
BEFORE THE NOVA SCOTIA UTILITY AND REVIEW BOARD

In the Matter of an Application by NSPI to Implement an
Advanced Meter Infrastructure Pilot/CI47124
(NSUARB M07767)

**Evidence of
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**On Behalf of
Counsel to the Nova Scotia Utility and Review Board**

On the Topic of the NSPI Advanced Meter Infrastructure Pilot

February 16, 2017

Table of Contents

1.	Introduction and Qualifications.....	1
2.	Summary of Conclusions and Recommendations.....	3
3.	Background	4
4.	The pilot is inappropriate for the decision-making process	5
5.	The cost-benefit analysis is flawed, is not well documented, and does not perform sensitivity analysis on key inputs and assumptions	14
6.	Pre-approval of the Pilot is not necessary	22
7.	Conclusions and recommendations	23
	Appendix A: Resume.....	25

1 **1. INTRODUCTION AND QUALIFICATIONS**

2 **Q. Please state your name, title, and employer.**

3 A. My name is Alice Napoleon. I am a Senior Associate at Synapse Energy Economics
4 (“Synapse”), located at 485 Massachusetts Avenue, Cambridge, MA 02139.

5 **Q. Please describe Synapse Energy Economics.**

6 A. Synapse is a research and consulting firm specializing in electricity and gas industry
7 regulation, planning, and analysis. Our work covers a range of issues including integrated
8 resource planning; economic and technical assessments of energy resources; electricity
9 market modeling and assessment; energy efficiency policies and programs; renewable
10 resource technologies and policies; and climate change strategies. Synapse works for a
11 wide range of clients including attorneys general, offices of consumer advocates, public
12 utility commissions, environmental groups, and federal clients such as the U.S.
13 Environmental Protection Agency and the Department of Justice. Synapse has a
14 professional staff of 30 with extensive experience in the electricity industry.

15 **Q. Please summarize your professional and educational experience.**

16 A. Since joining Synapse in 2005, I have provided economic and policy analysis of electric
17 systems and emissions regulations, with a focus on energy efficiency policies and
18 programs, on behalf of a diverse set of clients throughout the United States and in
19 Canada.

20 Before joining Synapse, I worked at Resource Insight, Inc., where I supported
21 investigations of electric, gas, steam, and water resource issues, primarily in the context
22 of reviews by state utility regulatory commissions.

23 I hold a Master’s in Public Administration from the University of Massachusetts at
24 Amherst and a Bachelor’s in Economics from Rutgers University. My resume is attached
25 as Appendix A.

26 **Q. Please describe your professional experience as it relates to Advanced Metering
27 Infrastructure.**

28 A. Last year, I reviewed and provided critical analysis of Rockland Electric Company’s
29 proposal to implement advanced metering infrastructure (AMI) throughout its New

1 Jersey service territory in support of Tim Woolf’s testimony before the New Jersey Board
2 of Public Utilities. I am familiar with AMI developments and deployments in New York,
3 Hawaii, Maryland, Colorado, and Vermont.

4 **Q. Please describe your professional experience as it relates to cost-benefit analysis.**

5 A. I have significant experience with cost-benefit analysis (CBA) of policies, with a focus
6 on energy efficiency programs. In Colorado, Maryland, and South Carolina, I facilitated
7 and provided expert analysis on program costs and benefits of demand-side resource
8 policy working groups. On the national level, I led the team that developed a cost-
9 effectiveness calculator, provided guidance on program design, and developed
10 communications materials and case studies to help state and utility energy efficiency
11 program administrators with implementing offerings to support participation in the U.S.
12 Department of Energy’s Superior Energy Performance program.

13 Since 2009, I have provided extensive and ongoing expert analysis and support for the
14 State of New Jersey regarding its state- and utility-administered energy efficiency and
15 combined heat and power programs. In over a dozen dockets regarding utility-
16 administered efficiency programs, I have conducted expert analysis, provided litigation
17 support, and drafted testimony when appropriate on behalf of the State with respect to a
18 number of issues, including energy efficiency CBA, program implementation, and
19 overlap between utility- and state-administered programs.

20 **Q. Please describe your professional experience with Nova Scotia energy policy.**

21 A. I am very familiar with the energy regulatory environment in Nova Scotia, particularly
22 with respect to demand-side management programs. In Nova Scotia, I provided evidence
23 in Case No. M06247 on behalf of the Nova Scotia Utility and Review Board, regarding
24 the 2015 Demand-Side Management Plan. Further, I supported Tim Woolf in Case No.
25 M06733 regarding EfficiencyOne's 2016 to 2018 demand-side management plan.

26 **Q. On whose behalf are you providing evidence in this case?**

27 A. I am providing evidence on behalf of Counsel to the Nova Scotia Utility and Review
28 Board (“Board”).

1 **Q. What is the purpose of this evidence?**

2 A. The purpose of this evidence is to assess Nova Scotia Power's (NSPI's or the
3 Company's) proposed AMI pilot, describe and present my concerns with it, and to
4 provide recommendations to the Board.

5 **2. Summary of Conclusions and Recommendations**

6 **Q. Please summarize your primary conclusions.**

7 A. I make the following findings:

- 8 • As designed, NSPI's proposed pilot will not accomplish the Company's stated goals,
9 nor will it be likely to provide a solid basis for determining whether the costs and
10 benefits associated with AMI justify a full rollout.
- 11 • The design of the Company's request for proposals (RFP) suggests that the pilot is a
12 phase of a larger AMI roll out rather than a true pilot designed to inform stakeholders
13 whether to proceed with full implementation.
- 14 • The CBA in support of the full rollout is premature, flawed, is not well documented,
15 and does not perform sensitivity analysis on key inputs and assumptions.

16 **Q. Please summarize your primary recommendations.**

17 A. I offer the following recommendations:

- 18 • The UARB should not approve NSPI's current pilot application based on the current
19 record of evidence. Instead, the Board should provide an opportunity for additional
20 inquiry into the current proposal and for the Company to modify the application to
21 address deficiencies identified herein. If the Company is convinced of the merits of its
22 AMI pilot, NSPI could decide to pursue AMI at risk to its shareholders rather than to
23 ratepayers. Furthermore, if the Company decides to proceed with the pilot having made
24 the changes I suggest in the body of this evidence (or proceeds on its own without Board
25 approval), NSPI should consider whether additional changes to the pilot design and
26 implementation are needed to maximize its learning from the pilot to support the possible
27 filing for full AMI deployment, and should expect that stakeholders will take keen
28 interest in what is learned.

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- 1 • Any future filing by NSPI with respect to AMI should include a comprehensive
2 business case justification, which includes a CBA that has been corrected consistent
3 with the recommendations in this evidence. It should also clearly demonstrate net
4 benefits after making adjustments to account for issues flagged in this evidence.
5 Further, it should provide details on the following:
- 6 ○ how NSPI will coordinate with E1
7 ○ programs that NSPI will implement to encourage customers to save energy and
8 reduce coincident peak demand
9 ○ assumptions underlying the CBA (e.g. participation rates, capacity value)
10 ○ lessons learned from the pilot, and how full implementation is likely to differ
11 from pilot implementation
12 ○ how/whether benefits will flow through to customers
- 13 • If the UARB decides to approve the pilot, improvements should be made to inform
14 the NSUARB’s decision consistent with the recommendations made in the body of
15 this evidence.

