policies. On behalf of Citizens Action Coalition of Indiana. May 23, 2005.

Indiana Utility Regulatory Commission (Cause No. 41954): Direct testimony concerning the pricing aspects and merits of continuation of the Joint Generation Dispatch Agreement in place between PSI and CG&E. On behalf of Citizens Action Coalition of Indiana. April 21, 2005.

State of Maine Public Utilities Commission (Docket No. 2004-538): Joint testimony with David Schlissel and Peter Lanzalotta regarding an Analysis of Maine Public Service Company Request for a Certificate of Public Convenience and Necessity to Purchase 35 MW of Transmission Capacity from New Brunswick Power. On behalf of Maine Office of the Public Advocate. April 14, 2005.

Nova Scotia Utility and Review Board (Order 888 OATT): Testimony regarding various aspects of OATTs and FERC's *pro forma* In The Matter of an Application by Nova Scotia Power Inc. for Approval of an Open Access Transmission Tariff (OATT). On behalf of the Nova Scotia Utility Review Board Staff. April 5, 2005.

Texas Public Utilities Commission (Docket No. 30485): Testimony regarding excess mitigation credits associated with CenterPoint's stranded cost recovery in the Application of CenterPoint Energy Houston Electric, LLC. for a Financing Order. On behalf of the Gulf Coast Coalition of Cities. January 7, 2005.

Ontario Energy Board (RP-2002-0120): Filed testimony and reply comments reviewing the Transmission System Code (TSC) and Related Matters, Detailed Submission to the Ontario Energy Board in Response To Phase I Questions Concerning the Transmission System Code and Related Matters. On behalf of TransAlta Corporation. October 31, 2002 and November 21, 2002.

Alberta Energy and Utilities Board (Application No. 2000135): Filed joint testimony with Dr. Richard D. Tabors in the matter of the Transmission Administrator's 2001 Phase I and Phase II General Rate Application pertaining to Supply Transmission Service charge proposals. On behalf of Alberta Buyers Coalition. March 28, 2001.

Ontario Energy Board (RP-1999-0044): Testimony critiquing Ontario Hydro Networks Company's Transmission Tariff Proposal and Proposal for Alternative Rate Design. On behalf of the Independent Power Producer's Society of Ontario. January 17, 2000.

Massachusetts Department of Public Utilities (Docket # DPU 95-2/3-CC-I): Filed a report (Fagan R., G. Watkins. 1995. *Sampling Issues in Estimating DSM Savings: An Issue Paper for Commonwealth Electric*. Charles River Associates). On behalf of COM/Electric System. April 1995.

Massachusetts Department of Public Utilities (Docket # DPU 95-2/3-CC-I): Filed initial and updated reports (Fagan R., P. Spinney, G. Watkins. 1994. *Impact Evaluation of Commonwealth Electric's Customized Rebate Program*. Charles River Associates. Updated April 1996). April 1994 and April 1995.

Resume dated January 2017

Tyler Comings, Senior Associate

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Senior Associate,* July 2014 – present, *Associate*, July 2011 – July 2014.

Conducts research on energy system planning and coal plant economics, and performs economic modeling and analysis in support of a wide range of projects. Performs economic impact and benefit-cost analyses, statistical modeling, and research on environmental issues. Conducts economic impact analyses using models such as REMI and IMPLAN.

Ideas42, Boston, MA. *Senior Associate*, 2010 – 2011.

Organized studies analyzing behavior of consumers regarding finances, and worked with top researchers in behavioral economics. Managed implementation and data analysis for a study of mitigation of default for borrowers that were at-risk of delinquency. Performed case studies for World Bank on financial innovations in developing countries.

Economic Development Research Group Inc., Boston, MA. *Research Analyst*, *Economic Consultant*, 2005 – 2010.

Performed economic impact modeling and benefit-cost analyses using IMPLAN and REMI for transportation and renewable energy projects, including support for Federal stimulus applications. Performed statistical modeling, including results on the timing of effects of highway construction on economic growth in Appalachia. Developed a unique Web-tool for the National Academy of Sciences on linkages between economic development and transportation, and presented findings to state government officials around the country. Created economic development strategies and improvements to company's economic development software tool.

Harmon Law Offices, LLC., Newton, MA. *Billing Coordinator, Accounting Liaison*, 2002 – 2005.

Allocated IOLTA and Escrow funds, performed bank reconciliation and accounts receivable. Projected legal fees and costs for cases at the firm.

Massachusetts Department of Public Health, Boston, MA. *Data Analyst* (contract), 2002.

