**BEFORE**

**THE PUBLIC UTILITIES COMMISSION OF OHIO**

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|---|---|---|
| In the Matter of the Application of Ohio Power Company for an Increase in Electric Distribution Rates. | ) | Case No. 20-585-EL-AIR |
| In the Matter of the Application of Ohio Power Company for Tariff Approval. | ) | Case No. 20-586-EL-ATA |
| In the Matter of the Application of Ohio Power Company for Approval to Change Accounting Methods. | ) | Case No. 20-587-EL-AAM |

# TESTIMONY OF CHRIS NEME, ENERGY FUTURES GROUP

**SUBMITTED ON BEHALF OF**
**ENVIRONMENTAL LAW AND POLICY CENTER**

**April 20, 2021**

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# I. Introductions and Qualifications

**Q: Please state your name, employer and business address.**

A: My name is Chris Neme. I am a co-founder and Principal of Energy Futures Group, a consulting firm that provides specialized expertise on energy efficiency and other clean energy markets, programs and policies. My business address is P.O. Box 587, Hinesburg, VT 05461.

**Q: Please describe your educational background.**

A: I received a Master of Public Policy ("MPP") degree from the University of Michigan (Ann Arbor) in 1986. That is a two-year, multi-disciplinary degree focused on applied economics, statistics and policy development. I also received a Bachelor's degree in Political Science from the University of Michigan (Ann Arbor) in 1985. My first year of graduate school counted towards both my Masters' and Bachelor's degrees.

**Q: Please summarize your business and professional experience.**

A: As a Principal in Energy Futures Group, I play major roles in a variety of consulting projects. Recent examples include:

- Assisting the Natural Resources Defense Council (NRDC) in consultations with utilities and other parties in Illinois, Michigan, Ohio and Minnesota on a range of clean energy policy and program issues, including efficiency program and portfolio design, implementation, and evaluation; distribution system planning, including non-wires alternatives; integrated resource planning; demand response; cost-effectiveness analysis

of distributed energy resources; shareholder incentive structures for investment in distributed energy; and other related topics;

- Serving on the Management Committee and supporting strategic planning and program design for a team of firms, led by TRC Energy Services, that was hired by the New Jersey Board of Public Utilities to deliver statewide energy efficiency programs;

- Co-Authoring the *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources* (May 2017) and the *National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources* (August 2020), as well as assisting state regulators and others across the country to understand and apply them;

- Helping the National Association of Regulatory Utility Commissioners and the Michigan Public Service Commission staff assess the merits of alternative approaches to defining utility efficiency program savings goals (focusing on lifetime savings).

During my career, I have worked in numerous jurisdictions to develop or review energy efficiency potential studies, develop or review Technical Reference Manuals ("TRM") which establish energy savings assumptions that utilities and commissions use to document efficiency program performance, and review or develop efficiency programs. All told, I have worked on these and/or other clean energy policy and program issues for clients in more than 30 states, seven Canadian provinces and several European countries. A copy of my curriculum vitae is attached as Exhibit 1.

**Q: Can you elaborate on the work you have done in Ohio?**

A: I have worked on a variety of energy efficiency policy and program issues in Ohio over the past twenty years. Much of that work has been in the past five years for the Natural Resources Defense Council (NRDC). That has included:

- **Review of utility efficiency program plans**. I have helped NRDC provide input to and ultimately review and critique all of the filed AEP, First Energy and Duke efficiency programs plans. I have also been involved in settlement negotiations regarding those plans. As I discuss below, I filed expert witness testimony (as well as rebuttal testimony) on First Energy's 2017-2019 plan.

- **Participation in Utility Collaborative meetings**. I have represented NRDC in a number of AEP, First Energy, and Duke collaborative meetings on the energy efficiency programs.

- **Analysis of Ohio legislative proposals regarding energy efficiency.** I have provided technical support to NRDC in reviewing and analyzing different versions of the energy efficiency legislation. I also testified before both the Ohio House of Representatives and the Ohio Senate on energy efficiency legislation (HB 554 and SB 320) in November 2016.

In addition, I initially led the Vermont Energy Investment Corporation (VEIC) team that was hired by the Public Utilities Commission of Ohio in 2010 to develop the Ohio Technical Reference Manual of deemed savings assumptions that the state's utilities still use to document the savings their efficiency programs have produced. When I left VEIC to form EFG several

months after that work started, my role changed from leading the project to just providing technical support to it.

**Q: Have you previously filed expert witness testimony in other proceedings before this Commission?**

A: Yes. I filed testimony in the following PUCO proceedings:

- 16-0743-EL-POR: regarding First Energy's proposed 2017 to 2019 efficiency program plan (both direct testimony and rebuttal testimony);
- 12-1230-EL-SSO: regarding First Energy's bidding of efficiency resources into the PJM capacity market; and
- Unknown 1990 docket:[1] regarding AEP's proposed plan for compliance with federal sulfur dioxide (acid rain) emission reduction requirements.

**Q: Have you served as an expert witness on energy efficiency matters before other regulatory commissions?**

A: Yes, I have filed expert witness testimony on nearly 60 other occasions before similar regulatory bodies in a dozen other states and provinces, including the neighboring jurisdictions of Michigan, Illinois, and Ontario.

**Q: Are you sponsoring any exhibits other than your CV?**

A: No.

[1] I no longer have a copy of my testimony in this proceeding and do not know the docket number.

# II. Testimony Overview

**Q: What is the purpose of your testimony?**

A: My testimony focuses on just one issue before the Commission in this proceeding: the provision in the settlement between AEP and other parties to strike AEP's proposed voluntary efficiency programs. I discuss the rationale for electric utility run efficiency programs. I also address both the merits and shortcomings of the specific programs and budgets originally proposed by AEP in this proceeding.

**Q: What do you conclude and recommend?**

A: My conclusions and recommendations can be summarized as follows:

1. Electric utility run efficiency programs can provide substantial energy bill savings to customers.

2. Customers who participate in such programs save on their bills because they reduce their electricity consumption. Additionally, customers who do not participate also receive significant benefits because energy efficiency programs lower market prices for energy and generating capacity, fewer new power plants need to get built, and utilities need to make less investment in new power lines and related distribution infrastructure.

3. The vast majority of the customer savings from cost-effective utility efficiency programs would not occur on their own because of numerous market barriers to residential and business customer investment in efficiency.

4. Competitive retail energy suppliers do not fill the void. There is no evidence to suggest that they have or ever will achieve efficiency savings at anything close to the scale that Ohio's electric utilities have achieved.

5. The portfolio of efficiency programs that AEP had originally proposed in this proceeding had many positive attributes. Among those positive attributes was a robust cost-effectiveness, with $2 in energy bill reductions for every program dollar spent. AEP estimated that the programs would provide over $35 million in bill reductions from just one year of programs. Moreover, that is a conservatively low estimate because it excludes a number of important benefits that AEP did not quantify or under-value.