16 **3. BACKGROUND**

17 **Q. Please describe the Company’s proposal.**

18 A. On November 18, 2016, NSPI filed its AMI Pilot Project Application (“application” or
19 “proposal”) before the Board. In the application, NSPI requests Board approval of a
20 capital work order (CI 47124) for a proposed \$8.2 million pilot to deploy advanced (or
21 “smart”) meters to up to 1,000 targeted customers.¹ NSPI anticipates that, by the end of
22 the pilot, it will have an economic analysis for a full AMI deployment using confirmed
23 costs and benefits; a customer experience and communications plan that reflects feedback
24 from pilot participants; and an operational plan to extend the use of AMI meters to all
25 customers.²

¹ NSPI Application, at 4-5.

² Ibid.

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- 1 4. The proposed network for the pilot is not consistent with the network that may be
2 required for full implementation.
- 3 5. The design of the Company’s RFP suggests that the pilot is a phase of a larger
4 AMI roll out rather than a true pilot designed to inform whether to proceed with
5 full implementation.
- 6 6. The size of the pilot program has not been adequately justified.

7 Each of these issues are discussed in the remainder of this section.

8 ***The pilot period is too short and does not cover the period of highest system demand***

9 **Q. What is the proposed duration of the pilot?**

10 A. NSPI states that the duration of the pilot is one year.⁶ However, the pilot program cannot
11 begin until the receipt of advanced metering infrastructure and technology, which would
12 not occur until March 2017 at the earliest, while the application for a full rollout is
13 expected in September 2017.⁷ This leaves only about six months to implement the pilot,
14 evaluate the results, and use those results to inform the decisions regarding the proposed
15 full rollout. It is noteworthy that this window for collection of data that will be included
16 in the regulatory filing for the full rollout would not cover the winter season, when
17 NSPI’s system peaks.⁸

18 **Q. Do you have concerns with the proposed pilot schedule?**

19 A. Yes. In my opinion, the window for data collection would be too short. Further, I am
20 concerned that it would not cover the system peak.

21 **Q. Please explain your concerns with the proposed pilot schedule.**

22 A. The window for data collection during the proposed pilot would not provide sufficient
23 time or cover the most critical time of the year to enable evaluation of three key
24 categories of benefits: (1) bill alert savings, (2) better load balancing, and (3) faster
25 outage restoration and avoided truck rolls.

⁶ Response to CA IR-6.

⁷ Response to Synapse IR-13.

⁸ Nova Scotia Power 2016. 10 Year System Outlook: 2016 Report, p. 8.

1 **Q. Please describe the benefits that can be attained through implementation of bill**
2 **alerts.**

3 A. Bill alerts would notify customers when they are close to budget and could, consistent
4 with the example of a bill alert shown in Appendix A of the Application, provide
5 customers with comparisons to their usage from a comparable historical period.⁹ Usage
6 comparisons can be designed to enable and motivate customers to manage their
7 electricity consumption. This would provide system benefits such as avoided energy and
8 capacity.

9 **Q. Why is the proposed pilot data collection window insufficient to evaluate bill alert**
10 **benefits?**

11 A. As designed, pilot data collection prior to the full deployment filing would only occur
12 over the spring and summer seasons, and would not allow for the evaluation of energy
13 and demand savings during the winter peak period. This is a critical flaw in the design of
14 the pilot, as projected loads during the winter peak drive system resource planning. The
15 length and timing of the proposed pilot will leave a large gap in the data for the economic
16 analysis, during the period of the highest system demand.

17 **Q. What are the benefits associated with better load balancing?**

18 A. NSPI contends that AMI may provide benefits associated with better load balancing,
19 including operations and maintenance (O&M) savings and avoided capacity costs.¹⁰
20 Although NSPI did not describe these benefits, presumably they arise from being able to
21 more precisely and efficiently respond to system needs in real-time or near-real time, and
22 by reducing wear and tear on the system by responding to stresses more quickly.

23 **Q. Why is the proposed pilot data collection period insufficient to evaluate benefits**
24 **associated with better load balancing?**

25 A. As with bill alerts, the proposed span of pilot data collection to inform the full
26 deployment economic analysis does not include system peak. This will undermine efforts
27 to estimate load balancing benefits.

⁹ NSPI Application at 7; Appendix A at 1.

¹⁰ Response to CA IR-67 Attachment 1.

1 **Q. What are the benefits associated with AMI-enabled power status checks?**

2 A. NSPI contends that AMI-enabled power status checks can provide confirmation of power
3 for faster outage restoration and avoided truck and personnel deployments to verify
4 service status.¹¹

5 **Q. Why is the proposed pilot data collection window insufficient to evaluate benefits**
6 **associated with power status checks?**

7 A. NSPI's proposed schedule for concluding the pilot project and implementing full-scale
8 deployment might not allow enough time to assess the impact of the pilot project on these
9 costs, since the Company will not collect a full year's worth of outage events. While
10 major events may occur throughout the year, the performance of the pilot project over a
11 winter season is likely to provide valuable information for the Company to integrate
12 during full deployment.

13 **Q. Please summarize your conclusions regarding the length and timing of the proposed**
14 **AMI pilot for enabling quantification of benefits associated with bill alerts, load**
15 **balancing, outage restoration and avoided truck rolls.**

16 A. As proposed, the usefulness of the pilot is limited by its length and timing. It will not
17 yield information on the magnitude of these benefits and costs at the time of highest
18 system demand. The data from the pilot cannot be assumed to represent the range of
19 conditions that the system experiences over time.

20 *The pilot will not yield information on benefits related to changes in billing*

21 **Q. What benefits are associated with billing improvements enabled by AMI**
22 **deployment?**

23 A. NSPI purports that AMI can produce benefits from cash flow savings and reduced billing
24 edits and estimates. These benefits derive from improved, more timely billing under the
25 full AMI rollout. [REDACTED]

26 [REDACTED] Bill estimates
27 are currently required when meters cannot be read manually due to adverse weather

¹¹ NSPI Application, Appendix B at 3.

1 conditions or inaccessible customer premises; according to NSPI, a full rollout of AMI
2 would virtually eliminate the need for bill estimates.^{12,13}

3 **Q. Will the pilot provide additional information on the benefits associated with**
4 **improved billing?**

5 A. NSPI does not plan to change billing during the pilot.¹⁴ With no change to billing during
6 this period, NSPI will not be able to gain additional information on these benefits. In this
7 respect, the pilot will not help with NSPI's goal of informing a full assessment of the
8 benefits, costs, and resources required to roll out a full, province-wide AMI meter
9 program.