Designed statistical programs using SAS based on data taken from health-related surveys. Extrapolated trends in health awareness and developed benchmarks for performance of clinics and other healthcare facilities for statewide assessment.

EDUCATION

Tufts University, Medford, MA
Master of Arts in Economics, 2007

Boston University, Boston, MA
Bachelor of Arts in Mathematics and Economics, 2002. *Cum Laude*, Dean's Scholar.

ADDITIONAL SKILLS

Software: MS Office, STATA, SPSS, SAS, REMI, IMPLAN, Mathematica
Programming: C++
Languages: Conversant in French

PUBLICATIONS

Comings, T., A. Allison. 2017. *More Mileage for Your Money: Fuel Economy Increases While Vehicle Prices Remain Stable*. Synapse Energy Economics for Consumers Union.

Cook, R., J. Koo, N. Veilleux, K. Takahashi, E. Malone, T. Comings, A. Allison, F. Barclay, L. Beer. 2017. *Rhode Island Renewable Thermal Market Development Strategy*. Meister Consultants Group and Synapse Energy Economics for Rhode Island Office of Energy Resources.

Fisher, J., P. Luckow, A. Horowitz, T. Comings, A. Allison, E.A. Stanton, S. Jackson, K. Takahashi. 2016. *Michigan Compliance Assessment for the Clean Power Plan: MPSC/MDEQ EPA 111(d) Impact Analysis*. Prepared for Michigan Public Service Commission, Michigan Department of Environmental Quality, and Michigan Agency for Energy.

Comings, T., S. Jackson, J. Fisher. 2016. *The Economic Case for Retiring North Valmy Generating Station*. Synapse Energy Economics for Sierra Club.

Comings, T., Allison, A., Ackerman, F. 2016. *Higher Fuel Economy Standards Result in Big Savings for Consumers*. Synapse Energy Economics for Consumers Union.

Jackson, S., P. Luckow, E.A. Stanton, A. Horowitz, P. Peterson, T. Comings, J. Daniel, and T. Vitolo. 2016. *Reimagining Brayton Point: A Guide to Assessing Reuse Options for the Somerset Community*. Synapse Energy Economics for Coalition for Clean Air South Coast, Clean Water Action, and Toxics Action Center.

Stanton, E. A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, K. Takahashi. 2016. *The RGGI Opportunity 2.0: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets.* Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network.

Stanton, E. A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, K. Takahashi. 2016. *The RGGI Opportunity: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate*

Targets. Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network.

Ackerman, F., T. Comings. 2015. *Employment after Coal: Creating New Jobs in Eastern Kentucky*. Synapse Energy Economics for the Mountain Association for Community Economic Development.

Vitolo, T., M. Chang, T. Comings, A. Allison. 2015. *Economic Benefits of the Proposed Coolidge Solar I Solar Project*. Synapse Energy Economics for Coolidge Solar I, LLC.

Wilson, R., T. Comings, E. A. Stanton. 2015. *Analysis of the Tongue River Railroad Draft Environmental Impact Statement.* Synapse Energy Economics for Sierra Club and Earthjustice.

Synapse Energy Economics, Labor Network for Sustainability and 350.org. 2015. *The Clean Energy Future: Protecting the Climate, Creating Jobs, and Saving Money.*

Fisher, J., T. Comings, F. Ackerman, S. Jackson. 2015. *Clearing Up the Smog: Debunking Industry Claims that We Can't Afford Healthy Air.* Synapse Energy Economics for Earthjustice.

Stanton, E. A., T. Comings, S. Jackson, E. Karaca. 2015. *Atlantic Coast Pipeline Benefits Review.* Synapse Energy Economics for Southern Environmental Law Center.

Daniel, J. A. Napoleon, T. Comings, S. Fields. 2015. *Comments on Entergy Louisiana's 2015 Integrated Resource Plan*. Synapse Energy Economics for Sierra Club.

Comings, T., S. Jackson, K. Takahashi. 2015. *Comments on Indianapolis Power & Light Company's 2014 Integrated Resource Plan*. Synapse Energy Economics for the Sierra Club.

Takahashi, K., T. Comings, A. Napoleon. 2014. *Maximizing Public Benefit through Energy Efficiency Investments.* Synapse Energy Economics for Sierra Club.

Comings, T., S. Fields, K. Takahashi, G. Keith. 2014. *Employment Effects of Clean Energy Investments in Montana.* Synapse Energy Economics for Montana Environmental Information Center and Sierra Club.