6. The scale of AEP's originally proposed portfolio of programs – the level of savings that would be achieved and therefore the level of economic benefits that would accrue to customers – is much lower than what the Company has achieved in the past (e.g., about $280 million in bill reductions from its 2020 programs based again on conservative AEP assumptions) or could achieve in the future.

7. In addition to providing substantial bill reductions, AEP efficiency programs would provide risk mitigating benefits to its customers, provide public health benefits to the broader Ohio community, and create thousands of local jobs.

8. The PUCO recently approved a voluntary efficiency program proposed by Columbia Gas. If Columbia Gas' efficiency program spending as a percent of its customers' total gas bill (about 3%) was applied to AEP's customers' total electric bill, the result would be an AEP efficiency program budget of $60 to $65 million – or substantially more than the $32 million AEP originally proposed for efficiency programs in this proceeding.

9. AEP could very effectively spend such additional funds – either by proportionally increasing the proposed budgets for all its originally proposed programs, or by focusing the entire increase on its three most cost-effective programs plus its low-income program.

10. AEP has a track record of effectively running such a robust portfolio of efficiency programs. That includes earning a federal Energy Star "Partner of the Year" award for sustained excellence in energy efficiency program delivery.

# III. Rationale for Efficiency Programs

## A. Purpose of Utility Efficiency Programs

**Q: What is the purpose of electric utility ratepayer-funded efficiency programs work?**

A: Utility efficiency programs help customers who would not otherwise invest in cost-effective efficiency measures to make such investments. By definition, focusing on cost-effective savings means such programs reduce the cost of providing electricity service to the utility's customers. That is their principal purpose. Customers who take advantage of programs save on their bills, but all customers benefit because utilities need to purchase less generation and they need to make less investment in the delivery system. As discussed further in subsection D below, utility efficiency programs can also provide other benefits for customers and the Ohio economy.

## B. How Utility Efficiency Programs Work

**Q: How do utility efficiency programs help customers invest in money saving efficiency upgrades?**

A: That assistance can take several forms. First, programs typically offer a financial incentive – a discount or rebate – to encourage customers to consider efficiency measures, to encourage vendors to stock and sell them, and to buy down the cost to a point where a significant portion of customers will make the investment. Programs also typically include "marketing" efforts to educate customers on the benefits of specific efficient products and services. They can also include technical training (to help builders, contractors and other market players understand how to make the products and services they sell more efficient), sales training (to help retailers, contractors, and other vendors more effectively educate their own customers), tools to help

customers find qualified contractors, financing to help customers afford major efficiency investments, and other strategies.

**Q: What kind of efficiency measures do programs promote?**

A: Generally speaking, most efficiency measures fall into one of three categories: (1) equipment purchases; (2) new construction design; and (3) retrofit investments.

**Q: How do efficiency programs influence equipment purchases?**

A: The most common utility efficiency programs are those that help to convince customers who are in the market to buy an electricity-consuming product to buy one of the most efficient products available instead of one of the standard (less efficient) products. For example, if a customer's existing electric water heater has broken or has just gotten old enough that the customer has decided to replace it, an efficiency program can influence the customer to buy the one that costs a little more but saves electricity and pays for itself over time – e.g., an efficient new heat pump water heater. Because heat pump water heaters cost more than much less efficient electric resistance models, the utility could offer a rebate to both buy down the cost and give retailers and plumbing contractors a tool to help upsell the customer to the efficient product.[2]

In addition to heat pump water heaters, utility efficiency programs commonly promote the purchase of efficient new residential appliances, residential and commercial HVAC equipment,

[2] Note that sometimes programs provide financial incentives "upstream" to distributors of heat pump water heaters (instead of "downstream" to the ultimate customers) so that they stock and sell more such products to their contractors who ultimately sell them to customers.

residential and commercial lighting products, commercial food service equipment, industrial motors and a wide range of other efficient products.

One key feature of opportunities to help customers purchase efficient products is that they are time-sensitive. If efficiency programs are not available at the time a customer is buying a new water heater, the customer may buy a standard product and the customer will essentially be stuck with that lower efficiency product (and its related higher annual energy cost) for another 10 to 15 years or more. As a result, the electricity system will have to maintain and operate more and/or larger power plants, transmission lines, distribution substations and other elements of the grid.

**Q: How do efficiency programs affect new construction decisions?**

A: A building constructed to the minimum requirements of the state building code will typically be more efficient than the average existing home, office, retail store or restaurant. However, it is typically both possible and cost-effective to design and build the home or commercial building to be even more efficient than required by code. In such cases, utility efficiency programs typically focus on encouraging architects, developers, builders and other relevant market actors – with technical training, marketing support and financial incentives – to design and construct more efficient buildings.

**Q: What are retrofit efficiency measures?**

A: Retrofit efficiency measures are measures that are added onto an existing building or building component to make it operate more efficiently. For example, an efficiency program can promote upgrading of attic insulation levels in a home. Similarly, a program can promote the addition of innovative technology called "demand control ventilation" to the existing ventilation system of an office building. Demand control ventilation is a technology that uses sensors to

measure things like carbon dioxide levels in a building (or to different parts of a building) and uses such readings to calibrate when and how much the building's ventilation system has to run to ensure indoor air quality needs are met. That can result in substantial energy savings because ventilation systems in many commercial buildings are designed to meet peak occupancy needs and then run as if the buildings are always at maximum occupancy – wasting significant amounts of energy when buildings are not occupied or lightly occupied.

Persuading customers to install retrofit measures like attic insulation or demand control ventilation is different than persuading them to make more efficient equipment purchases. For one thing, it requires convincing a customer who was not already planning to make any kind of purchase to make one. On the other hand, unlike equipment purchase and new construction measures, retrofit measures are not time-sensitive. Measures can be installed today, tomorrow, next month or next year at essentially the same cost.

**Q: Is the cost-effective savings potential from equipment purchase measures greater or less than the potential from retrofit measures?**

A: Both can be important because they help customers reduce their usage. However, most utilities get most of their savings from equipment replacement measures because they tend to be less costly savings to acquire. That is because the programs need only help customers overcome the *incremental cost* of an upgrade (e.g., the difference in cost between a standard new water heater and a heat pump water heater) rather than the *full cost* of a retrofit measure (e.g., the full cost of insulating an attic or the full cost of installing a new ventilation control system).

## C. How Utility Efficiency Programs Reduce Customers' Electricity Costs

**Q: How do electric efficiency programs reduce the cost of meeting its customers' electricity needs?**

A: Ohio law historically required energy efficiency programs to be cost-effective. This meant that cost savings to the electric system as a whole had to be greater than the cost of the efficiency programs, leaving ratepayers as a whole better off – even before or without considering other benefits that may be of public interest.[3]

Electric efficiency programs reduce the cost of supplying electricity to customers in several ways:

1. **Avoided Energy Costs**. Every kWh a customer does not consume as a result of an efficiency investment is a kWh that does not need to be generated by a power plant. The result is fuel cost savings, other operational cost savings associated with running power plants, and additional savings from reduction in line losses (between the generating plant and the customer's home or business).

