STATE OF NEW HAMPSHIRE

BEFORE THE

PUBLIC UTILITIES COMMISSION

Docket No. DE 20-092

2021-2023 Triennial Energy Efficiency Plan

TESTIMONY OF

DAVID G. HILL, PH.D.

On behalf of Clean Energy NH

October 29, 2020

STATE OF NEW HAMPSHIRE

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I. Introduction and Qualifications

Q: Please state your name and professional title.

A: My name is David Hill and I am a Managing Consultant with Energy Futures Group, Inc. in Hinesburg, Vermont.

Q: On whose behalf are you testifying?

A: I am testifying on behalf of Clean Energy New Hampshire ("CENH").

Q: Please describe your current role and relevant work experience.

A: I joined Energy Futures Group ("EFG") in January of 2020. My work since then has included expert testimony on the Dominion Energy South Carolina's 2020 Integrated Resource Plan; a critical analysis for the need of a proposed natural gas pipeline expansion in New York City; support for testimony on the partial transfer of ownership of a coal fired power plant in Montana; analysis of the customer economics for strategic electrification in Illinois; scenario modeling for statewide greenhouse gas reduction strategies in Massachusetts; and analysis of cost recovery for utility efficiency and demand response initiatives in Maryland.

EFG is a clean-energy consulting firm headquartered in Hinesburg, Vermont, with offices in Boston and New York. EFG designs, implements, and evaluates programs and policies to

promote investments in efficiency, renewable energy, other distributed resources, and strategic electrification. EFG staff have delivered projects on behalf of energy regulators, government agencies, utilities, and advocacy organizations in forty states, eight Canadian provinces, and several countries in Europe.

EFG brings to its work a unique combination of technical, economic, program, and policy expertise. EFG staff have critically evaluated hundreds of efficiency and renewable energy programs, playing key roles in developing many that have subsequently won awards for excellence. Recent work involves efficiency program portfolios and policies in each of the fifteen highest-ranking states on the ACEEE State Energy Efficiency Scorecard, as well as in Ontario, Manitoba, and British Columbia. We have also provided expert witness testimony on efficiency programs, integrated resource planning, and related policy issues in regulatory proceedings in twenty states and five Canadian provinces.

Prior to joining EFG, I worked for the Vermont Energy Investment Corporation ("VEIC") for twenty-two years, starting in 1998 as an analyst, subsequently holding several positions over the decades, and serving my last five years as Director of Distributed Resources and Policy Fellow.

As the Director of Distributed Resources and a Policy Fellow at VEIC, I was responsible for advancing sustainable energy program design and evaluation. For two decades, I regularly led major consulting assignments at VEIC, being best known for my work in distributed energy resources, particularly solar energy. I provided expert testimony and regulatory support on renewable energy and energy efficiency in six jurisdictions in Canada and the United States. I was regularly engaged as an expert on renewable energy market design; and regulatory issues at international, national and regional conferences and workshops. I served on national, state, and

local level boards. I also led policy committees and conferences, and comprehensive studies of the economic, technical, and achievable potentials for sustainable energy programming. My work also supported detailed level program budget planning and implementation.

Over the years, I have led or significantly contributed to the design and development of more than six large programs, with annual budgets of $100+ million, for initiatives in New Jersey, New York, Vermont, Arizona, and Maryland. My clients are in more than a dozen states and provinces, and six countries outside North America. I have conducted work for several international organizations, including the World Bank. I have also created and led the launch of Sun Shares, a subsidiary of VEIC that develops and provides community solar services to employers and their employees.

I have provided testimony in regulatory hearings on more than a dozen occasions and have participated in scores of technical workshops and working groups on behalf of many clients. I recently submitted and defended expert testimony on the characterization and analysis of energy efficiency and demand response in Dominion Energy South Carolina's 2020 Integrated Resource Plan on behalf of the Southern Environmental Law Center and the Coastal Conservation League. In 2019, I presented at a technical workshop on efficiency portfolio diversification and submitted supporting testimony in Nova Scotia on behalf of EfficiencyOne. In 2018, I provided testimony on behalf of the Ecology Action Centre to the Nova Scotia Utility and Review Board regarding NS Power's Advanced Metering Infrastructure project.[1] For the last decade, I have provided ongoing expert review and testimony on EmPOWER Maryland's energy efficiency portfolio on behalf of that state's Office of People's Counsel. I also led VEIC's

[1] Nova Scotia Utility and Review Board, Matter M08349, Direct Testimony of David G. Hill on Behalf of Ecology Action Centre, January 18, 2018.

team in a review of utility efficiency programs for the Pennsylvania Office of Consumer Advocate on that state's legislatively authorized efficiency initiatives (Act 129), providing testimony in 2013 and 2009. I have also provided expert review and testimony on proposed efficiency programs of Brampton and Hydro One in Ontario, on behalf of the Green Energy Coalition in 2005.

In addition, I have written, presented, and/or defended written analyses and/or testimony for regulatory workshops, commission staff, and legislative hearings on efficiency, alternative rate design, net metering and interconnection of distributed energy systems, and strategies for sustainable development of solar markets. This has included my work in New York, Pennsylvania, Vermont, Arizona, Michigan, and New Jersey. Further details on my work experience and education are provided in my professional resume included as **Exhibit 1.**

Q. Have you previously testified before the New Hampshire Public Utilities Commission?

A. No, this is my first time testifying before the New Hampshire Public Utilities Commission.

II. Summary

Q: What is the purpose of your testimony in this hearing?

A: The purpose of my testimony is to provide a critical review and analysis of the 2021-2023 Triennial Energy Efficiency Plan filed by the Electric and Gas utilities with the New Hampshire Public Utilities Commission on September 1, 2020 in Docket DE 20-092 ("the Plan," "Triennial Plan," or "NHSaves Plan"). Energy efficiency is a key resource for utility planning, and the utilities filing of a joint-three year plan provides an important opportunity for CENH and

other intervenors to provide review and constructive comments on how the plan as a document, and in implementation, might be improved.

Q: Please summarize your key findings.

A: While I offer several suggestions on how the Plan might be improved, my overall assessment is positive, and I recommend the Commission approve the savings targets and budgets as proposed. The second jointly filed Triennial Plan under New Hampshire's Energy Efficiency Resource Standard ("EERS") reflects continuing progress and it is a significant step forward in maximizing the economic benefits to New Hampshire's economy from energy efficiency. The efforts by the utilities and stakeholders to work collaboratively on the development and revisions to the Plan through the Energy Efficiency and Sustainable Energy ("EESE") Board and the EERS committee of that Board are commendable. These efforts result in a plan that has been well vetted, and clearly while not every party agrees to every point, the proposed plan has a significant level of "buy-in" as submitted. There are many historic and current planning and regulatory proceedings from around the country that could learn from this example.

Q: What are the economic benefits that can be expected from implementation of the plan?

A: They are significant. Implementation of the proposed plan results in $912 million of total resource benefits, and net benefits using the Granite State Test ("GST") over more than $619 million. Over their lifetime, the installed measures are expected to provide customers with more than $1.3 billion in savings on their bills for electricity, natural gas, and other fuels. This money can be saved and/or recirculated within the State's economy as residential consumers, public entities, and private businesses spend less on energy, leaving more for spending and investment

on other needs and priorities. The anticipated economic benefits extend to workforce development and deployment with local jobs that will be required to implement the plan. Energy efficiency employment in the state continues to experience steady growth, increasing 11.5 percent from 2017 to 2019[2], with only 16 percent of firms reporting no difficulties in hiring.