10 *Complementary programs are missing from the pilot proposal*

11 **Q. How does the Company propose to help customers realize the benefits of smart**
12 **meters?**

13 A. The Company's pilot proposal includes a "Digital Engagement Strategy" that will
14 provide digital tools such as a web portal and digital bill alerts. The Company claims that
15 such tools will help customers "take full advantage of smart meter benefits."¹⁵

16 **Q. Is the proposed Digital Engagement Strategy sufficient to enable customers to**
17 **realize the full benefits of smart meters?**

18 A. No. While the Digital Engagement Strategy is a start, it may not stimulate significant
19 changes in consumer behavior. The Company has failed to include in its proposal a range
20 of complementary programs. For example, it does not include energy efficiency or
21 demand response programs (whether offered by E1 or NSPI). Omission of such
22 complementary programs is likely to substantially limit the benefits that customers would
23 experience and the cost savings to the utility system from implementation of AMI.

¹² NSPI Application, at 7.

¹³ NSPI does not explain what billing edits are.

¹⁴ Response to Synapse IR-2.

¹⁵ NSPI Application, at 13.

1 **Q. What has NSPI said about leveraging AMI data through existing or planned**
2 **programs?**

3 A. NSPI expects that the existing heat pump and budget billing programs might be enhanced
4 by AMI data, and plans to review existing business practices and programs as a part of
5 the AMI pilot. However, the Company “has not completed any detailed planning on
6 potential impacts or changes to existing or planned programs.”¹⁶ Furthermore, citing data
7 security and customer privacy concerns, NSPI has expressed reservations about sharing
8 data with E1, a natural partner to leverage AMI data to maximize energy and demand
9 savings through energy efficiency and demand response programs.¹⁷

10 *NSPI’s proposed network for the pilot is not consistent with the network that may be*
11 *required for full implementation*

12 **Q. Please summarize NSPI’s characterization of the network that will be used to collect**
13 **AMI meter data during the pilot.**

14 A. NSPI’s application identifies that, as part of the pilot, the utility will deploy a secure
15 wireless radio frequency (RF) communications network.¹⁸ Further elaborating in respect
16 to information request Synapse IR-1, NSPI says that “The AMI network will be a RF
17 mesh network.”

18 **Q. Will a pilot that uses only a RF mesh sufficiently test the technologies required to**
19 **implement AMI across the province?**

20 A. This test would only be sufficient if the vendor that NSPI selects in response to the smart
21 meter request for proposal process proposes to use only RF mesh.

22 **Q. Have the RFP respondents proposed such RF mesh-only networks?**

23 A. [REDACTED]
24 [REDACTED]
25 [REDACTED]
26 [REDACTED]
27 [REDACTED]

¹⁶ Response to Synapse IR-9.

¹⁷ Response to Synapse IR-9.

¹⁸ NSPI Application, at 10, lines 17-18.

1
2
3
4

[REDACTED]

5 **Q. Should NSPI test all of the technologies required by their selected vendor during the**
6 **pilot?**

7 A. Yes. If the pilot is to fulfill its intended purposes of “[c]onfirmation of network
8 capabilities to deliver operational benefits”¹⁹ and “validation of performance of
9 technology sourced through RFP process,”²⁰ the pilot would need to test all of the
10 technology sourced through the RFP process.

11 **Q. What conclusions can you draw regarding the pilot based on your examination of**
12 **the communications network characterization?**

13 A. I conclude that the pilot as described by NSPI will only meet these stated objectives if the
14 Company selects a vendor whose technology aligns with the characterization of the pilot,
15 or if the utility changes the pilot plans to test other communications technology as well.
16 The latter option may change the required costs or structure of the pilot. If, as it appears,
17 NSPI intends this pilot to reduce the risk of the regulatory filing for a full AMI
18 deployment this fall, NSPI should bear the risk associated with changes in pilot design
19 and cost to best meet this objective.

20 *The design of NSPI’s RFP suggests that the Company does not see the end of pilot as a*
21 *decision point for the full rollout*

22 **Q. Does NSPI’s RFP for AMI systems or meter data management (MDM) systems**
23 **support a conclusion that the pilot is necessary in order to decide whether to**
24 **proceed with a proposal for full AMI deployment?**

25 A. No. Instead, examination of the RFP supports a conclusion that NSPI has decided that it
26 will make a full application, and simply needs further information to support that

¹⁹ NSPI Application, at 15, line 13.

²⁰ Response to Synapse IR-13, at 2, line 4.

1 application. NSPI hopes to gain that information during the pilot. (“The goal of the AMI
2 Pilot is to gather information, learn, and prepare for the broader rollout.”)²¹

3 **Q. What is it about the RFP that leads you to this conclusion?**

4 A. The primary fact that supports this conclusion is that the RFP was not issued by NSPI
5 alone. In fact, it was issued by a consortium of four utilities: New Brunswick Power,
6 Emera Maine, Tampa Electric Company, and NSPI. As described in the IR where this
7 fact was revealed, CA IR-22, NSPI hopes that the consortium approach will increase
8 bargaining power, share expertise across companies, and share the costs of the
9 procurement process.

10 [REDACTED]
11 [REDACTED]
12 [REDACTED]
13 [REDACTED]
14 [REDACTED]

15 [REDACTED] NSPI has stated that it “plans
16 to use the same meter vendor for the pilot as for the full roll out” and is in final stages of
17 vendor selection.²³ In addition, NSPI indicated that it is highly likely that the same meters
18 will be deployed for the pilot and the full rollout.²⁴ These indicate to me that NSPI is
19 clearly not thinking of the end of pilot as a decision point for the full rollout, but rather a
20 first step in a larger effort despite questionable cost effectiveness (as discussed later in
21 this evidence).

22 **Q. Is there anything else that concerns you about the RFP?**

23 A. In order to achieve the greatest benefit from the consortium approach to procurement, the
24 consortium members must be able to wield the increased bargaining power and
25 economies of scale that come with acting in concert. This comes through joint
26 identification of a single vendor. I am concerned that the best deal for the consortium as a

²¹ NSPI Application, at 4.

²² AMI SEEI IR-17 Attachment 1, at 12.

²³ Response to Synapse IR-17

²⁴ Response to Synapse IR-17.

1 whole may not be the best deal for Nova Scotia and its ratepayers. While I admit that a
2 compromise vendor may be less expensive, this process could leave Nova Scotia with a
3 sub-optimal AMI deployment.

4 *The size of the pilot program has not been adequately justified*

5 **Q. How does NSPI justify the size of the proposed AMI pilot?**

6 A. NSPI maintains that the size of the load research sample for a 2013 cost of service study
7 (680), adjusted to allow for greater population diversity, would be appropriate for the
8 AMI pilot.²⁵

9 **Q. Do you have any concerns with the size of the pilot?**

10 A. Yes. NSPI's justification for the pilot size is insufficient. The Company does not indicate
11 why the size of a load study would be appropriate for an AMI pilot. The size of a load
12 research study is based on diversity of load profiles, whereas the size of a technology
13 proof-of-concept like the proposed AMI pilot should be based on the size necessary to
14 answer the questions that pilot is designed to address. These purposes are primarily to
15 assess the functioning of the selected technology, as well as to gather information on
16 costs and benefits. Sufficient clarity on some costs and benefits (e.g., AMI operations and
17 program management) might be gained with a smaller sample size.