2. **Avoided Generation Capacity Costs**. Most efficiency measures lower electricity usage, at least to some degree (on average across all customers), during hours of peak demand. Ultimately, that reduces the amount of new generating capacity (power plants) that needs to be built to meet peak demand.

[3] Industry best practices are to include all values related to state policy objectives in cost-effectiveness tests. See Woolfe, Tim et al, *National Standard Practice Manual for Benefit Cost Analysis of Distributed Energy Resources*, August 2020 (https://www.nationalenergyscreeningproject.org/wp-content/uploads/2020/08/NSPM-DERs_08-24-2020.pdf).

3. **Avoided Transmission and Distribution (T&D) System Upgrade Costs**. Electric utilities invest in substations and other elements of the T&D system every year. Some of those investments are related to growing demand for electricity in certain geographic areas. For example, a utility may make a capital investment to upgrade the capacity of a substation so that it can accommodate future levels of peak demand without sacrificing reliability. System-wide efficiency programs, if broad enough in scope, will cause at least some customers downstream of virtually every substation – and virtually every other component of T&D systems – to invest in efficiency measures each year. The combined effect of such investments over multiple years will reduce the need for at least some substation upgrades. These are commonly known as "passive deferrals" because they are not the result of targeting efficiency programs to specific geographic areas or to defer specific T&D capital projects.[4] All such passive deferrals save customers money. For example, in 2011, Consolidated Edison, the electric utility serving New York City and neighboring Westchester County, found that when it included the effects of its system-wide efficiency programs in its 10-year forecast of distribution system needs its forecast capital expenditures declined by more than $1 billion.[5]

4. **Market Price Reductions**. In states like Ohio where utilities purchase generation in a competitive wholesale market, the market clearing price for both electric energy and generating capacity is affected by both the cost of different supply options and the

[4] Neme, Chris and Jim Grevatt, Energy Efficiency as a T&D Resource: Lessons Learned from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments, Northeast Energy Efficiency Partnerships, January 9, 2015 (https://neep.org/sites/default/files/products/EMV-Forum-Geo-Targeting_Final_2015-01-20.pdf).

[5] Gazze, Chris and Madlen Massarlian, "Planning for Efficiency: Forecasting the Geographic Distribution of Demand Reductions", in *Public Utilities Fortnightly*, August 2011, pp. 36-41.

magnitude of demand. All other things equal, when demand goes down because of efficiency programs, the market clearing price goes down. Indeed, a recent PUCO Staff report found that Ohio's utility efficiency programs reduced market clearing prices for electric energy by 5.7%.[6] Such cost savings accrue to all electricity customers.

5. **Reduced Credit and Collection Costs**. When programs lead to installation of efficiency measures in homes or businesses whose occupants are struggling to pay their bills, efficiency can lead to more regular and on-time payments. This means lower costs to the utility for shut-offs, reconnects, and carrying charges for unpaid bills on their books that get passed on to customers.

**Q: Who benefits from these cost savings?**

A: The customers who participate in the efficiency programs benefit most because they experience reductions in their electricity consumption. However, many of the benefits of efficiency programs accrue to all ratepayers. For example, the effects that efficiency programs have on reducing market clearing prices for both electric energy and capacity accrue to all ratepayers. Avoided capacity costs, avoided T&D costs and reduced credit and collection costs also benefit all ratepayers.

[6] Public Utilities Commission of Ohio, Letter to Senator Balderson and Representative Roegner (Co-Chairs of the Energy Mandate Study Subcommittee), February 26, 2015.

**Q: Are there ways to ensure that the benefits of efficiency programs are as widely spread as possible?**

A: The best way to make sure benefits of efficiency programs are spread as widely as possible is to make sure that the portfolio of programs is diverse enough to offer opportunities for all customers to participate and that there is enough budget to support broad participation. It is also important to maintain stability in the offering of programs over time because not all customers are in the market to buy significant energy consuming products each year.

## D. Other Benefits of Utility Efficiency Programs

**Q: What other benefits – beyond reducing electricity costs – can utility efficiency programs provide?**

A: Additional benefits include reduced risk to utility customers, reductions in environmental emissions, related improvements to public health, and increases in local jobs and economic development. There are also additional non-energy benefits to participating customers such as reduced water consumption, improved comfort, improved health and safety and improved business productivity.

**Q: How do efficiency programs reduce risk?**

A: Most electric efficiency measures last a decade or more. In fact, AEP estimated that the savings from the efficiency measures its 2020 programs promoted would last an average of 14 years.[7] Thus, when customers install efficiency measures that reduce their electricity consumption they reduce their exposure to future fuel price volatility. They also reduce their

[7] AEP, 2020 Portfolio Status Report on Energy Efficiency and Peak Demand Response Programs, filed February 12, 2020 in Case No. 21-139-EL-EEC.

exposure to potential future costs of compliance with new environmental regulations that could increase electricity prices in the future.

Customers get economic value from such risk reduction. The purchase and installation of an efficiency measure with a 14-year life is tantamount to buying a 14-year fixed price contract for the amount of electricity the measure will save each year. A recent study found that there was about an 8% "wholesale risk premium" associated with fixed price contracts of up to just three years.[8] In other words, customers were willing to pay 8% more than the expected future cost of electricity to lock in a price for three years. That is a conservative proxy for the risk mitigating value of efficiency improvements because the price premium would undoubtedly be higher for longer-term contracts more akin to the life of the average efficiency measure.

**Q: Are there studies that have quantified the value of public health improvements resulting from reduced emissions?**

A: Yes. For example, the independent evaluator of Commonwealth Edison's Chicago-area efficiency programs recently estimated that the economic value of the public health benefits of the emissions reductions resulting from just one year of running its programs will be on the order of $0.5 billion – or about $0.03 per kWh saved.[9] That value is substantially greater than the entire annual cost to ComEd of running its efficiency programs.

[8] Synapse Energy Economics et al., *Avoided Energy Supply Components in New England: 2018 Report*, prepared for the AESC 2018 Study Group, amended October 24, 2018.

[9] The estimates for the 2022 programs are about $550 million in benefits, or the equivalent of $0.0354 per kWh. The value is forecast to decline slightly each ensuing year because of expectations that the generation mix is getting cleaner [Guidehouse, ComEd Non-Energy Impacts Research Update, presented at the IL SAG NEI Working Group meeting, December 8, 2020, slide 6 (https://ilsag.s3.amazonaws.com/ComEd-GH-SAG-NEI-WG-2020-12-08.pdf)].