The Plan's projected net benefits are to be expected as energy efficiency is typically a least-cost resource for meeting energy needs. The Plan's projected net benefits are also consistent with the New Hampshire Office of Strategic Initiatives' 10-year strategy and the directive to pursue cost effective savings as an economic growth opportunity.[3]

Implementing the proposed plan will also provide significant environmental benefits, including avoiding an estimated 4.4 million tons of carbon dioxide equivalent greenhouse gases. To comply with the Legislative directive[4] the plan also includes more than $77 million of program spending and initiatives benefiting income eligible populations.[5] Further comments on the economic, environmental, and social equity impacts of the plan follow in the body of my Testimony.

Q: Are there areas where the Plan could be further clarified or improved in the Commission's Order?

A: Yes, there are several topics I recommend be specifically addressed in the Order to help improve the plan. These are:

[2] Clean Energy New Hampshire, 2019 New Hampshire Clean Energy and Employment Report, Figure 15, p.17. and Figure 16, p. 18.
[3] New Hampshire Office of Strategic Initiatives. *New Hampshire 10-Year State Energy Strategy*. Apr. 2018. Available at: https://www.nh.gov/osi/energy/programs/documents/2018-10-year-state-energy-strategy.pdf.
[4] House Bill 4, 2019 Session, page 25, lines 25-36.
[5] Triennial Plan, Table 4-4, Bates p. 135.

i. Clarification on whether the trigger for mid-term modification related to avoided cost updates and evaluation results are a **combined** 10% change in anticipated budget and savings or **separable** (each can be up to 10% before trigger).

ii. Encourage formal ongoing participation by stakeholders and the EERS Committee, as opposed to waiting for October 2022 and the start of planning for the next Triennial cycle.

iii. Expand the Home Energy Assistance Program budget and target for cold climate heat pumps targeting electric resistance heat replacements.

iv. As participation and market acceptance rates permit, encourage the utilities to consider adjusting the maximum share of total project costs for Home Performance with Energy Star downwards from the proposed 90% level.

v. Formally recognize the value of active demand response as a strategic asset to help with future time and location specific investments to avoid T&D costs. Highlight the complementary abilities for ADR and efficiency programs to be combined to maximize customer benefits.

vi. Demonstrate and characterize the potential emissions and economic benefits from allowing the cross-fuel optimization framework.

vii. Recognize the long-term net rate impacts and the projected benefits accruing to customers from the near-term rate increases. If near-term rate impacts are deemed unacceptable adopt strategies for ameliorating rate impacts instead of reducing program budgets and savings targets.

viii. Recognizing the uncertainties and headwinds related to COVID-19 and the scale of expansion in this Triennial Plan support the 65% threshold for minimum performance. However, make clear the expectation the threshold will increase to at least 75% for future performance periods.

Each of these topics is further discussed in the remainder of my Testimony.

Q: Based on your review and analysis what recommendations do you have for the Commission?

A: I recommend the Commission provisionally approve the 2021-2023 New Hampshire Statewide Energy Efficiency Plan as filed by the Joint Utilities on September 1, 2020. The modifications I recommend be required in a final approved Plan are:

1. Increase the total number of heat pump installations to replace existing electric resistance heat for income qualified customers to a total of 450 participants over the Triennial Plan.
2. Establish clear ongoing stakeholder collaboration processes and expectations.

The remainder of my testimony is presented in four sections. First, I review and highlight some of the economic and environmental benefits for New Hampshire arising from the proposed Triennial Plan. Second, I discuss several process issues where clarifications and/or improvements to the Plan should be considered in the Commission's deliberations. Next, I highlight some Plan content and analysis where I recommend modifications or changes be considered. This includes a recommendation to double the number of cold climate heat pump replacements in the Home Energy Assistance Program targeting the replacement of existing electric resistance heat. Finally, I offer a summary with my list of recommendations for the Commission's consideration.

III. Benefits to New Hampshire

Q: Can you please expand on the anticipated benefits to New Hampshire of the Commission approving and the utilities successfully implementing the 2021-2023 Triennial Plan?

A: Yes, let me start with the economic benefits. Energy efficiency as a resource creates net benefits when the costs for saving electricity and natural gas are cheaper than the cost of the displaced supply. Using the GST, as applied to the proposed electric utility portfolios as an example, Table 1 illustrates anticipated net benefits from the 2021-2023 Triennial Plan to be $619 million. The GST benefits of $965 million include avoided utility costs for energy, capacity, reserves, transmission and distribution, line losses, ancillary services, renewable portfolio compliance, credit and collections, and environmental compliance.[6]

Table 1: Electric Portfolio Estimated Granite State Test Costs and Benefits

Total All Electric Utilities				
Program Year	GST Benefits	Utility Costs	Net Benefits	B/C Ratio
2021	$ 260	$ 95	$ 165	2.73
2022	$ 316	$ 115	$ 202	2.76
2023	$ 389	$ 137	$ 252	2.85
Total	**$ 965**	**$ 347**	**$ 619**	**2.78**

The utility costs reflect the full costs for delivering the efficiency programs, including measure costs, technical support, administration, monitoring and evaluation, and share older incentives. The estimated net benefits are the result of more than a doubling of the utility

[6] Triennial Plan, Figure 10-1 Granite State Test, Bates page 208.

spending on efficiency from $150 million in the 2018-2020 plan to almost $350 million in the 2021-2023 proposed Plan.[7]

These results indicate that adopting the 2021-2023 Plan will result in a net reduction of system costs for delivering energy services of more than $600 million. The total life-time consumer bill savings estimated from the 2021-2023 portfolio are $1.3 Billion.[8] These are impressive impacts from a three-year plan highlighting the scale at which NHSaves is expected to strengthen New Hampshire's economy.

Although not quantified in the GST test, additional positive impacts that can be expected from adoption of the 2021-2023 Triennial Plan include reduced exposure to fuel price volatility and the reduction of risk from possible future environmental regulations, such as a cost on carbon.

The proposed NHSaves Plan is also notable for identifying and including direct steps to address financing for energy efficiency and workforce development. These two barriers can hinder or prevent states from capturing the economic benefits of enhanced energy efficiency portfolios, and the inclusion of strategies to support financing and workforce development are an example of how the Triennial Plan is taking a holistic perspective on how to maximize the economic benefits for the state.

Q: Does the proposed 2021-2023 Triennial Plan estimate anticipated environmental benefits?

A: Yes, the Plan results in a significant reduction in consumption of fossil fuels and their associated greenhouse gas, and other emissions. The Plan estimates savings of 9.6 trillion

[7] Triennial Plan, Figure 1-1, Electric Programs Over Time, Bates page 17.
[8] Triennial Plan, Bates p. 8.

British Thermal Units ("Tbtu") of natural gas, and 8.3 Tbtus of fuel oil and propane. This results in an estimated lifetime reduction of greenhouse gas emissions of 4.4 million tons. While the most appropriate value for the social cost of carbon continues to be debated, it should be clear the value is not zero. If, for example, one was to use $112/metric ton recently approved by the Vermont Public Utility Commission[9], the value of the avoided carbon emissions is $493 million.