Daniel, J., T. Comings, J. Fisher. 2014. *Comments on Preliminary Assumptions for Cleco's 2014/2015 Integrated Resource Plan.* Synapse Energy Economics for Sierra Club.

Comings, T., J. Daniel, P. Knight, T. Vitolo. 2014. *Air Emission and Economic Impacts of Retiring the Shawnee Fossil Plant.* Synapse Energy Economics for the Kentucky Environmental Foundation.

Fisher, J., T. Comings, D. Schlissel. 2014. *Comments on Duke Energy Indiana's 2013 Integrated Resource Plan*. Synapse Energy Economics and Schlissel Consulting for Mullet & Associates, Citizens Action Coalition of Indiana, Earthjustice, and Sierra Club.

Comings, T., K. Takahashi, G. Keith. 2013. *Employment Effects of Investing in Select Electricity Resources in Washington State.* Synapse Energy Economics for Sierra Club.

Stanton, E. A., T. Comings, K. Takahashi, P. Knight, T. Vitolo, E. Hausman. 2013. *Economic Impacts of the NRDC Carbon Standard.* Synapse Energy Economics for Natural Resources Defense Council (NRDC).

Ackerman, F., T. Comings, P. Luckow. 2013. *A Review of Consumer Benefits from a Corporate Average Fuel Economy (CAFE) Standards.* Synapse Energy Economics for Consumer Union.

Comings, T., P. Knight, E. Hausman. 2013. *Midwest Generation's Illinois Coal Plants: Too Expensive to Compete? (Report Update)*. Synapse Energy Economics for Sierra Club.

Stanton, E. A., F. Ackerman, T. Comings, P. Knight, T. Vitolo, E. Hausman. 2013. *Will LNG Exports Benefit the United States Economy?* Synapse Energy Economics for Sierra Club.

Vitolo, T., G. Keith, B. Biewald, T. Comings, E. Hausman, P. Knight. 2013. *Meeting Load with a Resource Mix Beyond Business as Usual: A regional examination of the hourly system operations and reliability implications for the United States electric power system with coal phased out and high penetrations of efficiency and renewable generating resources.* Synapse Energy Economics for Civil Society Institute.

Keith, G., S. Jackson, A. Napoleon, T. Comings, J. Ramey. 2012. *The Hidden Costs of Electricity: Comparing the Hidden Costs of Power Generation Fuels.* Synapse Energy Economics for Civil Society Institute.

Fagan, R., M. Chang, P. Knight, M. Schultz, T. Comings, E. Hausman, R. Wilson. 2012 *The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region.* Synapse Energy Economics for Energy Future Coalition.

Bower, S., S. Huntington, T. Comings, W. Poor. 2012. *Economic Impacts of Efficiency Spending in Vermont: Creating an Efficient Economy and Jobs for the Future*. Optimal Energy, Synapse Energy Economics, and Vermont Department of Public Service for American Council for an Energy-Efficient Economy (ACEEE).

Comings, T., E. Hausman. 2012. *Midwest Generation's Illinois Coal Plants: Too Expensive to Compete?* Synapse Energy Economics for Sierra Club.

Woolf, T., J. Kallay, E. Malone, T. Comings, M. Schultz, J. Conyers. 2012. *Commercial & Industrial Customer Perspectives on Massachusetts Energy Efficiency Programs*. Synapse Energy Economics for Massachusetts Energy Efficiency Advisory Council.

Hornby, R., T. Comings. 2012. *Comments on Draft 2012 Integrated Resource Plan for Connecticut (January 2012)*. Synapse Energy Economics for AARP.

Hornby, R., D. White, T. Vitolo, T. Comings, K. Takahashi. 2012. *Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky*. Synapse Energy Economics for Mountain Association for Community Economic Development and the Kentucky Sustainable Energy Alliance.

Hausman, E., T. Comings, G. Keith. 2012. *Maximizing Benefits: Recommendations for Meeting Long-Term Demand for Standard Offer Service in Maryland*. Synapse Energy Economics for Sierra Club.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2011. *Toward a Sustainable Future for the U.S. Power Sector: Beyond Business as Usual 2011*. Synapse Energy Economics for Civil Society Institute.

Hausman, E., T. Comings, K. Takahashi, R. Wilson, W. Steinhurst, N. Hughes, G. Keith. 2011. *Electricity Scenario Analysis for the Vermont Comprehensive Energy Plan 2011*. Synapse Energy Economics for the Vermont Department of Public Service.

Steinhurst, W., T. Comings. 2011. *Economic Impacts of Energy Efficiency Investments in Vermont*. Synapse Energy Economics for the Vermont Department of Public Service.