**Q: Has AEP estimated the impacts that its originally proposed efficiency programs would have on jobs?**

A: Yes. AEP estimated that its originally proposed portfolio of efficiency programs would create over 1000 direct jobs and over 1600 indirect in 2021.[10]

## E. Many Cost-Effective Savings Will Not Be Realized without Utility Programs

**Q: If these efficiency savings are cost-effective, why are utility programs needed? Wouldn't they happen on their own?**

A: If the programs are well-designed and targeted to the right efficiency opportunities, they will produce substantial savings that would not otherwise be realized. Customers – even sophisticated business customers – rarely invest in all cost-effective efficiency measures absent the support of utility programs.[11]

**Q: Why is that?**

A: Customers are often reluctant to pay more for products up front even if it's in their economic interest to do so. This is particularly true for residential customers who may be operating on a tight budget or business customers concerned about short term profits.

Additionally, a number of other market barriers prevent customers from investing in all cost-effective efficiency measures. For example, customers rarely – if ever – have perfect information about the nature of efficiency opportunities, the magnitude of the savings potential, what products or services to buy (and from whom they can or should buy them) to realize that

[10] Exhibit JFW-1, p. 22 of 26.

[11] To be sure, most utility efficiency programs have some free riders – program participants who would have made the efficiency investment without the program. However, such customers are typically a relatively small fraction of program participants.

potential, what other benefits such products might provide, etc. Also, some customers do not have adequate access to capital. Others face what is known as the "split incentives" problem – e.g., there is a landlord who makes capital investment decisions but doesn't pay the energy bills and tenants who pay the energy bills but cannot make capital investment decisions (and may not make investments even if they could because of uncertainty about whether they would occupy the space long enough to reap sufficient benefits).

**Q: Is there evidence to support the conclusion that savings claimed by efficiency programs would not occur absent the programs?**

A: Yes. There have been numerous studies of utility efficiency programs in many different jurisdictions that demonstrate most customers who participate in such programs would not have made the efficiency investments they made without the program support. For example, the Illinois utilities have independent evaluators conduct net-to-gross studies – assessments of the portion of the savings attributable to the programs after accounting for free rider effects – of all their major efficiency programs at least once each four-year cycle. Based on those studies, the evaluators recommend net-to-gross assumptions for each residential and business program and, in many cases, for different program sub-components or measures. For ComEd,[12] there were 167 different NTG assumptions recommended for its 2021 programs. 133 of them were between 0.80 and 1.00 – meaning 80% to 100% of the savings produced are attributable to the programs and would not have occurred without them. Only 11 of them were less than 0.60.

[12] ComEd 2021 NTG Recommendations (Final Excel 9/30) (https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/).

**Q: What about competitive retail energy suppliers? Won't they capture efficiency savings?**

A: No. While some retail energy suppliers may offer their customers some limited efficiency measures or services, such offers cannot be anywhere near as comprehensive as those offered through utility programs.

**Q: Is there any evidence to suggest that retail energy suppliers promote efficiency investments to their customers at a significant scale?**

A: I am not aware of any such evidence. In fact, the only research paper on this subject with which I am aware – a study that looked at results from nine states that were early adopters of electricity deregulation – concluded that retail energy suppliers cannot be expected to effectively address a significant portion of cost-effective efficiency savings potential:

> *"The retail electricity commodity supplier industry has not demonstrated itself to be an effective vehicle for achieving energy efficiency improvements…the vision of a robust supplier industry bundling the electricity commodity and energy efficiency to provide customers with the lowest-cost energy solutions has simply not materialized."*[13]

**Q: Why is it that retail energy suppliers are not effective vehicles for achieving substantial energy savings?**

A: The ACEEE report I just referenced offers several reasons including:

[13] Kushler, Martin and Patti Witte, "Can We Just 'Rely on the Market' to Provide Energy Efficiency? An Examination of the Role of Private Market Actors in an Era of Electric Utility Restructuring", American Council for an Energy Efficient Economy Report Number U011, September 2001 (https://www.aceee.org/research-report/u011).

*"…a high failure rate among supplier firms, a mixed interest in energy efficiency among suppliers, a lack of commodity suppliers actually marketing tangible energy efficiency measures, and a lack of customer interest in obtaining energy efficiency from commodity suppliers (due to perceived conflict of interest and other reasons).*[14]

In addition, retail energy suppliers are not well-positioned to effectively address energy savings opportunities associated with many customer equipment purchase decisions. To effectively address equipment purchase decisions efficiency programs must engage retailers, vendors, contractors and other trade allies that sell energy consuming products. That means working with such trade allies to persuade them to stock and display and promote efficient products. In some cases, it also means persuading them to discount those efficient products at the cash register (with the program later reimbursing them for those discounts). Trade allies will not do all of that if the program is too complex. Among other things, that means that the program must promote a single efficiency standard that makes clear what products are being promoted, be available to all of the customers the trade allies serve, have one set of marketing materials on display, etc. A Home Depot just will not deal with 10 or 20 or 50 different efficiency program offerings from different retail energy suppliers. A residential heating and cooling contractor cannot deal with keeping track of 10 or 20 or 50 different rebate levels for efficient air conditioners, let alone 10 or 20 or 50 different lists of which air conditioners are deemed efficient enough to qualify for a rebate and 10, 20 or 50 different rebate forms to provide to their customers – all depending on who their retail energy supplier is.

[14] Ibid.

# IV. Merits of AEP's Originally Proposed Efficiency Programs

**Q: Please summarize AEP's original proposal for efficiency programs in this docket.**

A: AEP originally proposed to spend $32.6 million per year on a range of electric efficiency programs to be offered to residential and business customers. The proposal also included spending $4 million a year for an electric transportation program. AEP forecasted its proposed Plan would produce 44.1 MW of peak demand savings and over 225 GWh of new annual electricity savings.

As Figure 1 shows, the residential programs included rebates for purchases of efficient products (light bulbs, heating and cooling equipment, appliances and heat pump water heaters), free installation of efficiency measures for low income customers, promotion of smart thermostats as both an efficiency and demand response measure, and support for the design and installation of new homes that are more efficient than building codes require. The business programs include rebates for a range of efficient products (lighting, HVAC, food service, compressed air and refrigeration equipment), assistance with analyses and investment in more complex commercial and industrial energy savings projects, support for efficient commercial new construction, and a turnkey service to directly install efficiency measures in small businesses.