Q: How does the proposed 2021-2023 Triennial Plan address social equity issues?

A: The plan allocates 20 percent of the funding from the system benefits charge ("SBC") to limited income programs.[10] As a result, the Home Energy Assistance ("HEA") program is not less than 17 percent of each utility's total portfolio budget exclusive of carryover of unspent limited income program funds from a prior year. The HEA program is a fuel neutral weatherization program designed to help income-eligible homeowners and renters reduce their energy costs and make their homes safer, healthier, and more comfortable.

The utilities commitment in the Plan to enhance and expand the HEA program is commendable. Energy efficiency is an important potential resource for households with limited incomes, and the HEA program aims to adopt steps to reduce barriers, increase participation, and increase savings. These include enhanced tracking and referral systems, an increased per household funding cap to allow implementation of all cost effective measures, new screening methods using the GST and a portfolio wide approach so necessary and appropriate funds can be used to address health and safety barriers to cost effective efficiency projects, a new HEA implementation manual, and new HEA pathways and "on ramps" for customers to participate and access services. Coordination between utilities and with the Community Action Agencies

[9] https://epsb.vermont.gov/?q=downloadfile/417666/138298
[10] New Hampshire House Bill 4, 2019, page 25 lines 25-31.

that provide weatherization services are critical to efficiently providing services to this customer population.

The HEA program offers a comprehensive set of measures to address appliance, HVAC, and lighting end uses. The Plan estimates that up to 22 percent of New Hampshire's households meet income eligibility requirements for the program, though noting some of these have been served by utility and or weatherization programs over the last two decades. The Plan proposes to serve 7,487 participants through the electric utility programs and 1,483 participants through the gas utility program in the coming three years.

IV. Process

Mid-Term Modifications

Q: Do you have any comments on the mid-term modification triggers?

A: Yes. First, I strongly support integrated three-year targets and a performance period and the updating of results and cost effectiveness testing during the performance period based on evaluation results and avoided cost updates. It is also valuable to have two levels, the first requiring notification – and not resulting in any change to targets and budgets, and the second requiring Commission approval for mid-term modifications that are more substantive and would impact budgets and targets. This encourages flexibility and continuity in program management and market development. These positive features are discussed in Section 2.1.6 to 2.1.8 of the Plan.

One of the second-tier mid-term modifications requiring Commission approval is a change to GST portfolio benefits or primary energy savings greater than 10 percent in either

direction as a result of an update to avoided costs and/or evaluation findings.[11] My interpretation is that this means if ***the combined*** impact of these two factors is greater than 10 percent the trigger threshold is reached. The alternative would be that ***each factor*** could have up to a 10 percent change before the threshold is reached. I recommend the combined impact be used for the threshold, and the Commission Order should clarify this point.

Stakeholder Collaboration

Q: Do you have any comments related to stakeholder collaboration?

A: I think the Triennial Plan submitted by the Joint Utilities has benefited greatly from active, structured opportunities for stakeholder input, review and iterative feedback. My experience is that plans developed in collaboration with stakeholders can have greater impacts and, in the best of cases, result in less contentious regulatory review and formal proceedings. It can be very helpful if clear expectations and guidelines for stakeholder collaboration are included in plans and regulatory orders. At times, the Commission may want to charter specific assignments for a working group – say for example to provide a working group report on a given topic by a specific date. Topics could include for example the development of equity metrics, impact and response to COVID-19, coordination between gas and electric program services, coordination of low-income initiatives, and harmonization of multi-year efficiency plans with utility Integrated Resource Plans and evaluation of non-wire alternatives. When appropriate, specific deliverable charters and deadlines as directions from the Commission helps to focus activities and encourages collaborative review and discussion of topics of greatest value for informing Commission decision making.

[11] Triennial Plan, Baker page 044.

The 2021-2023 Triennial Plan indicates a planning stakeholder process for the 2024-2026 Triennial Plan will commence in October 2022, and the stakeholder process will be conducted through scheduled meetings of the EERS committee of the EESE Board.[12] The timing for this activity seems appropriate, but I would also respectfully recommend that the Order approving the Plan indicate that an ongoing collaborative process be specified, most likely in coordination with the EERS committee of the EESE Board. I also recommend the Commission identify top priorities, or ask the collaborative to identify top priorities, and work plans for action on the most important items.

Municipal and Main Street Initiatives

Q: Do you have any comments on recruitment and marketing for the Municipal and Main Street Initiatives?

A: Yes, in general, I strongly support the objectives and design of the Municipal Programs as described in Section 3.3 of the Triennial Plan. As noted in the Plan, there are often unique barriers facing municipal projects and decision makers, and the benefits of increased efficiency and building performance accrue to the whole community in the form of lower operating and maintenance costs and enhanced indoor building environments. I support the objectives of increasing the comprehensiveness of fuel neutral municipal projects and of looking for multiple pathways to encourage participation.

The Plan indicates a steering committee will be established to help strategically focus municipal and main street efforts.[13] I agree and recommend that, to the degree possible, the recruitment and marketing efforts maintain an "open-door" stance towards qualification so that

[12] Triennial Plan, Baker page 222.
[13] Triennial Plan, Bates p. 67.

instead of having to compete against other communities, each municipality has the opportunity to work with the program to identify and implement projects that meet their current situation and establish the base for future activity.

The municipal program budget remains essentially flat over the three-year Plan with $1.9 million per year and 220 to 227 participants.[14] I recommend monitoring the level of demand, and, if this level of budget is insufficient to meet demand, that reallocation of budget from other C/I initiatives may be warranted.

Energy Optimization Pilot

Q: Do you support the Energy Optimization Pilot as proposed?

A: Yes, cold climate air source heat pumps provide an important opportunity to reduce fossil fuel consumption and emissions. Using electricity and compression/expansion heat pumps to transfer heat, in place of conventional combustion of fuels, results in greatly improved efficiency. The savings in energy costs can be significant, particularly for customers who rely on propane or fuel oil which are relatively more expensive fossil fuels. The pilot plans to target customers that are not already considering a heat pump. Customers who are considering a heat pump can be directed and encouraged to participate in the ENERGY STAR Products Program. To best serve all potential customers, who are contemplating or needing emergency heating system replacements, coordinating the messaging and qualification efforts between the pilot and other programs will be important.

The pilot has a target of 100 participants for the 2021-2023 Plan. This is a rather modest target given the prevalence of propane and fuel oil heating in much of New Hampshire. The

[14] Triennial Plan Table 3-2. Bates p. 74.

pilot will provide valuable experience and feedback on program design, delivery, and market demand. If early results are encouraging, and demonstrate success, the utilities should consider moving from pilot to a full program offering within the 2021-2023 cycle, rather than assuming that a full program will only be implemented in the next cycle.

Home Performance with ENERGY STAR

Q: Do you support the Home Performance with ENERGY STAR program as proposed?

A: Yes, I appreciate program enhancements that are proposed including the use of virtual audits, home heating index, and an increase on the maximum cost per project as proposed. Capturing deep savings levels in the existing home retrofit market is challenging and the program design thoughtfully provides strategies that should enhance program performance. One recommendation is that with the higher per project limit of up to $8,000, the utilities should carefully consider reducing the maximum incentive share of project costs downward from 90 percent to 75 percent or lower. As program participation grows, it should be possible to maintain participation and market acceptance, along with larger per project spending, while decreasing the share of project costs covered by incentives to 75 percent or less.