18 Furthermore, NSPI's description of the pilot population is inconsistent with their
19 justification. NSPI proposes that the 1,000 pilot participants would include roughly 500
20 residential, 300 commercial, and 200 industrial customers.²⁶ However, in response to CA
21 IR-19, NSPI indicates a desire to "evaluate the network technology across urban, sub-
22 urban, and rural population densities." With only 500 residential participants, NSPI's
23 ability to fully test this range of densities may be limited. By basing the justification for
24 the pilot size on the load research study, commercial and industrial customers may be
25 over-represented in the pilot compared with these customers' share of total NSPI
26 customers overall. The technologies and customer outreach may be better evaluated

²⁵ Response to NSUARB IR-4.

²⁶ Response to SBA IR-5

1 through a pilot that has parity for residential customers (say, in proportion to their
2 numbers in NSPI's overall customer base).

3 On the other hand, the sample size may be too small to provide statistically significant
4 results to inform some claimed sources of AMI savings. For example, the claimed
5 savings resulting from participation in bill alerts is [REDACTED] of sales to participating customers.
6 Even if the pilot population could be matched to a statistically similar control group,
7 verifying this small level of savings would require a sample size of 2,500 or more. Even
8 if all 500 residential pilot participants chose to receive bill alerts, this would be more than
9 five times too small, and the full 1,000 for the pilot would be less than half the size
10 necessary to see the effect.

11 **5. THE COST-BENEFIT ANALYSIS IS FLAWED, IS NOT WELL DOCUMENTED,**
12 **AND DOES NOT PERFORM SENSITIVITY ANALYSIS ON KEY INPUTS AND**
13 **ASSUMPTIONS**

14 **Q. Has the Company provided a CBA of the pilot?**

15 A. No. However, NSPI did provide a summary of the CBA of the full rollout in the
16 Application,²⁷ and also in the workbook containing the underlying analysis in response to
17 CA IR-67. In its analysis, NSPI found a net present value benefit of [REDACTED] for the
18 full rollout.

19 **Q. Do you have concerns with this CBA?**

20 A. Yes. The CBA of the full rollout has omitted justification for some critical inputs and is
21 flawed. The correction of the flaws described in the remainder of this section has a
22 considerable impact on the bottom line for ratepayers, as shown in Table 1.

²⁷ NSPI Application, at 19.

Table 1. NSPI Cost Benefit Results and Adjustments

Cost/benefit category	Net benefit / adjustment (millions)
NSPI-calculated net benefit	██████████
Adjustments	
Avoided meter purchases and exchanges	██████████
CVR	██████████
Avoided net meters	██████████
Adjusted net benefit	██████████

When these adjustments are made, the AMI rollout is only marginally cost effective. Since there are other areas where additional adjustments to NSPI’s CBA may be appropriate—as described in this section—it is very possible that the rollout of AMI is a net cost to ratepayers rather than a net benefit.

Q. Please provide an overview of your concerns with the CBA.

A. First, I have concerns with NSPI’s calculation and attribution of certain categories of net benefits to the AMI rollout, including avoided new traditional meters, CVR costs and benefits, and net meter benefits. Second, it appears customer engagement costs and benefits associated with complementary programs are not included in the analysis. Third, certain key assumptions, including the participation rates and value of avoided capacity, have either not been provided or have not been justified. Finally, the assumed life of the meters is too long.

Attribution of certain net benefits to the AMI rollout

Q. What does the preliminary cost-benefit calculation presented in CA IR-67 Attachment 1, identify as meter testing, exchange, and replacement-related costs avoided by a full AMI deployment?

A. Confidential Attachment 1 to CA IR-67 identifies estimated savings of about ██████████ present value from an item variously characterized as “Avoided Meter and Installation Costs” (page 3) and “Avoided Meter Testing” (page 4). ██████████ from avoiding three types of costs associated with meters: exchange, purchase, and testing. I do not have access to definitions of the types of activities and purposes of these three categories. It appears that

1 these savings are a part of either the “Operational Benefits including ... meter testing” or
2 the “Avoided Future Costs Benefits” categories on page 20 of the Application (or split to
3 contribute to both).

4 **Q. Is avoided meter purchase an appropriate benefit to attribute to a proposal to**
5 **purchase and install meters for all of NSPI’s customers?**

6 A. Yes, in part. Replacing all of NSPI’s meters at once will disrupt the typical pattern of
7 replacing a small fraction of the meters each year. Confidential Attachment 1 to CA IR-
8 67 page 12 identifies purchases of [REDACTED]

9 [REDACTED]
10 This is consistent with steady replacement of assets with a life of 20-25 years. Page 4 of
11 Confidential Attachment 1 to CA IR-67 shows that there is a continuing cost for AMI
12 meters and their installation throughout the period [REDACTED]

13 [REDACTED]
14 [REDACTED]
15 **Q. Is it appropriate to consider all of the nearly 20 years of avoided meter purchases as**
16 **a benefit?**

17 A. No. The limited study period, through 2036, has the effect of excluding the cost of
18 replacing all of the AMI meters 20 years after installation, namely starting in 2037 and
19 extending through 2039. The cost-benefit calculation compares two futures that therefore
20 differ regarding the average life of meters. Customers are not better served by younger or
21 older meters that are equally accurate, so the comparison is suspect unless efforts are
22 made to account for this difference in meter age. In effect, NSPI is proposing comparing
23 the costs of a system through 2036 in which the meters are allowed to age to an average
24 age of 18 years with one where constant replacement keeps the average age at a steady
25 state of around 10 years (half of meter life).

26 **Q. Can you estimate how much this effect impacts the cost-benefit calculation?**

27 A. Yes, I believe the effect is about [REDACTED] present value if only meter purchases are
28 affected by this correction, and more than [REDACTED] if meter exchange is also affected.
29 These values are calculated as the present value of costs not incurred when allowing the
30 existing meter fleet to age to an average age of [REDACTED] by the end of the study period,
31 leveling the playing field with the AMI case.

1 **Q. Please describe your concerns with the economic analysis of Conservation Voltage**
2 **Reduction (CVR) benefits and costs.**

3 A. While AMI is not technically necessary for CVR implementation, AMI can improve the
4 economics of implementing CVR. However, CVR also requires significant additional
5 hardware that has not been addressed or justified in this proceeding (nor is it proposed to
6 be addressed as part of the full filing this fall). Therefore, the costs and benefits
7 associated with CVR—[REDACTED]—should not be included in the
8 economic analysis.

9 **Q. What does the preliminary cost-benefit calculation presented in CA IR-67**
10 **Attachment 1, identify as costs associated with net metering or distributed**
11 **generation that would be avoided by a full AMI deployment?**

12 A. The calculation presents two classes of avoided costs: “Avoided Net Meters” with a
13 present value of [REDACTED] and “Avoided Net Meters Operating Savings” with a
14 present value of [REDACTED]. I believe that the avoided meter costs are included in the
15 “Avoided Future Cost Benefits” category on page 20 of the Application, while the
16 operating savings are included in the “Operational Benefits” category.