*Figure 1: AEP Originally Proposed Programs Savings, Costs and Cost-Effectiveness*[15]

| Proposed Program | Coincident Demand Savings (kW) | Energy Savings (MWh) | Annual Budget | UCT Benefits | UCT | Non-Energy Benefits | Total Benefits | RVT |
|---|---|---|---|---|---|---|---|---|
| Efficient Products | 5,900 | 30,039 | $ 4,423,500 | $ 13,454,935 | 3.0 | $ - | $ 13,454,935 | 3.0 |
| Retrofit Low Income | 800 | 2,758 | $ 7,000,000 | $ 1,253,712 | 0.2 | $ 7,595,000 | $ 8,848,712 | 1.3 |
| Residential Demand Response | 17,400 | 58,015 | $ 2,000,000 | $ 2,540,391 | 1.3 | $ - | $ 2,540,391 | 1.3 |
| New Homes | 2,400 | 4,317 | $ 2,000,000 | $ 2,768,313 | 1.4 | $ - | $ 2,768,313 | 1.4 |
| e3smart | 400 | 3,817 | $ 1,000,000 | $ 1,535,912 | 1.5 | $ - | $ 1,535,912 | 1.5 |
| **Residential Subtotal** | **26,900** | **98,945** | **$ 16,423,500** | **$ 21,553,263** | **2.2** | **$ 7,595,000** | **$ 29,148,263** | **2.2** |
| | | | | | | | | |
| Efficient Products for Business | 13,200 | 88,244 | $ 8,426,500 | $ 34,815,742 | 4.1 | $ 14,434,436 | $ 49,250,178 | 5.8 |
| Process Efficiency | 900 | 18,068 | $ 1,500,000 | $ 7,629,883 | 5.1 | $ 3,003,927 | $ 10,633,811 | 7.1 |
| Business New Construction | 1,900 | 13,503 | $ 1,500,000 | $ 5,009,133 | 3.3 | $ 2,174,870 | $ 7,184,003 | 4.8 |
| Small Business Express | 1,200 | 7,091 | $ 2,000,000 | $ 2,835,349 | 1.4 | $ 1,159,898 | $ 3,995,246 | 2.0 |
| C&I Demand Response | 0 | 0 | $ - | $ - | N/A | $ - | $ - | N/A |
| **Business Subtotal** | **17,200** | **126,906** | **$ 13,426,500** | **$ 50,290,107** | **3.7** | **$ 20,773,131** | **$ 71,063,237** | **5.3** |
| | | | | | | | | |
| Community Energy Savers | | | $ 500,000 | | | | | |
| Targeted Customer Outreach | | | $ 500,000 | | | | | |
| Innovation and Technology | | | $ 1,300,000 | | | | | |
| Education and Training | | | $ 450,000 | | | | | |
| Electric Transportation | | | $ 4,000,000 | | | | | |
| **Cross Sector Subtotal** | | | **$ 6,750,000** | | | | | |
| | | | | | | | | |
| **Total*** | **44,100** | **225,851** | **$ 36,600,000** | **$ 71,843,370** | **2.3** | **$ 28,368,131** | **$ 100,211,500** | **3.0** |

*Plan cost effectiveness tests include estimated base rate internal labor and program administration fee. Exclusions include: Retrofit Low Income and Cross Sector programs.

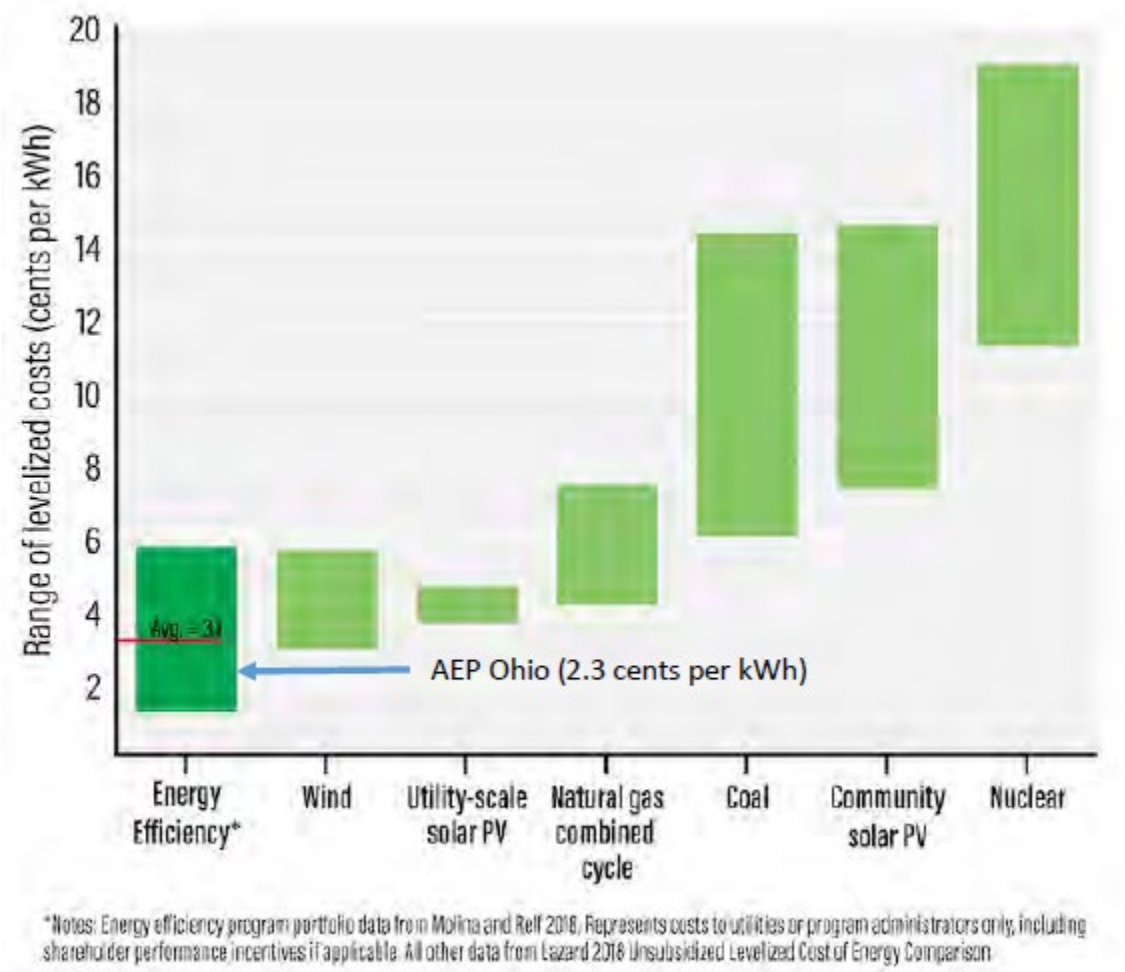
**Q: Was AEP's proposed portfolio of efficiency programs consistent with industry best practices?**

A: There are a number of positive attributes to the proposal that are consistent with industry best practices. First, it addressed a range of potential efficiency measures and opportunities, so it enabled all customers to participate in some way. Second, it included a focus on some cutting-edge efficiency measures such as heat pump water heaters and industrial process efficiency improvements. It even had an "innovation and technology" initiative designed to continue to identify and explore opportunities to test new efficiency technology and new program approaches. Third, it had an important focus on low income customers (more than 40% of the

[15] This figure is copied directly from AEP's plan filed in this proceeding (Exhibit JFW-1, Figure 1 on p. 6 of 26). Note that AEP also proposed a 10% administrative fee (i.e., $3.66 million) that is not shown budget column in the Figure but was included in the cost-effectiveness results provided in the last several columns.

residential budget), as well as an initiative specifically designed to address barriers to investment in efficiency faced by typically hard to reach small business customers. Fourth, as AEP itself stated and illustrated in Figure 2 below, its proposed program savings were both less expensive than the industry average for electric efficiency programs and considerably less expensive than all forms of electric generation that would otherwise be required to serve less efficient homes and businesses.