Performance Incentives

Q: Do you support the proposed structure utility performance incentives?

A: Yes, the performance incentive framework as developed by the DE 17-136 working group results in six weighted performance indicators with minimum and maximum thresholds. [15] I support this type of structured approach to performance incentives. The Plan notes the working

[15] Tables 10-1 and 10-2, Triennial Plan, Bates p. 214.

group had recommended the minimum threshold for the performance indicators be raised from 65% to 75%. However, due to the significant potential ongoing social and economic impacts of COVID-19, the Triennial Plan proposes to move the minimum thresholds back to 65%. I support the 65% minimum threshold for this triennium, assuming the savings targets are maintained. If savings targets are reduced in the final approved plan, then I would recommend a 75% threshold is appropriate. I also recommend the Commission indicate the 65% threshold is provisional, based on COVID-19 and the newly expanded NHSaves portfolio and that it is not intended to be the minimum performance threshold for future performance incentives and plans.

Joint Delivery and Coordination

Q: Do you have additional process related comments?

A: Yes, key strengths of the NHSaves Triennial Plan are joint delivery marketing and coordination. Consumers, trade allies, regulators, advocates, and legislators all benefit from consolidated initiatives. They provide consistency. They provide clearer paths for navigating and understanding program opportunities, successes, and challenges. They reduce the time and efforts required to design, review, modify and approve plans. They increase consumer familiarity and impact of education and marketing.

These advantages are gained through the sustained, and at times difficult, process of getting the various parties to work together, negotiate and compromise to design and deliver consistent, consolidated programs. This can be done while maintaining the individual responsibility and accountability of the parties to manage and deliver on their own initiatives.

V. Content and Analysis

Home Energy Assistance

Q: Do you have comments related to the content and analysis of specific initiatives in the Triennial Plan?

A: I do. While I support approval of the Plan as filed, I have identified several opportunities for clarification and program enhancements. The first of these is to increase the planned number of cold climate heat pump installations in the Home Energy Assistance Program, prioritizing opportunities to replace existing electric resistance heat.

Q: Please explain your analysis and recommendation adjustment for the Home Energy Assistance Program.

A: New Hampshire has approximately 50,000 electrically heated households.[16] The HEA program description estimates roughly 22 percent of New Hampshire households meet the program's income eligibility qualifications. Applying this to the estimated number of electrically heated households results in a target population of roughly 10,000 income eligible households with electric resistance heat. The utilities propose a total of 164 heat pump replacement over three years in the HEA program. [17]

Table 2: Current Plan HEA Heat Pump Replacements

HEA Heat Pump (heating) Replacements				
Program Year	Eversource	Liberty	NHEC	Unitil
2021	40	-	-	-
2022	50	-	-	2
2023	60	-	8	4
Total	**150**	**-**	**8**	**6**

[16] U.S. Census, American Community Survey, 528,109 households and 9.1% electrically heated = 48,058 households.
[17] Eversource, Bates p.634, Liberty Bates p. 702, NHCoop Bates p. 749, Unitil Bates p. 792.

The proposed participation in Table 2 represents a very small portion (roughly 1.6%) of the potential target market of electrically heated households that meet income eligibility requirements.

The plan estimates annual per participant savings of 4.78 MWh. Using the Technical Reference Manual, measure characterization number "***1.29 HVAC Heat Pump – Ductless,***"[18] I estimate net annual per participant savings of 5.78 MWh. My calculations include increased cooling consumption, assuming no pre-existing cooling, a 3-ton system, 2.6 HSPF for the heat pump, and 18 SEER for heat pump cooling. In either case, and recognizing there may be differences in assumptions, heat pump replacements for existing electric resistance heating provide large per participant savings.

HEA heat pump replacements for electric resistance heated households are an important opportunity to increase the electric savings for the HEA program. They will also dramatically reduce annual heating costs for participating households. In the Final Plan, I recommend the Commission direct Eversource to at least double its HEA heat pump target and that each of the other three utilities be directed to target at least 50 heat pump replacements over the three-year Plan. The statewide total for the three-year plan would thereby be at least 450 replacements.

Q: What changes to the HEA budget and electric savings changes would you expect if this recommendation is adopted?

A: With an average cost of $10,000 per participant my proposed new target of 450 is an increase of 286 heat pump replacements over the currently proposed 164 units, requiring a budget increase for HEA on the order of $2.86 million over the current Plan. This would increase the currently proposed HEA budget of $69.8 million by about 4 percent.

[18] Bates p. 331.

The increased heat pump installations would increase the anticipated electric savings by about 10 percent. I recommend the total NHSaves Triennial portfolio budget and targets be adjusted to reflect this increase in the HEA heat pump replacements. Alternatively, downward adjustments to other program budgets and targets in the portfolio could be made to support this increase in the HEA program.

Active Demand Response

Q: Do you have comments on the content and analysis for other program elements?

A: Yes, I want to compliment Eversource, Liberty and Unitil for including the Active Demand Response ("ADR") in their electric portfolio. Eversource and Unitil plan to offer ADR for residential and the commercial industrial markets, while Liberty is limiting ADR to commercial industrial.

Eversource and Unitil are building upon the experience and learning from the 2019 ADR pilots for commercial and industrial customers. The evaluated results indicate load reductions during peak summer events were successful with 6.9 MW reduction for the annual peak installed capacity hour (ICAP) with 7.5 MW of enrolled capacity and 47 customers in New Hampshire.[19] The evaluation contains process recommendations and detailed discussions of baseline and impact analyses, providing a strong foundation for expanded and more streamlined efforts. The 2021-2023 Triennial Plan anticipates increasing the ADR impact by more than four times from the pilot initiatives, reaching over 31 MW by 2023 as illustrated in Table 3. More than 90% of the impact is from the C/I sector, though Eversource and Unitil will both offer residential ADR.

[19] Energy & Resource Solutions (ERS) Inc., 2019 Cross-State C&I Active Demand Reduction Initiative Summer 2019 Evaluation Report. Prepared for Eversource, National Grid and Unitil. Table 1-6 State Level Summary.

Table 3: 2021 to 2023 ADR Summer Peak Impacts

	ADR Annual Active Demand kW				
	Eversource	Liberty	NHEC	Unitil	Total
2021	9,312	3,343	NA	2,025	**14,680**
2022	14,018	5,015	NA	2,488	**21,521**
2023	20,978	7,522	NA	2,950	**31,450**

Reducing loads during peak hours benefits participants and non-participants as the system wide costs for generation, transmission, and distribution capacity are reduced. Reductions in summer peak also tends to avoid generation with high emissions profiles. The plan indicates the expanded ADR initiatives for C/I segment are highly cost-effective savings with estimated 2021-2023 GST benefit-cost ratios ranging from 2.95 to 3.5 as show in Table 4.

Table 4: ADR Granite State Test B/C Ratios 2021-2023

	ADR Benefit/Cost Ratios			
	Eversource	Liberty	NHEC	Unitil
Residential	2.45	-	-	1.02
Com/Ind	3.18	2.95	-	3.5

Residential ADR has lower benefit cost ratios and represents less than 10% of the anticipated impact and participation. As the number and capabilities of connected devices grows, and electrification of end uses increases, residential ADR will likely grow in future years. The Plan indicates the utilities have undertaken or will undertake cyber-security risk reviews, an important safeguard as ADR activity grows.