17 **Q. Is it appropriate to count avoided costs for meters capable of net metering as a**
18 **ratepayer or utility benefit of AMI deployment?**

19 A. No. The costs of meters for net metering are borne by the customer installing a net
20 metering system, not by the utility or its ratepayers at large. Under Section 3.6.5(a) of
21 NSPI’s regulations governing net metering,

22 Net energy metering shall be accomplished using a single meter capable of
23 registering the flow of electricity in two directions as approved by Measurement
24 Canada. If the eligible customer-generator’s existing electrical meter is not
25 capable of measuring the flow of electricity in two directions, the customer-
26 generator shall be responsible for incremental meter costs and any other related
27 costs.

28 i. If NSPI determines that the flow of electricity in both directions cannot be
29 reliably or safely determined through use of a single meter, NSPI may require
30 that separate meters be installed. Such metering will be at the customer’s cost.

31 **Q. What change would removing avoided net meter costs make in the overall estimated**
32 **cost-benefit for full AMI deployment?**

33 A. Benefits from full AMI deployment would be reduced by [REDACTED]

1 **Q. Is it appropriate to include savings from saved operating costs for net meters?**

2 A. Yes. These costs are borne by all ratepayers, and AMI meters that can handle net
3 metering without any additional cost would avoid them.

4 **Q. Is the [REDACTED] savings from net metering operating savings well justified?**

5 A. No. The pace of deployment of net metering generators, and thus meters which require
6 additional operating cost, does not make sense to me. It is modeled as [REDACTED]

7 [REDACTED]

8 [REDACTED] If NSPI believes that a dramatic but
9 short-lived boom in net metering will begin [REDACTED], it should justify that
10 assumption if and when it makes the filing for the approval of full AMI deployment.

11 Until then, I would view the [REDACTED] in operating savings with a great deal of
12 skepticism.

13 *Omitted costs and benefits*

14 **Q. Has NSPI included all costs related to customer engagement?**

15 A. Customer engagement costs do not appear to have been included in the CBA. While
16 some costs may be included within another cost category, there is no obvious place where
17 customer engagement and outreach costs would reside. If customer engagement costs
18 have not been included in the CBA, the bottom line could change considerably.

19 **Q. Are there benefits that should have been included in the CBA?**

20 A. As discussed earlier in this evidence, complementary programs such as energy efficiency
21 and demand response can help customers to experience the benefits of AMI. To the
22 extent such complementary programs are implemented, it would be appropriate to include
23 the associated avoided costs for energy, capacity, transmission and distribution, and
24 environmental compliance in the CBA.

1 *Omitted or Unjustified Assumptions*

2 **Q. Did NSPI provide all of the key assumptions from its CBA?**

3 A. No. Some critical assumptions used in the CBA were not provided, or if they were
4 provided, they were not justified. These key assumptions include, but are not limited to,
5 participation rates and the avoided capacity value.

6 **Q. Why do participation rates matter?**

7 A. Some of the benefits of AMI will be achieved through programs like bill alerts. Bill alerts
8 will be a voluntary program.²⁸

9 **Q. Has NSPI included its assumptions about participation rates?**

10 A. NSPI estimates that enrollment in bill alerts starts at [REDACTED]
11 [REDACTED] The spreadsheet indicates that these enrollment rates are “based on ebill
12 growth.”

13 **Q. Is this a reasonable assumption?**

14 A. It’s really not clear, and NSPI has not justified it. Regardless, this assumption is
15 important, since projected benefits for bill alerts [REDACTED] will be sensitive to the
16 participation rate. Likewise, benefits related to e-bills [REDACTED] will depend on enrollment
17 in that program.

18 **Q. How does NSPI account for the value of avoided capacity in its CBA?**

19 A. For several AMI benefits including those associated with load balancing, bill alert
20 savings, and CVR, NSPI uses an avoided capacity value of [REDACTED].²⁹ This
21 value, however, has not been substantiated in this proceeding and is not consistent with
22 earlier estimates of capacity value from the 2014 Integrated Resource Plan.³⁰ NSPI’s

²⁸ Response to Synapse IR-16.

²⁹ CA IR-67 Attachment 1.

³⁰ The 2014 IRP value was \$215/kW nominal (or \$215,000/MW) (per 2014 IRP Appendix A: Avoided Cost of DSM) [REDACTED].

1 AMI CBA workbook shows a one-time capacity benefit for bill alerts in [REDACTED], however I
2 am aware of no capacity additions forecasted for that year.³¹

3 *Useful life of new meters*

4 **Q. Do you have any additional concerns regarding the Company’s CBA?**

5 A. Yes. I am concerned that the assumed useful life of the meters—20 years—may be too
6 long.

7 **Q. Why might a 20-year useful life assumption be too long?**

8 A. Unlike analog meters, advanced meters are likely to have a much shorter useful life due
9 to component failure and the risk of technology obsolescence. In fact, the Office of the
10 Auditor General of Ontario reports that a 15-year useful life may be “overly optimistic
11 because smart meters:

- 12 • are subject to significant technological changes, making it difficult to maintain
13 hardware and software for the first-generation meters, which do not have the
14 advanced functions of newer models;
- 15 • have complex features, such as radio communications and digital displays, which
16 are subject to higher malfunction and failure rates;
- 17 • are similar to other types of information technology, computer equipment and
18 electronic devices in that they are backed by short warranty periods and require
19 significant upgrades or more frequent replacements as the technology matures;
20 and
- 21 • will likely be obsolete by the time they are re-verified as required by the federal
22 agency Measurement Canada every six to 10 years.”³²

³¹ See the 10-Year System Outlook, Figure 24. According to the 2016 10 Year System Outlook, “the forecasted peak customer demand from the 2016 Load Forecast indicates a capacity short fall will exist if [Tuft’s Cove 1] is retired in 2025” consistent with the assumptions in the 2014 IRP. (p. 27) However, NSPI does not include Tuft’s Cove 1 in its assumed unit retirements from 2016-2025 (p. 15), because the Company could delay retirement if necessary (p. 27).