*Figure 2: AEP Efficiency Costs Relative to Alternatives*




That said, the scale of AEP's originally proposed efficiency program portfolio – 226 GWh of new savings each year – is quite modest. In that regard, it fell short of industry best practices.

226 GWh represents only about 0.5% of the Company's annual electricity sales.[16] 33 different states achieved electricity savings levels greater than that in 2019.[17] Three quarters of the 52 largest electric utilities in the country (including AEP) achieved greater than 0.5% savings in 2018 – with the average being about double that level (i.e., 1.03%).[18] Moreover, AEP itself achieved more than three times as much savings (728 GWh) in 2020.[19] That is about 2.1% of sales to customers eligible to participate in its programs that year.[20] In other words, while the mix of efficiency programs that AEP initially proposed in this proceeding was reasonably structured and balanced, its level of ambition for reducing its customers' energy waste and electricity bills would have left significant and demonstrably achievable savings opportunities out of the program.

**Q: Was AEP's originally proposed efficiency program portfolio cost-effective?**

A: Yes. It is very cost-effective. As also shown in Figure 1 above, AEP estimated that the Utility Cost Test (UCT) benefits from $36.6 million in spending would be $71.8 million. In other words, for every year that it ran these programs, AEP would reduce its customers' electric bills by $35.2 million. Put another way, AEP estimated that its programs would produce about $2 in reductions to electric utility system costs (what the UCT test measures) for every $1 of

[16] AEP response to NRDC-INT-01-004(c)(i).
[17] Berg, Weston et al., "The 2020 State Energy Efficiency Scorecard", American Council for an Energy Efficient Economy Research Report, December 2020 (https://www.aceee.org/state-policy/scorecard).
[18] Relf, Grace et al., "2020 Utility Energy Efficiency Scorecard", American Council for an Energy Efficient Economy Report U2004, February 2020.
[19] AEP, 2020 Portfolio Status Report on Energy Efficiency and Peak Demand Response Programs, filed February 12, 2020 in Case No. 21-139-EL-EEC.
[20] Ibid.

program spending.[21] Moreover, it is clear that AEP's estimate of the electricity system benefits from its programs is very conservative.

**Q: Why is AEP's estimate of the electricity system benefits from its programs very conservative?**

A: First, as noted in Jon Williams' June 15, 2020 testimony in this proceeding, the Company did not assign any value to the effects the efficiency programs would have on deferring or eliminating the need for capital investments in transmission and distribution (T&D) system infrastructure.[22] Mr. Williams agrees that the cumulative effects of multiple years of system-wide efficiency programs could produce sufficient local peak demand savings to defer T&D investments.[23] In my experience, most utilities include avoided T&D capacity costs in analyses of the cost-effectiveness of efficiency programs.[24]

Second, AEP's analysis of electric system benefits included only the effects that efficiency programs have in reducing market clearing prices for energy on program participants. That ignores the fact that when efficiency programs reduce market clearing prices, those reductions are experienced by *all customers* – not just program participants. By not valuing the benefits of lower prices for non-participants, AEP has significantly underestimated the electricity bill reducing value of this benefit.

[21] The table shows a UCT benefit-cost ratio of 2.3 for the portfolio. It appears as if AEP excluded some portfolio level costs – including spending on electric transportation – when computing that higher benefit-cost ratio. That may be because the Company didn't quantify benefits that may accrue from those non-efficiency program costs.
[22] Jon Williams testimony, p. 11, lines 12-20.
[23] Response to NRDC-INT-01-006.
[24] The Mendota Group, "Benchmarking Transmission and Distribution Costs Avoided by Energy Efficiency Investments", prepared for Public Service Company of Colorado, October 23, 2014, attached as Exhibit SWM-2 to direct testimony of Shawn M. White in Colorado Proceeding Number 14A-1057EG.

Third, AEP appears to be understating the magnitude of reductions in line losses from its efficiency programs – and therefore understating the value of their benefits – by using average annual line loss rates rather than marginal line loss rates to convert kWh savings at customers' meters to the amount of reduced power plant generation required to meet their needs.[25] Marginal line losses are greater than average loss rates.[26] Efficiency programs, by definition, reduce consumption on the margin. Therefore, their impacts on line losses should be computed using marginal loss rates rather than the average loss rates used by AEP. Marginal line losses are greater – typically on the order of 50% greater – than average loss rates.[27]

**Q: Has AEP estimated the value of any other benefits – beyond reductions in electric system costs – from its efficiency programs?**

A: Yes. AEP hired an evaluation firm to assess non-energy benefits to the participants in its business efficiency programs. Non-energy benefits include:

- Operation and maintenance (O&M) cost savings
- Revenue/sales increases
- Increased worker and equipment productivity
- Increased safety
- Reduced downtime

[25] Response to NRDC-INT-01-003.
[26] Lazar, Jim and Xavier Baldwin, "Valuing the Contribution of Energy Efficiency to Avoided Marginal Line Losses and Reserve Requirements", Regulatory Assistance Project, August 2011 (https://www.raponline.org/knowledge-center/valuing-the-contribution-of-energy-efficiency-to-avoided-marginal-line-losses-and-reserve-requirements/).
[27] Ibid.

- Decreased compliance costs

- Reductions in product loss

As shown in Figure 1 above, AEP ultimately estimated that the business programs it originally proposed in this proceeding would produce $20.7 million in non-energy benefits. [28] That is about $1.50 in non-energy benefits for every dollar of its originally proposed program spending.

AEP has not yet conducted a similar study of non-energy participant benefits from its residential efficiency programs. However, it did analyze and quantify the reduction in what it called charge-offs and the reduction in collections needed for the Universal Service Fund that result from its low income Community Assistance Program. The Community Assistance Program provides efficiency measures to customers whose incomes are below 150% of the federal poverty level. AEP found that "for every $1 spent in Community Assistance, there is $1.52 returned to all residential customers."[29] The Community Assistance Program represents $5 million of the $7 million in annual low income program spending initially proposed by AEP (the other $2 million/year was to be spent on the "Supplemental Low Income Program" which provides efficiency support to customers with incomes above 150% of poverty, but still defined as low income). Thus, AEP estimated the reduction in charge-offs and collections for the Universal Service Fund from its initially proposed efficiency program to be $7.595 million – more than the combined cost of both its low income programs.