Looking forward ADR will be an increasingly important asset that can be both geographically and temporally targeted. Targeted and broader market-based ADR can help address circuit limitations and other localized transmission and distribution constraints and serve as the basis for cost effective non-wire alternatives (NWAs). ADR should complement the energy efficiency initiatives for all the electric utilities, and I would encourage NHEC to learn from the other utilities, and their own battery pilot initiative, and plan for inclusion of this asset in their future program design and planning.

VI. Paying for the Plan's Investments

Q: Do you have observations on the proposed funding and rate impacts of the proposed Triennial Plan?

A: I do. The 2021-2023 Triennial Plan represents a very significant increase in the funding and investment for the NHSaves Portfolio. Cumulative program funding for the combined electric and natural gas initiatives more than doubles from the 2018-2020 Plan level of $185 million to more than $392 million in the proposed 2021-2023 Plan. As explained in earlier sections of my Testimony, I support this level of investment and am confident that the Utilities can deliver the proposed services in a manner that provides significant net benefits to New Hampshire's economy and ratepayers.

The 2021-2023 Plan focuses savings and spending on the Commercial, Industrial and Municipal sectors, with 85 percent of electric savings and 60 percent of gas savings coming from these non-residential markets. This sectoral focus helps the full portfolio cost-effectively attain the proposed savings targets. Since the overall budgets are increasing the level of funding and services available, the residential sector also continues to increase in comparison to prior cycles.

Given the differential levels of program investment by sector, I support differentiated systems benefits charges. This implies the C/I sector will face larger increases in the system benefit charge component of their rates than the residential sector, since the C/I sector receives the largest share of portfolio spending. As an example, Table 5 illustrates that Eversource, which accounts for 78 percent of the proposed three-year electric program budgets, estimates the SBC rate for its C&I customers will more than triple, from 7/10ths of a cent to 2.432 cents per kWh.[20]

Table 5: Eversource Projected System Benefit Charge Impacts

Eversource SBC Rate Impacts				
	2020	2021	2022	2023
Total SBC - Res (¢/kWh)	0.743	0.866	0.898	0.941
Total SBC - C&I (¢/kWh)	0.743	1.270	1.807	2.432

Q: Does this level of SBC rate impact, particularly for the C&I segment raise concerns?

A: It can, and indeed some have expressed concern with this level of rate impact. However, it is important to note the SBC impact presented in Table 5 does not account for the reduced cost benefits that accrue to the system from the energy efficiency investments. Table 5 indicates that to fund the proposed programs, the systems benefit charge needs to increase, but it does not account for what the system costs would be if the investments in energy efficiency were not made. Since, by definition, cost effective energy efficiency is a lower cost resource that the avoided supplies, the system without the energy efficiency investment will have higher overall costs and, in the absence of the programs, these costs will also need to be recovered from ratepayers.

[20] Triennial Plan, Part 3, Bates p. 672.

The Plan provides a net rate and bill impact analysis conducted by Synapse Energy Economics, as Attachment M and the results help to illustrate this point. The rate and bill impact analysis estimates that long-term revenue requirements will be reduced by more than $410 million for the electric utilities and more than $72 million for the natural gas utilities as a result of the proposed 2021-2023 Plan programs.[21]

Funding the program's investments through the SBC over three years results in a marked increase in the SBC rate, followed by savings due to lower system costs that are realized over the following decade. Over the long-run, the estimated average change in bills during the life of the measures installed by the program are expected to decrease, even for those customers that are not participants as illustrated in Figure 1.

[21] Triennial Plan Attachment M, Table 1. Bates p.959.

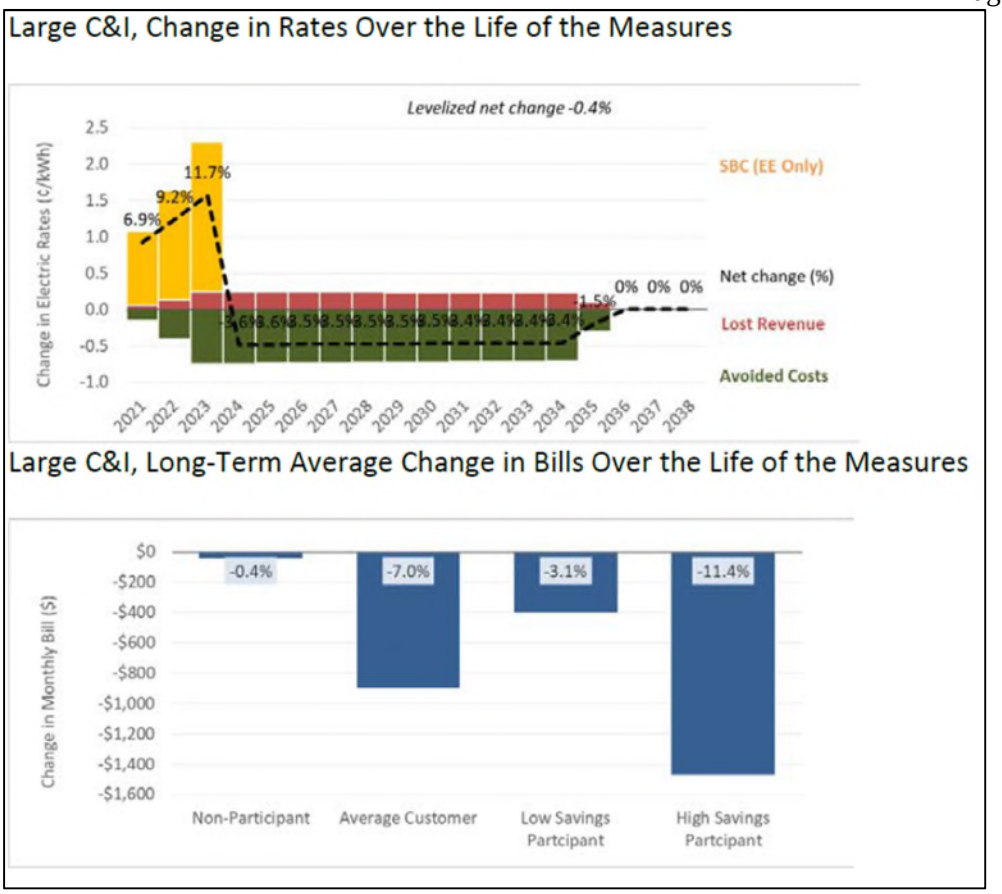

Figure 1: Eversource Rate & Bill Impact Analysis for Large C&I

Gaining the significant benefits of the proposed Triennial Plan portfolio requires investment, and it is important to help consumers and decision makers understand the long-term benefits and savings, rather than having a short-sighted focus on the near-term gross SBC rate impact.

Q: Despite the long-term benefits if the SBC impacts is found to be unacceptable are there modifications or alternatives you can recommend?

A: Yes, while I think the near-term SBC impact is a very worthwhile investment in New Hampshire's future economy, there are some options the utilities and Commission can consider that limit the SBC increases. One of these is to spread the SBC payments represented by the yellow bars during the first three years in Figure 1 above over more years. If a social cost of

capital can be used to finance this amortization of program costs, then the short-term costs and long-term benefits can be brought into closer alignment. While there will be some additional cost associated with such financing, if the near-term SBC rates as proposed are found to be unacceptable, then this approach to financing the costs over a longer period is preferable to reducing the program budgets or savings targets.