³² Office of the Auditor General of Ontario, 2014 Annual Report, Tabled in the Legislative Assembly of Ontario on December 9, 2014, at 391. Available at <http://www.auditor.on.ca/en/content/annualreports/arbyyear/ar2014.html>

1 **Q. Are there any examples of smart meters that have been replaced sooner than**
2 **expected?**

3 A. Yes. The Office of the Auditor General of Ontario provides several examples, noting that
4 in 2013, one large distribution company notified the Ontario Energy Board that 96,000
5 meters installed in 2006 had to be replaced to take advantage of more advanced
6 technologies, while in 2012, another large distribution company was forced to replace
7 71,000 smart meters due to a communication defect in the meters.³³

8 In the United States, Pennsylvania Power and Light is in the process of replacing the
9 smart meters it installed between 2002 and 2004, as the meters no longer meet the
10 legislatively required standards for advanced metering technology.³⁴ Other examples
11 include Oncor (formerly TXU), which began deploying smart meters in 2005. A year
12 later, the Texas Public Utilities Commission set standards that made 900,000 of Oncor's
13 meters obsolete. Similarly, PG&E installed 210,000 meters in 2006 that lacked
14 functionality to support additional demand response and dynamic pricing options. For
15 this reason, PG&E sought, and was approved for, a meter upgrade to replace some of its
16 recently deployed meters.³⁵

17 **Q. How have regulators managed risks associated with technological obsolescence or**
18 **component failure?**

19 A. In order to ensure that the benefits reflected in a BCA are reasonable, some jurisdictions
20 assume a 10- or 15-year useful life for the meters and for the BCA. This shorter
21 timeframe reduces the risk to customers that the cost of the assets would not have been
22 fully recovered by the end of the asset's useful life. For example, upon the
23 recommendation of the Staff of the Maryland Public Service Commission, Baltimore Gas

³³ Office of the Auditor General of Ontario, 2014 Annual Report, Tabled in the Legislative Assembly of Ontario on December 9, 2014, at 391. Available at <http://www.auditor.on.ca/en/content/annualreports/arbyyear/ar2014.html>

³⁴ Pennsylvania Public Utilities Commission, Opinion and Order, *Petition of PPL Electric Utilities Corporation for Approval of Its Smart Meter Technology Procurement and Installation Plan*, M-2014-2430781, September 3, 2015

³⁵ Case No. 9208, before the Maryland Public Service Commission, Direct Testimony and Exhibits of Thomas Asp, Exhibit V, October 1, 2009, at 23.

1 and Electric (BG&E) reduced its analysis period from 15 years to 10 years in order to
2 make a more conservative business case.³⁶

3 **6. PRE-APPROVAL OF THE PILOT IS NOT NECESSARY**

4 **Q. What is NSPI seeking from the Board in this case?**

5 A. NSPI is seeking pre-approval of the investments related to its proposed AMI pilot.

6 **Q. Should the Board question the need for such pre-approval?**

7 A. Yes. It is reasonable to expect utilities to invest in pilots without asking for pre-approval
8 from public utility commissions. Pre-approval of utility investments has significant
9 implications for the Board and for customers.

10 The Company's request for pre-approval should be scrutinized for several reasons:

- 11 1. Pre-approval would curtail the Board's future authority to review the decision to
12 invest in the pilot and possibly the full rollout, since the decision to proceed with
13 the pilot is very interconnected with the decision to proceed with full rollout, as
14 described in the body of this evidence.
- 15 2. Pre-approval may limit the Board's future ability to review costs spent in
16 connection with the AMI pilot, and possibly the full rollout. By pre-approving the
17 AMI investments in this case, the only issue that the Board may be able to review
18 and rule on in future cases is how well NSPI implemented its proposed AMI pilot.
19 Again, because the pilot is interconnected with the full rollout, the Board may be
20 constrained in future review of projected costs and benefits of the full rollout.
- 21 3. Pre-approval represents an undue shift in risk from the Company to the
22 customers. The Company has not provided evidence as to why customers should
23 have to bear the risk of the decision to proceed with AMI.

³⁶ Maryland Public Service Commission, Order 83531, In the Matter of the Application of Baltimore Gas and Electric Company for Authorization to Deploy a Smart Grid Initiative and to Establish a Surcharge for the Recovery of Cost, Case 9208, August 5, 2010, available at: http://webapp.psc.state.md.us/intranet/casenum/NewIndex3_VOpenFile.cfm?ServerFilePath=C:\Casenum\9200-9299\9208\82.pdf.

1 If the Board does decide to pre-approve, the Board should retain the right to review both
2 the prudence of the Company's decision to invest in AMI, and to review the specific
3 costs spent on the pilot.

4 If the Company is convinced of the merits of its proposed pilot, NSPI could decide to
5 pursue AMI at risk to its shareholders, rather than to ratepayers.

6 **7. CONCLUSIONS AND RECOMMENDATIONS**

7 **Q. Please summarize your primary conclusions.**

8 A. I make the following conclusions:

- 9
- 10 • As designed, NSPI's proposed pilot will not accomplish the Company's stated
11 goals, nor will it be likely to provide a basis for determining whether or not the
12 costs and benefits associated with AMI justify a full rollout.
 - 13 • The design of the Company's RFP suggests that the pilot is a phase of a larger
14 effort rather than informing whether to proceed with full implementation.
 - 15 • The CBA in support of the full rollout is flawed, is not well documented, and does
16 not perform sensitivity analysis on key inputs and assumptions.

17 In short, the application does not provide enough detail to justify an approval by the
18 Board.

19 **Q. Please summarize your primary recommendations.**

20 A. My recommendations are as follows:

- 21
- 22 1. The UARB should not approve NSPI's current application based on the current
23 record of evidence. Instead, the Board should provide an opportunity for
24 additional inquiry into the current proposal and for the Company to modify the
25 application to address deficiencies identified herein. If the Company is convinced
26 of the merits of its AMI pilot, NSPI could decide to pursue AMI at risk to its
27 shareholders rather than to ratepayers. Furthermore, if the Company decides to
28 proceed with the pilot having made the changes I suggest (or proceeds on its own
without Board approval), NSPI should consider whether additional changes to the

1 pilot design and implementation are needed to maximize its learning from the
2 pilot to support the possible filing for full AMI deployment, and should expect
3 that stakeholders will take keen interest in what is learned. With respect to the
4 pilot, the improvements I recommend include: lengthening the window for data
5 collection to support the full rollout to a year, including all technologies proposed
6 by the chosen vendor, and redesigning the pilot sample to better reflect the mix of
7 customer classes.

8 2. Any future filing by NSPI with respect to a full roll out of AMI should include a
9 full business case justification, which includes a CBA that has been corrected
10 consistent with the recommendations in this evidence. In addition, it should
11 clearly demonstrate net benefits after making adjustments to account for issues
12 flagged in this evidence. Further, it should provide details on the following:

- 13 a. how NSPI will coordinate with E1 to leverage complementary programs
14 and increase benefits to customers
- 15 b. programs that NSPI will implement to encourage customers to save energy
16 and reduce coincident peak demand
- 17 c. assumptions underlying the CBA (e.g. participation rates, avoided
18 capacity value)
- 19 d. lessons learned from the pilot, and how full implementation is likely to
20 differ from pilot implementation
- 21 e. how/whether benefits will flow through to customers

22
23 **Q. Does this conclude your pre-filed evidence?**

24 **A.** Yes, it does.
25
26

1 **APPENDIX A: RESUME**

Alice Napoleon, Senior Associate

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. *Senior Associate*, June 2013 – present; *Associate*, July 2008 – June 2013; *Research Associate*, April 2005 – July 2008.