[28] It is not clear which business non-energy benefits were ultimately quantified, monetized and included in this estimated. However, AEP's independent evaluation firm found that O&M cost savings alone were worth an average of $381 per year per business customer who participates in AEP's efficiency programs, or about 1.8 cents per kWh saved (Exhibit JFW-2, Figure 6).
[29] Exhibit JFW-2 p. 18 of 44.

**Q: Are there other non-energy benefits that AEP has not quantified?**

A: Yes. As previously stated, the Company did not quantify non-energy benefits accruing to residential program participants. Such non-energy benefits can include improved comfort, improved health and safety, and reduced O&M costs. The Company has also not quantified, monetized or included in its benefit-cost analyses any benefits associated with reduced risk (e.g., program participants' reduced exposure to future energy cost uncertainty), reduced public health costs associated with lower emissions of environmental pollutants, or increased jobs or local economic development.

**Q: Would a more robust program portfolio than the one originally proposed by AEP in this proceeding have also been cost-effective?**

A: Yes. One need only look at what the Company achieved in 2020 to see that is the case. Specifically, in 2020 AEP spent $64.4 million on its efficiency programs – roughly double what it originally proposed in this proceeding – and achieved 728 GWh of annual energy savings – or more than three times the 226 GWh of savings it forecast for the efficiency programs originally proposed in this proceeding. AEP also estimates that its 2020 programs had a benefit-cost ratio under the Utility Cost Test of more than 5 to 1. In other words, its 2020 programs produce more than $5 in electric bill reductions for every $1 it spent on those programs. That amounts to on the order of $280 million in net electric bill reductions for AEP's customers. Moreover, that estimate of net electricity bill savings is conservatively low because it excludes avoided T&D costs, excludes market price suppression effects and is based on average rather than more accurate marginal line loss rates.

Put simply, AEP's larger scale 2020 programs were actually more cost-effective than the portfolio of programs it originally proposed in this proceeding. There are probably several reasons for that. For example, the Company spent much less on low income programs in 2020 than it was originally proposing in this proceeding, and low income programs tend to cost more per unit of savings achieved than programs targeting other customers. There may also have been some economies of scale – larger programs allow any program costs that are largely fixed to be spread across a larger volume of savings. Regardless, it is very clear that a significant expansion of the efficiency programs that AEP originally proposed in this proceeding could be very cost-effective – significantly increasing the magnitude of electric bill savings that would accrue to its customers.

## V. Utility Efficiency Programs without Legislative Mandates

**Q: Is it your understanding that AEP is no longer required by Ohio law to run energy efficiency programs?**

A: I am not an attorney, but that is my understanding.

**Q: Are there other utilities in Ohio that have voluntarily proposed to run efficiency programs – absent statutory requirements?**

A: Yes. For example, Columbia Gas, which is also not required by law to run efficiency programs, has proposed and received Public Utility Commission of Ohio (PUCO) approval to run efficiency programs.

**Q: Are there utilities in other states that are running efficiency programs without statutory requirements to do so?**

A: Yes. For example, I know that is the case for both Ameren Missouri and Evergy (also in Missouri).

**Q: How does Columbia Gas' approved Ohio efficiency program spending compare to AEP's original proposal in this proceeding?**

A: Columbia Gas has a PUCO approved energy efficiency program budget of $27.9 million for 2021.[30] I estimate that to be equal to approximately 3.25% of their annual delivery revenue[31]

[30] Application of Columbia Gas and Commission Order in Case No. 16-1309-GA-UNC.
[31] Based on data from U.S. Energy Information Administration gas utility form 176 (https://www.eia.gov/naturalgas/ngqs/#?year1=2016&year2=2019&company=Name), I estimate Columbia Gas 2019 delivery revenues to be $858.4 million. Columbia Gas reported revenue from transportation customers was $794.7 million and revenue from sales customers to be $119.0 million. Based on the differences in cost per

and 1.34% of their customers' total annual gas bills.[32] For AEP, 3.25% of the its delivery costs would be approximately $59.8 million[33] and 1.34% of its customers' total electric bill (including revenues from retail energy suppliers serving customers in its service territory) would be approximately $65.4 million.[34]

**Q: What does that suggest about what would be a reasonable efficiency program budget for AEP?**

A: It suggests that an efficiency program portfolio of $60 to $65 million – or on the order of double what AEP initially proposed in this proceeding – would be consistent with recent PUCO approvals.

**Q: Has AEP demonstrated that it is capable of effectively running an efficiency program portfolio of that magnitude?**

A: Yes. In fact, AEP spent $64.4 million in 2020. As I previously noted, its 2020 programs were extremely cost-effective, yielding more than $5 in electric bill savings for every program

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dekatherm (DTh) for transportation customers and sales customers (by sector), I have estimated the portion of the $119.0 million from sales customers that was attributable to delivery costs to be $63.7 million.

[32] Based on data from U.S. Energy Information Administration gas utility Form 176 (https://www.eia.gov/naturalgas/ngqs/#?year1=2016&year2=2019&company=Name), I estimate Columbia Gas customers' total 2019 gas bills to be $2.074 billion. Columbia Gas reported revenue from sales customers to be $119 million and revenue from transportation customers to be $795 million. Based on the differences in cost per dekatherm (DTh) for transportation customers and sales customers (by sector), I have estimated that the commodity costs paid by its transportation customers to be on the order of $1.161 billion.

[33] Based on data from the U.S. Energy Information Administration electric utility form 861 (https://www.eia.gov/electricity/data/eia861/), I estimate AEP delivery revenues to be $1.841 billion. Ohio Power Company reported revenue from delivery only customers to be $1.12 billion and revenue from bundled customers to be $1.385 billion. Based on the difference in cost per kWh between delivery only and bundled customers (by sector), approximately $0.72 billion of the bundled revenue is estimated to be associated with delivery costs.

[34] Based on data from the U.S. Energy Information Administration electric utility form 861 (https://www.eia.gov/electricity/data/eia861/), I estimate AEP customers' total electric bill to be $4.86 billion. Ohio Power Company reported revenue from bundled customers to be $1.384 billion and revenue from delivery only customers to be $1.12 billion. Based on the difference in cost per kWh between delivery only and bundled customers (by sector), I have estimated commodity costs associated with bills from retail energy suppliers to be an additional $2.361 billion.

dollar spent. AEP has also won national awards for its efficiency programs, including a 2020 federal Energy Star "Partner of the Year" award for sustained excellence in energy efficiency program delivery. Among the 2019 efficiency program accomplishments for which AEP was recognized was "providing incentives and training to over 15,000 retailers on the benefits of Energy Star certified heat pump water heaters, air and ground source heat pumps, smart thermostats, appliances and pool pumps."[35]

**Q: What would be a reasonable way for AEP to increase efficiency program budgets from those it originally proposed in this proceeding?**

A: It is highly likely that all of the efficiency programs originally proposed in this proceeding by AEP could be ramped up significantly. Thus, one reasonable option would be to proportionally increase each efficiency program budget in its originally proposed plan – other than the electric transportation budget – by 55% to 70%. Alternatively, the increase could be targeted primarily to the three most cost-effective programs – Residential Efficient Products, Efficient Products for Business and Business Process Efficiency – plus the Low Income program.