A second option that will have a much smaller impact is to shift some portfolio investments and savings towards the residential sector. For example, my testimony above presents a recommendation that the Home Energy Assistance Program three-year budget be increased in order to support a higher level of heat pumps replacing electric resistance heating. Such shifts could reduce the near-term C&I SBC rate impact but likely only by small degrees given the overall portfolio composition and objectives.

A third option is to carefully examine opportunities for underspending or carryover funds from existing initiatives to help reduce the near-term SBC impact.

I do not recommend allowing concerns over the near-term SBC impact to outweigh the long-term benefits provided by the Triennial Plan as proposed. Before reducing the proposed budgets or savings targets, I support these options for reducing the SBC impact as necessary.

VII. Recommendations

Q: Please summarize your recommendations for the Commission based on your review of the 2021-2023 Triennial Plan

A: I strongly support the 2021-2023 Triennial Plan as submitted. The proposed plans and investments will benefit New Hampshire's economy, ratepayers, and environment for years to come. The work by the utilities and stakeholders to develop and refine the plan is commendable.

In my testimony I have discussed seven areas where I recommend the Commission direct modifications or request clarifications as conditions for Plan approval. These are:

1. Clarify that the combined, as opposed to separable, impacts from evaluation and updated avoided costs of more than 10 percent constitute a mid-term modification trigger.
2. Require the Plan, or a supplement, to include a stakeholder collaborative workplan with tasks and working groups and deliverables that include but are not limited to activities for 2024-2026 Planning.
3. Require an increased target for Home Energy Assistance Program Heat Pump replacements for electric resistance heating of at least 450 households.
4. Encourage NHEC to learn from the Active Demand Response activities being implemented by the other utilities and require all utilities to seek to expand ADR offerings.
5. If the Energy Optimization Pilot has early promising results, encourage it to expand to program scale within 2021-2023 plan delivery period.
6. Indicate that while the minimum 65 percent performance incentive thresholds are acceptable for this Plan, the Commission anticipates minimum thresholds of 75 percent will apply for future plans.
7. If the Commission determines it is necessary to adopt strategies to reduce the SBC rate impacts, it should consider amortization program costs over a longer period, shifting funds between programs, and the use of carryforward or unspent funds, before reducing portfolio savings targets or budgets.

Q: Does this conclude your testimony?

A: Yes, it does.

Exhibit List

Exhibit 1	Resume of D.G. Hill

David Hill
Managing Consultant

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Professional Summary

David Hill joined EFG as a Managing Consultant at the start of 2020, after 22 years of employment with VEIC, most recently as Director of Distributed Resources and a VEIC Policy Fellow. He is known nationally for his advancement of sustainable energy program design and evaluation, and renewable energy policy. David has been the principal investigator and led analysis teams for multi-year stakeholder informed studies on solar market and decarbonization pathways and scenarios. David provides expert testimony and regulatory support; participates in international, national, and state boards; leads policy committees and conferences; provides comprehensive studies of the economic, technical, and achievable potentials for sustainable energy programming; and supports program budget planning and implementation. He has led or significantly contributed to the design and development of efficiency and renewable energy programs with annual budgets of $100+ million for initiatives in New Jersey, Washington DC, New York, Vermont, Arizona, and Maryland. He has clients in more than a dozen states and six countries; several of them are international organizations.

Experience

January 2020 – present: Managing Consultant, Energy Futures Group, Hinesburg, Vermont (VT)

2014 – 2019: Director, Distributed Energy Resources, Policy Fellow, VEIC, Burlington, VT

2010 – 2014: Managing Consultant, VEIC, Burlington, VT

2008 – 2010: Deputy Director, Planning and Evaluation, VEIC, Burlington, VT

2000 – 2008: Senior Consultant, VEIC, Burlington, VT

1998 – 2000: Consultant, VEIC, Burlington, VT

1993 – 1998: Research Associate, Tellus Institute and the Boston Center of the Stockholm Environment Institute

Education

Ph.D., Energy Management and Policy Planning, University of Pennsylvania, Philadelphia, Pennsylvania (PA), 1993.

- Fulbright Scholar: Research on energy decision-making in rural Nepal, 1991 – 1993.

Master's, Appropriate Technology and International Development, University of Pennsylvania, Philadelphia, PA, 1989.

B.A., Geography and Political Science, Middlebury College, Middlebury, VT, 1986.

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David Hill
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Selected Projects (from more than 100)

Institute for Energy Economics and Financial Analysis. Lead author, for "*Critical Elements in Short Supply: Assessing the Shortcomings of National Grid's Long-Term Capacity Report"*, study calling into question proposed natural gas pipeline investment for New York City region.

Massachusetts Executive Office of Energy and Environmental Affairs. Senior advisor for team creating Low Emissions Analysis Platform (LEAP) integrated scenario modeling to inform Massachusetts efforts to reach greenhouse gas reduction targets.

Pennsylvania Department of Environmental Protection. Led team creating scenario modeling using the Low Emissions Analysis Platform (LEAP) model in support of two- and half-year study "*Pennsylvania's Solar Future*". Presentations for modeling review and collaborative stakeholder feedback at more than half a dozen stakeholder meetings and webinars.

U.S. Department of Energy. Principal Investigator for a three-year SunShot Initiative Solar Market Pathways study, investigating the technical, regulatory, and business model implications of getting 20 percent of Vermont's total electric supply from solar by 2025.

Sun Shares. Created and launched, and responsible for management and business development of, a community solar business subsidiary to provide "Easy and Affordable Solar for Employers and their Employees," 2015 – present.

New Jersey Clean Energy Program. Program design and policy advisor for the renewable energy program for more than a decade.

Rhode Island Office of Energy Resources. Strategic Advisor on State Energy Plan and System Reliability Procurement and Distributed Generation programs.

Alaska Energy Authority. Principal consultant for two studies on renewable and energy efficiency financing and funding strategies.

New York State Energy Research and Development Authority (NYSERDA). Twice led the renewable energy analysis for 20-year forecast of energy efficiency and renewable energy potential, 2003 and 2012.

World Bank. Expert consultant on a short-term study of efficiency and micro- / mini-grid opportunities in Tanzania, 2014.

Arizona Public Service. Managed a rapid assessment and redesign of PV and solar hot water incentives, 2009.

Testimony as Expert Witness

Expert witness at technical working groups and before commissions on renewable energy and energy efficiency initiatives in Vermont, New York, New Jersey, Maryland, Pennsylvania, Nova Scotia and Ontario.

2020 *Dominion Energy South Carolina, 2020 Integrated Resource Plan*. Expert witness testimony before the South Carolina Public Service Commission submitted on behalf of Southern Alliance for Clean Energy and the South Carolina Coastal Conservation League on the characterization

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and analysis of energy efficiency and demand response in Dominion's 2020 IRP. Docket No. 2019-226-E.

2019 *Efficiency One 2020-2022 DSM Plan: Portfolio Diversification and Lighting Transition*. Expert Witness Testimony submitted on behalf of Efficiency Nova Scotia, to the Nova Scotia Utility and Review Board, Matter 09096.