Petraglia, L., T. Comings, G. Weisbrod. 2010. *Economic Development Impacts of Energy Efficiency and Renewable Energy in Wisconsin*. Economic Development Research Group and PA Consulting Group for Wisconsin Department of Administration.

Economic Development Research Group. 2009. *Economic Assessment of Proposed Brockton Power Facility*. Prepared for Brockton Power Company.

Economic Development Research Group and KEMA NV. 2009. *Economic Benefits of Connecticut's Clean Energy Program*. Prepared for the Connecticut Clean Energy Fund.

Howland, J., D. Murrow, L. Petraglia, T. Comings. 2009. *Energy Efficiency: Engine of Economic Growth in Eastern Canada*. Economic Development Research Group and Environment Northeast.

Economic Development Research Group and KEMA NV. 2008. *New York Renewable Portfolio Standard: Economic Benefits Report*. Prepared for New York State Energy Research and Development (NYSERDA).

Economic Development Research Group and Navigant Consulting. 2008. *Economic Potential of an Advanced Biofuels Sector in Massachusetts*. Prepared for the Massachusetts Office of Energy and Environmental Affairs.

Economic Development Research Group. 2006. *Environmental Impacts of Massachusetts Turnpike and Central Artery/Tunnel Projects*. Prepared for the Massachusetts Turnpike Authority.

TESTIMONY

Ohio Public Utilities Commission (Cases No. 16-0395-EL-SSO, 16-396-EL-ATA, and 16-397-EL-AAM): Direct testimony regarding Dayton Power & Light's proposed Distribution Modernization Rider and the value of the Company's coal fleet. On behalf of Sierra Club. November 21, 2016.

Oklahoma Corporation Commission (Cause No. PUD 201600059): Responsive and rebuttal testimony evaluating the economics of Oklahoma Gas & Electric's application to install dry scrubbers at the Sooner generating facility. On behalf of Sierra Club. March 14, 2016 and March 23, 2016.

Hawaii Public Utilities Commission (Docket No. 2015-0022): Direct and rebuttal testimony on the economic impacts of the proposed merger of NextEra Corporation and Hawaiian Electric Companies (HECO). On behalf of the Hawaii Division of Consumer Advocacy. August 10, 2015 and October 7, 2015.

Ohio Public Utilities Commission (Case No. 14-1297-EL-SSO): Direct, supplemental and rehearing testimony evaluating the assumptions and analysis used by FirstEnergy Ohio in support of its application for approval of an electric security plan and related Retail Rate Stability Rider. On behalf of Sierra Club.

December 22, 2014, supplemental (May 11, 2015, October 13, 2015 and December 30, 2015) and rehearing June 22, 2016.

Oklahoma Corporation Commission (Cause No. PUD 201400229): Direct and rebuttal testimony evaluating the assumptions in the analysis supporting Oklahoma Gas & Electric's request for authorization and cost recovery of a Clean Air Act compliance plan and Mustang modernization. On behalf of Sierra Club. December 16, 2014 and January 26, 2015.

Maryland Public Service Commission (Case No. 9361): Direct and surrebuttal testimony on the economic impact analysis filed by Exelon Corporation and Pepco Holdings, Inc. in their joint petition for the merger of the two entities. On behalf of the Maryland Office of the People's Counsel. December 8, 2014 and January 21, 2015.

State of New Jersey Board of Public Utilities (Docket No. EM14060581): Direct testimony on the economic impact analysis filed by Exelon Corporation and Pepco Holdings, Inc. in their joint petition for the merger of the two entities. On behalf of the New Jersey Division of Rate Counsel. November 14, 2014.

District of Columbia Public Service Commission (Formal Case No. 1119): Direct and answer testimony evaluating the economic impact analysis of the proposed Exelon-Pepco merger. On behalf of the District of Columbia Government. November 3, 2014 and March 20, 2015.

Kentucky Public Service Commission (Case No. 2013-00259): Direct and supplemental testimony regarding East Kentucky Power Cooperative's Application for Cooper Station Retrofit and Environmental Surcharge Cost Recovery. On behalf of Sonia McElroy and Sierra Club. November 27, 2013 and December 27, 2013.

Indiana Utility Regulatory Commission (Cause No. 44339): Direct testimony in the Matter of Indianapolis Power & Light Company's Application for a Certificate of Public Convenience and Necessity for the Construction of a Combined Cycle Gas Turbine Generation Facility. On behalf of Citizens Action Coalition of Indiana. August 22, 2013.

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