- Conduct expert analysis, draft testimony, and provide litigation support regarding energy efficiency program implementation and extension, cost recovery and incentive mechanisms, budgeting, evaluation, cost-effectiveness screening, potential studies, and plans.
- Lead a team to develop a toolkit for energy efficiency program administrators to incorporate the energy performance program Superior Energy Performance™ into their portfolios. Develop case studies of existing energy efficiency program offerings that support implementation of strategic energy management by industrial customers.
- Provide ongoing expert consulting for the State of New Jersey regarding state- and utility-administered residential, low-income, commercial, and industrial energy efficiency, combined heat & power, and advanced metering infrastructure (AMI) programs and proposals, including review, analysis, comments and testimony assistance on the following: program performance, designs, and budgets; program funding and cost recovery; cost-benefit analysis; energy efficiency market potential studies; program evaluation; design of the societal benefits charge credit program (a self-directed energy efficiency program); marketing; overall administrative structure; and roll out of AMI.
- Facilitate residential, commercial, and industrial policy working groups and manage supporting technical analysis of working group recommendations to reduce greenhouse gas emissions in Colorado, South Carolina, and Maryland.
- Research historical emissions of criteria and hazardous air pollutants, greenhouse gases, and coal combustion wastes. Research and develop potential state and local emissions mitigation strategies, such as for reducing ambient fine particulates in New York City.
- Conduct surveys of regional, state, and utility policies and practices regarding ratemaking for energy efficiency, power procurement, risk management, and fuel diversity.
- Research federal, regional, and state case histories on integrated resource planning, power procurement, power plant operations, renewable portfolio standards, and market power.
- Monitor and analyze electricity, coal, and emissions allowance market data, models, and projections, as well as economic and policy developments that impact these markets.

-
- Write and edit reports, expert testimony, and discovery questions and responses.

Resource Insight, Inc., Arlington, MA. *Research Assistant*, 2003-2005.

Responsible for conducting research and analysis on electric, gas, steam, and water resource issues. Conducted discounted cash flow analysis for asset valuation; developed market-price benchmarks for analysis of power-supply bids using market and regulated prices for energy, capacity, ancillary services, transmission, and ISO services and adjusting for load shape, assignment of transmission rights, and losses. Prepared discovery responses, formal objections, comments, and testimony; collaboratively wrote and edited reports; created and formatted exhibits. Participated in drafting an Energy Plan for New York City. Edited solicitation for competitive power supply to serve aggregated municipal load.

University of Massachusetts, Amherst, MA. *Teaching Assistant*, 2001-2002.

Developed and taught lessons on applied math to a diverse group of incoming graduates; tutored students in microeconomic theory and cost benefit analysis; graded problem sets and memoranda.

International Council for Local Environmental Initiatives, Berkeley, CA. *Cities for Climate Protection Intern for the City of Northampton, MA*, 2001.

Compiled primary and secondary source data on energy consumption and solid waste generation by the municipal government, city residents, and businesses; applied emissions coefficients to calculate total greenhouse gas (GHG) emissions; identified current and planned municipal policies that impact GHG emissions; researched the predicted effects of global warming locally; gathered public feedback to provide acceptable and proactive policy alternatives. Composed a GHG emissions inventory describing research findings; wrote and distributed a policy report and press releases; gave newspaper and radio interviews; addressed public officials and the public during a televised meeting.

University of Massachusetts, Amherst, MA. *Research Assistant*, 2000-2001.

Located federal data sources, identified changes, and updated a research database to evaluate the Habitat Conservation Program; proofread articles and white papers; composed a literature review on land use modelling. Collaboratively administered, tested, and proposed interface enhancements for a web-based data warehouse of regional habitat change research; formally presented the system to an independent research group.

Court Square Data Group, Inc., Springfield, MA.

Administration Manager, 1998-2000.

Analysed profitability and diversity of income sources; managed cash flow, expense, and income data; created budgets; devised and implemented procedures to increase administrative efficiency; implemented new accounting system with minimal disruption to workflow.

Project Administrator, 1996-1998.

Coordinated implementation of software features; identified opportunities for future development; monitored problem resolution; wrote and coordinated production of a user's manual and questionnaires; edited technical proposals and a business plan.

EDUCATION

University of Massachusetts, Amherst, MA
Master of Public Administration, 2002

Rutgers University, New Brunswick, NJ
Bachelor of Arts in Economics, 1995

Syracuse University, Syracuse, NY, 1994

PUBLICATIONS

Kallay, J., A. Napoleon, M. Chang. 2016. *Opportunities to Ramp Up Low-Income Energy Efficiency to Meet States and National Climate Policy Goals*. Synapse Energy Economics.

Woolf, T., A. Napoleon, P. Luckow, W. Ong, K. Takahashi. 2016. *Aiming Higher: Realizing the Full Potential of Cost-Effective Energy Efficiency in New York*. Synapse Energy Economics for Natural Resources Defense Council, E4TheFuture, CLEAResult, Lime Energy, Association for Energy Affordability, and Alliance for Clean Energy New York.

Napoleon, A., K. Takahashi, J. Kallay, T. Woolf. 2016. "Evaluation, Measurement, and Verification in Virginia." Memorandum prepared by Synapse Energy Economics for Clean Energy Solutions Inc., Virginia Energy Efficiency Council, and Virginia Department of Mines, Minerals and Energy.

Woolf, T., A. Napoleon, M. Whited. 2015-2016. *Comments and Reply Comments in the New York Public Service Commission Case 14-M-0101: Reforming the Energy Vision*. Comments related to Staff's (a) a benefit-costs analysis framework white paper, (b) ratemaking and utility business models white paper, and (c) Distributed System Implementation Plan guide. Prepared by Synapse Energy Economics on behalf of Natural Resources Defense Council and Pace Energy and Climate Center.

Kallay, J., K. Takahashi, A. Napoleon, T. Woolf. 2015. *Fair, Abundant, and Low-Cost: A Handbook for Using Energy Efficiency in Clean Power Plan Compliance*. Synapse Energy Economics for the Energy Foundation.

Woolf, T., K. Takahashi, E. Malone, A. Napoleon, J. Kallay. 2015. *Ontario Gas Demand-Side Management 2016-2020 Plan Review*. Synapse Energy Economics for the Ontario Energy Board.

Biewald, B., J. Daniel, J. Fisher, P. Luckow, A. Napoleon, N. R. Santen, K. Takahashi. 2015. *Air Emissions Displacement by Energy Efficiency and Renewable Energy*. Synapse Energy Economics.

Takahashi, K., A. Napoleon. 2015. "Pursue Behavioral Efficiency Programs." Ed. John Shenot. In *Implementing EPA's Clean Power Plan: A Menu of Options*. National Associate of Clean Air Agencies.

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

Whited, M., T. Woolf, A. Napoleon. 2015. *Utility Performance Incentive Mechanisms: A Handbook for Regulators*. Synapse Energy Economics for the Western Interstate Energy Board.

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

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.