2018 *In the Matter of an Application by Nova Scotia Power for Approval of its Advanced Meter Infrastructure Project*. Expert Witness Testimony submitted on behalf of Ecology Action Center, to the Nova Scotia Utility and Review Board, Matter 08349.

2018 *Becoming an Advanced Solar Economy.* Testimony before the Vermont House Committee on Energy and Technology, Montpelier.

2017 Maryland Public Service Commission. On behalf of Office of People's Counsel on EmPOWER Maryland Utilities 2018-2020 plans. Presentation and testimony, October 25-26, 2017.

2016 Maryland Office of People's Counsel, EmPOWER Maryland. *Written Comments on 2015 Semi Annual (Q3 and Q4) Review.* Presentation and testimony, May 4, 2016.

2015 Maryland Office of People's Counsel, EmPOWER Maryland. *Written Comments on 2015 Semi Annual Review.* Presentation and testimony, October 14-15, 2015.

2014 Maryland Office of People's Counsel, EmPOWER Maryland. *Written Comments on 2015-2017 Utility Proposed Plans.* Presentation and testimony, October 21-22, 2014.

2014 Maryland Office of People's Counsel, EmPOWER Maryland. Evaluation of Semi-Annual Reports - Case Nos. 9153-9157. Presentation and testimony, April 7, 2014.

2013 Pennsylvania Public Utility Commission. On behalf of the Office of Consumer Advocate, regarding Petitions of the Pennsylvania Power Company for Approval of its Act 129 Phase II Energy Efficiency and Conservation Plan (Docket Nos. M-2012-2334395 and M-2012-2334392); Petition of Metropolitan Edison Company (Docket No, M-2012-2334387); and Petition of West Penn Power Company (Docket No. M-2012-2334398). Written testimony. January 8, 2013.

2013 Maryland Office of People's Counsel, EmPOWER Maryland. *Written comments on 2012 Q3-Q4 Semi-Annual Report.* Presentation and testimony, October 2-3, 2013.

2011 Maryland Office of People's Counsel. *Utility-Specific Comments on the 2012-2014 EmPOWER Maryland Program Plans*. Case Nos. 9153-9157. Written testimony. October 19, 2011.

2011 Maryland Office of People's Counsel. *Written Comments on 2010 Annual Reports, and Q4 2010 reports*. Case Nos. 9153-9157. Presentation and testimony. March 31, 2011.

2011 Maryland Public Service Commission. On behalf of the Maryland Office of People's Counsel. *Comments on the 2012-2014 EmPOWER Maryland Utility Program Plans.* October 2011.

2009 Pennsylvania Public Utility Commission. On behalf of the Office of Consumer Advocate, regarding Petition of Duquesne Light Company for Approval of Its Energy Efficiency and Conservation and Demand Response Plan, Docket No. M-2009-2093217. August 7, 2009.

2005 Ontario Energy Board. On behalf of Green Energy Coalition, regarding Hydro One Networks and Brampton Conservation and Demand Management Plans. February 4, 2005 (written comments) and February 17-18, 2005 (testimony).

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2005 Pennsylvania Public Utility Commission. On behalf of Penn Future, regarding net metering standards. Written comments and testimony. June 2005.

2005 Pennsylvania Public Utility Commission. On behalf of Penn Future. Written testimony and comments on interconnection standards. April 2005.

2005 Testimony to the Vermont State Legislature House Committee on Energy and Natural Resources on Vermont's Solar and Small Wind Incentive Program. February 9, 2005.

Selected Presentations

2017 Sun Shares, Easy and Affordable Solar for Employers and their Employees, American Solar Energy Society, Solar 2017, Denver.

2017 Vermont Solar Market Pathways, American Solar Energy Society, Solar 2017, Denver.

2016 *Oxymoron: Harmonizing Distributed Energy Integration Realities with Policy Frameworks*. Solar Power International.

2015 World Bank, International Conference on Energy Efficiency in Cities, Puebla New Mexico. Invited Panel speaker on Efficiency Vermont and Third Party Administration Model. February, 2015.

2015 *Vermont Solar Market Pathways.* Presentations at Solar 2015 (State College, Pennsylvania), and Renewable Energy Vermont Conference.

2014 New York State Energy Research and Development Authority (NYSERDA), Renewable Energy Potential Study Results, Albany, NY.

2013 *Transformative Energy Planning*. Invited speaker at Innovations in Renewable Energy Symposium, Metcalf Institute for Marine and Environmental Reporting, Narragansett, Rhode Island.

2012 World Renewable Energy Forum, 2012 – Welcome Address and Introduction of Keynote Plenary Speakers. American Solar Energy Society, Denver.

2012 *Efficiency Vermont: A Successful Statewide Clean Energy Utility Model.* Presented at the 2012 Business of Clean Energy in Alaska Conference, Anchorage.

2011 Nova Scotia Feed In Tariff Forum: Invited speaker for two panels addressing Regional Coordination and Export Potential and International Feed-in Tariffs.

2011 *Integrating Renewable Energy and Efficiency Services.* Presentation to the Clean Energy States Alliance Fall 2011 Meeting, Washington, DC.

2010 *The Potential for Energy Efficiency and Renewables as Resources in Wholesale Capacity Markets,* Presentation at EUEC 2010 Conference, Phoenix, AZ.

2008 "Technology and Policy; Getting it Right." Solar Power International, Invited panel speaker. San Diego, California.

2008 *Solar Market Transition in New Jersey: Promise and Progress towards Sustained Growth*. Solar 2008, American Solar Energy Society.

2008 *Review of Efficiency Vermont Administrative Structure and Experience*. Penn Future 2008 Clean Energy Conference, May 2008.

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2006 *Scoping Analysis of Potential Photovoltaic Contributions Towards Offsetting Transmission System Upgrades in Southern Vermont.* Solar 2006, American Solar Energy Society.

2006 *Growing New Construction Markets for Photovoltaics: Recent Strategies and Activities from LIPA's Solar Pioneer Program.* Solar 2006, American Solar Energy Society, 2006.

2005 *Market Response to Photovoltaic Incentive Offerings: An Analysis of Trends and Indicators*. Presented at the International Solar Energy Society Solar World Congress, 2005.

2003 *Solar Energy Value and Opportunities in Vermont*, Invited Session Panel Moderator and Speaker, 2nd Annual Power for a New Economy Conference, Burlington, Vermont, October 8, 2003. Renewable Energy Vermont.

2003 *Renewable Energy Case Studies: Redefining the Models, Refining the Messages, and Getting the Word Out*, Invited Session Panel Moderator, Solar 2003 National Solar Energy Conference, Austin, Texas June 22, 2003. American Solar Energy Society.

2002 *Transforming Markets for Customer Sited Clean Renewable Energy: Connecting Field Experience with Lessons from the Efficiency World*, Invited Session Panel Moderator, Solar 2002 National Solar Energy Conference, Reno, Nevada June 18, 2002. American Solar Energy Society.

1997 *IDENTIFY: Improving Industrial Energy Efficiency and Mitigating Global Climate Change.* Software and paper prepared for the United Nations Industrial Development Organization, presented at the 1997 ACEEE Summer Study on Energy Efficiency in Industry.

1997 *E2/FINANCE: A Software System for Evaluating Industrial Eco-Efficiency Opportunities*, sponsored by the U.S. Department of Energy. ACEEE 1997 Summer Study on Energy Efficiency in Industry.