Keith, G., B. Biewald, K. Takahashi, A. Napoleon, N. Hughes, L. Mancinelli, E. Brandt. 2010. *Beyond Business as Usual: Investigating a Future without Coal and Nuclear Power in the US*. Synapse Energy Economics for Civil Society Institute.

Napoleon, A., W. Steinhurst, M. Chang, K. Takahashi, R. Fagan. 2010. *Assessing the Multiple Benefits of Clean Energy: A Resource for States*. US Environmental Protection Agency with research and editorial support from Stratus Consulting, Synapse Energy Economics, Summit Blue, Energy and Environmental Economics, Inc., Demand Research LLC, Abt Associates, Inc., and ICF International.

Napoleon, A., D. Schlissel. 2009. *Economic Impacts of Restricting Mountaintop/Valley Fill Coal Mining in Central Appalachia*. Synapse Energy Economics for Sierra Club, and Appalachian Center for the Economy and the Environment.

Napoleon, A., J. Fisher, W. Steinhurst, M. Wilson, F. Ackerman, M. Resnikoff. 2008. *The Real Costs of Cleaning Up Nuclear Waste: A Full Cost Accounting of Cleanup Options for the West Valley Nuclear Waste Site*. Synapse Energy Economics for Citizens' Environmental Coalition.

Napoleon, A., G. Keith, C. Komanoff, D. Gutman, P. Silva, D. Schlissel, A. Sommer, C. Chen, A. Roschelle, J. Levy, P. Kinney. 2007. *Quantifying and Controlling Fine Particulate Matter in New York City*. Synapse Energy Economics for Coalition Helping Organize a Kleaner Environment, Natural Resources Defense Council (NRDC), Reliant Energy.

Drunic, M., A. Napoleon, E. Hausman, R. Hornby. 2007. *Arkansas Electric Generation Fuel Diversity: Implementation of EPC Act 2005 Amendments to PURPA Section 111 (d)*. Synapse Energy Economics for Arkansas Public Service Commission Staff.

Hausman, E., R. Fagan, D. White, K. Takahashi, A. Napoleon. 2007. *LMP Electricity Markets: Market Operations, Market Power, and Value for Consumers*. Synapse Energy Economics for American Public Power Association.

Synapse Energy Economics. 2006. *Portfolio Management: Tools and Practices for Regulators*. Prepared for National Association of Regulatory Utility Commissioners.

Steinhurst, W., A. Napoleon, K. Takahashi. 2006. *Energy in the Northern Forest Region: A Situation Analysis*. Synapse Energy Economics for Northern Forest Center and The North Country Council.

Synapse Energy Economics. 2006. *Ensuring Delaware's Energy Future: A Response to Executive Order Number 82*. Synapse Energy Economics for Delaware Public Service Commission Staff by the Delaware Cabinet Committee on Energy and others.

Fagan, R., A. Napoleon, A. Rochelle, A. Sommer, W. Steinhurst, D. White. K. Takahashi. 2006. *Mohave Alternatives and Complements Study: Assessment of Carbon Sequestration Feasibility and Markets*. Sargent & Lundy and Synapse Energy Economics, Inc. for Southern California Edison.

TESTIMONY

Public Service Commission of South Carolina (Docket No. 2016-223-E): Direct Testimony of Alice Napoleon regarding South Carolina Electric and Gas Energy Efficiency Efforts. On behalf of South Carolina Coastal Conservation League. September 1, 2016.

Nova Scotia Utility and Review Board (Case No. M06247): Direct testimony in the matter of an application by Efficiency Nova Scotia Corporation for approval of its electricity demand-side management plan for 2015. On behalf of Counsel to the Nova Scotia Utility and Review Board. July 14, 2014.

TESTIMONY ASSISTANCE

State of New Jersey Board of Public Utilities (Docket No. ER16060524): Direct testimony of Tim Woolf regarding the Petition of Rockland Electric Company for Approval of an Advanced Metering Program, and for Other Relief. On behalf of New Jersey Division of the Ratepayer Advocate. September 9, 2016.

Nova Scotia Utility and Review Board (Matter No. M06733): Direct testimony of Tim Woolf regarding EfficiencyOne's 2016-2018 demand-side management plan. On behalf of the Nova Scotia Utility and Review Board. June 2, 2015.

Missouri Public Service Commission (File No. EO-2015-0055): Rebuttal and surrebuttal of Tim Woolf on the topic of Ameren Missouri's 2016-2018 Energy Efficiency Plan. On behalf of Sierra Club. March 20, 2015 and April 27, 2015.

State of New Jersey Board of Public Utilities (Docket No. EO14080897): Direct testimony of Kenji Takahashi regarding the Petition of Public Service Electric & Gas Company to continue its Energy Efficiency Economic Extension Program on a Regulated Basis (EEE Extension II). On behalf of New Jersey Division of the Ratepayer Advocate. November 7, 2014.

Kentucky Public Service Commission (Case No. 2014-00003): Direct testimony of Tim Woof regarding Louisville Gas and Electric Company and Kentucky Utilities Company's proposed 2015-2018 demand-side management and energy efficiency program plan. On behalf of Wallace McMullen and the Sierra Club. April 14, 2014.

State of New Jersey Board of Public Utilities (Docket No. GO12050363): Direct testimony of Maximilian Chang regarding South Jersey Gas Company's proposal to extend and modify its energy-efficiency programs. On behalf of New Jersey Division of the Ratepayer Advocate. November 9, 2012.

New Jersey Board of Public Utilities (Docket No. GO12070640): Direct testimony of Robert Fagan 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.

State of New Jersey Board of Public Utilities (Docket No. GO11070399): Direct testimony of Robert Fagan regarding Elizabethtown Gas Company's Proposed Energy Efficiency Program. On behalf of New Jersey Division of the Ratepayer Advocate. December 16, 2011.

New Jersey Board of Public Utilities (Docket No. GR11070425): Direct testimony of Robert Fagan 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. November 16, 2011.

State of New Jersey Board of Public Utilities (Docket No. GR10030225): Direct testimony of David Nichols regarding New Jersey Natural Gas Company's Proposed Energy Efficiency Program. On behalf of New Jersey Division of the Ratepayer Advocate. July 9, 2010.

Virginia State Corporation Commission (Case number PUE-2009-00097): Direct testimony of William Steinhurst regarding Appalachian Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 et seq. On behalf of the Southern Environmental Law Center, Chesapeake Climate Action Network, Appalachian Voices, and the Virginia Chapter of The Sierra Club. March 23, 2010.

Delaware Public Service Commission (Docket No. 07-20): Jointly authored an expert report, with Robert Fagan, 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 (BPU Docket EM05020106): Direct and surrebuttal testimony of Bruce Biewald, Robert Fagan, 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.

Illinois Commerce Commission (Dockets 05-0160, 05-0161, 05-0162): Direct testimony of William Steinhurst regarding 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 testimony of William Steinhurst regarding Commonwealth Edison’s Proposal to implement a competitive procurement process. On behalf of Illinois Citizens Utility Board and Cook County State’s Attorney’s Office. June 8, 2005 and August 3, 2005.

Resume dated February 2017