1995 *Process Evaluation of Three Gas Utility Commercial Industrial Demand Side Programs.* Prepared for the Colonial Gas Company, and presented at ACEEE 1995 Summer Study on Energy Efficiency in Industry.

Selected Publications

2017 Smart Electric Power Alliance, 51st State Initiative, *Role of Utilities in the Transforming Energy Economy of the 51st State*, September 2017.

2016 *Vermont Solar Market Pathways: From a Developed to an Advanced Solar Economy*. A Phase II Roadmap document prepared for the *Smart Electric Power Alliance 51st State Initiative*.

2016 *Vermont Solar Market Pathways,* Vols. 1-4. U.S. Department of Energy, Sun Shot Initiative, Office of Energy Efficiency and Renewable Energy. Award DE-EE-0006911. www.Vermontsolarpathways.org.

2016 *Energy Efficiency Program Evaluation and Financing Needs Assessment*. Report prepared for the Alaska Energy Authority, May 2016.

2015 *Michigan Renewable Resource Assesment*. Final Report, prepared for the Michigan Public Service Commission Staff under agreement with the Clean Energy States Alliance. April 2015.

2012 *Renewable Energy Grant Recommendation Program: Process and Impact Evaluations.* Principal in Charge for comprehensive two-volume study. Alaska Energy Authority.

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2011 "Solar in Nepal: Small Systems, Big Benefits." *Solar Today.* July / August 2011.

2011 "National Clean Energy Standard: Congress Needs to Design It Properly." Perspective with Shaun McGrath and Jeff Lyng. *Solar Today.* July / August 2011.

2010 "National RPS Now!" *Solar Today*. July / August 2010.

2009 "Carbon Regulation: What's the Most Effective Path?" *Solar Today*. June 2009.

2009 "Policy Recommendations for the 111th Congress: Tackling Climate Change and Creating a Green Economy." Prepared by the American Solar Energy Society Policy Committee.

2008 "Pennsylvania Solar Assessment." Final Report, November 25, 2008. Incorporated into American Council for an Energy-Efficient Economy, *Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania.* ACEEE Report No. E093. Washington, DC: ACEEE, April 2009.

2008 "Solar Market Transition in New Jersey: Promise and Progress towards Sustained Growth." *Proceedings of Solar 2008*, American Solar Energy Society.

2004 "Cost Effective Contributions to New York's Greenhouse Gas Reduction Targets from Energy Efficiency and Renewable Energy Resources." *Proceedings of 2004 ACEEE Summer Study on Energy Efficiency in Buildings.*

2002 "The Ten Percent Challenge: A Participatory Community Scale Climate Campaign." *Proceedings of 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Volume 9, (with Tom Buckley, Jennifer Green, and Debra Sachs).

2000 "Implementing and Monitoring Community-Based Climate Action Plans." *Proceedings of 2000 ACEEE Summer Study on Energy Efficiency in Buildings.* Volume 9, pp. 149-160 (with Tom Buckley, Mark Eldridge, Debra Sachs, and Abby Young).

1998 *Eco-Efficiency Financing Resource Directory*. Electronic web-site, and printed directory prepared for the Environmental Protection Agency, Region I, New England.

Leadership

2017 – 2019	Energy Coop of Vermont, Board Member and Treasurer.
2013	Solar 2013, "Power Forward, Baltimore Maryland." Chair of Conference Advisory Committee responsible for recruiting and coordinating four main conference plenary sessions.
2012 – 2013	American Solar Energy Society (ASES), Chair of the Board.
2012	Policy Track Chair for the World Renewable Energy Forum, Denver, Colorado, May.
2009 – 2012	ASES Policy Committee, Board Member and Chair.
2007	Vermont Governor's Climate Change Committee, Member of the Plenary Working Group.
2000 – 2010	Renewable Energy Vermont, Founding Board Member, Past Board Chair.

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Regulatory and Other Governmental / NGO Documents

2000 – 2012 *New Jersey's Clean Energy Programs – Honeywell Team Program Plans.* Led team on designing and implementing of Renewable Energy Program plans and initiatives. Many program plans and strategies for transition to market-based incentives.

1998 – 2008 *Long Island Power Authority's Clean Energy Initiative.* Lead Technical and Senior Advisor on Renewable Energy Plans, including the Solar Pioneer Initiative and Residential Energy Efficiency Programs.

2000 *The Climate Action Plan: A Plan to Save Energy and Reduce Greenhouse Gas Emissions*, Lead author for the Burlington (Vermont) Climate Protection Task Force.

1998 *Home Weatherization Assistance Program Environmental Impact Analysis*. Prepared for the Ohio Department of Development, Office of Energy Efficiency.

1997 *Achieving Public Policy Objectives Under Retail Competition: The Role of Customer Aggregation*. Prepared for the Colorado Governor's Office of Energy Conservation.

1997 *IDENTIFY: Improving Industrial Energy Efficiency and Mitigating Global Climate Change*, software and paper. For the United Nations Industrial Development Organization.

1997 *Review of the Swaziland Energy Information System and Report on LEAP Training Activities*. Prepared for the Ministry of Natural Resources and Energy, Government Kingdom of Swaziland.

1996 *Evaluation of the IDB's Policies and Practices in Support of Renewable Energy and Energy Efficiency: A Report to the Inter-American Development Bank*. Brower and Company and Tellus Institute.

1996 *Action Plan for the Massachusetts' Industrial Services Program (ISP)*, prepared for the Sustainable Industries Initiative of the Corporation for Business Work and Learning.

1995 *Framework for National Energy Planning: Mission Report*, The Republic of Maldives. United Nations Department for Development Support and Management Services.

1994 *The SEI / UNEP Fuel Chain Project: Methods, Issues, and Case Studies in Developing Countries. Venezuela Case Study*.

1994 *Future Energy Requirements for Africa's Agriculture (Sudan Case Study)*. Report to the African Development Bank by the UN Food and Agriculture Organization.

1994 Report to the Idaho Public Utility Commission on Suggested Cost Allowances for the Idaho Power Company's DSM Programs. Prepared for the Idaho Public Utilities Commission, Tellus Report No. 94-177.

1994 Review of Pennsylvania Electric Company's 1995 Demand Side Management Filing. Prepared for: Pennsylvania Office of Consumer Advocate. Tellus Study No. 94-071.

1994 Review of Union Electric Company's Electric Utility Resource Planning Compliance Filings. Prepared for: The Missouri Office of Public Counsel. Tellus Study No. 93-300.

1994 *Incorporating Environmental Externalities in Energy Decisions: A Guide for Energy Planners*. A Report to the Swedish International Development Agency. SEI-B Report No. 91-157.

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Other Qualifications

Nepal, Himalayan Light Foundation. Installed solar lighting systems in 3 remote health clinics and 3 homes, 2010.

Advanced PV Installation certificate. Solar Energy International, 2010.

Peace Corps volunteer. Sierra Leone, 1984 – 1986.

Languages

- Nepali: ILR Level 3, speaking; ILR Level 2, reading
- Krio and Mende (Sierra Leone): ILR Level 2, speaking

Software competency

- LEAP (Low Emissions Analysis Platform), Stockholm Environment Institute. Former trainer and current Principal Investigator of team using scenario modeling on three projects.
- NREL System Advisor Model. Financial and technical modeling tool for renewable energy systems.

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