**Q: Does this conclude your testimony?**

A: Yes.

[35] U.S. Environmental Protection Agency, 2020 Energy Star Awards: Profiles in Leadership (https://www.energystar.gov/sites/default/files/asset/document/2020%20Profiles%20in%20Leadership_Final%20%28Updated%205.5.2020%29.pdf).

# Chris Neme
# Principal

ENERGY FUTURES GROUP

## Professional Summary

Chris specializes in analysis of markets for energy efficiency, demand response, renewable energy and strategic electrification measures, as well as the design and evaluation of programs and policies to promote them. During his 25+ years in the clean energy industry, Mr. Neme has worked for energy regulators, utilities, government agencies and advocacy organizations in more than 30 states, 7 Canadian provinces and several European countries. He has defended expert witness testimony in more than 60 cases before regulatory commissions in 13 different jurisdictions; he has also testified before several state legislatures. Chris has also authored numerous reports and papers regarding clean energy policies and programs, including the first edition (Spring 2017) of the National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, an update of that Manual addressing all distributed energy resources (August 2020), and several reports on non-wires alternatives.

## Experience

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

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

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

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

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

## Education

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

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

## Selected Projects

- Natural Resources Defense Council (Illinois, Michigan and Ohio). Critically review multi-year efficiency, demand response, electrification, distribution system investment and integrated resource plans filed by Illinois, Michigan & Ohio utilities. Draft/defend regulatory testimony on critiques. Represent NRDC in regular stakeholder-utility engagement processes. Also represent NRDC in collaborative development of non-wires alternative pilots. Support development of Illinois clean energy legislation. (2010 to present)
- Ontario Energy Board. Serve on provincial gas DSM Evaluation Advisory Committee. Work includes input on multi-year evaluation plans, input on scopes of work for evaluation studies, serving on OEB teams that review and score proposals submitted in response to evaluation RFPs, and critical review and input on independent evaluator assessments of utilities' annual gas savings

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claims. Also serve on advisory committees on gas and electric efficiency potential studies and advisory committee on carbon price forecast studies. (2015-present)

- Green Energy Coalition (Ontario). Represent coalition of environmental groups in regulatory proceedings, utility negotiations and stakeholder meetings on DSM policies (including integrated resource planning on pipeline expansions) and utility proposed DSM Plans. (1993 to present)
- E4TheFuture. Co-authored first edition (Spring 2017) of the National Standard Practice Manual (NSPM) for cost-effectiveness analysis of energy efficiency. Presenting the NSPM for EE to a wide variety of audiences across the U.S. and Canada; helping several to assess how to use it to refine current practices. Co-authoring updated NSPM (expected June 2020) that will expand focus from just EE to address all distributed energy resources. (2016 to present)
- New Jersey Board of Public Utilities. Serve on management team responsible for statewide delivery of New Jersey Clean Energy Programs. Lead strategic planning; support regulatory filings, cost-effectiveness analysis & evaluation work. (2015 to 2020). Served on management team for start-up of residential and renewables programs for predecessor project. (2006-2010)
- Regulatory Assistance Project - U.S. Provide guidance on efficiency policy and programs. Lead author on strategic reports on program options for decarbonizing Vermont buildings, achieving 30% electricity savings in 10 years, using efficiency to defer T&D system investments, & bidding efficiency into capacity markets. (2010 to 2020)
- Energy Efficiency Alberta. Assisting EEA in providing input to Alberta Utilities Commission on the role efficiency resources can play in reducing electric system costs. (2019 to 2020)
- Citizens Action Coalition of Indiana. Critically reviewed how energy efficiency resources were modeled in utility IRPs, as well as the design of energy efficiency program portfolios. (2018 to 2020)
- Consumers Association of Canada (Manitoba) and Winnipeg Harvest. Critically reviewed and filed regulatory testimony on Efficiency Manitoba's first three-year plan (2020-2023), with particular emphasis on the extent to which the plan supported advanced heat pump technology as both an electric efficiency measure and a key to future building electrification. (2019-2020).
- Efficiency Vermont. Provided technical support in review of avoided cost assumptions, as well as related policies on cost-effectiveness analyses of efficiency resources (2019).
- Earth Justice and Southern Alliance for Clean Energy. Helped critically review Florida utilities' efficiency potential studies and proposed 2020-2024 energy efficiency savings targets. (2019)
- Regulatory Assistance Project - Europe. Provide on-going support on efficiency policies and programs in the United Kingdom, Germany, and other countries. Reviewed draft European Union policies on Energy Savings Obligations, EM&V protocols, and related issues. Drafted policy brief on efficiency feed-in-tariffs and roadmap for residential retrofits. (2009 to 2018)
- Green Mountain Power (Vermont). Support development and implementation of GMP's compliance plan for Vermont RPS Tier 3 requirement to reduce customers' direct consumption of fossil fuels, with significant emphasis on strategic electrification strategies. Also developed 10-year forecast of sales that could result from three different levels of policy/program promotion of residential electric space heating, electric water heating and electric vehicles. (2016 to 2018)

# Chris Neme
## Principal

- Alberta Energy Efficiency Alliance. Drafted white paper how treatment of "efficiency as a resource" could be institutionalized in Alberta. The paper followed several presentations to government agencies and others on behalf of the Pembina Institute. (2017 to 2018)
- Southern Environmental Law Center. Assessed reasonableness of Duke Energy's historic efficiency program savings claims, as well as the design of their efficiency program portfolios for 2019. Filed expert witness testimony on findings in North Carolina dockets (2018).
- Toronto Atmospheric Fund. Helped draft an assessment of efficiency potential from retrofitting of cold climate heat pumps into electrically heated multi-family buildings (2017).
- Northeast Energy Efficiency Partnerships. Helped manage Regional EM&V forum project estimating savings for emerging technologies, including field study of cold climate heat pumps. Led assessment of best practices on use of efficiency to defer T&D investment. (2009 to 2015)
- Ontario Power Authority. Managed jurisdictional scans on leveraging building efficiency labeling/disclosure requirements and non-energy benefits in cost-effectiveness screening. Supported staff workshop on the role efficiency can play in deferring T&D investments. Presented on efficiency trends for Advisory Council on Energy Efficiency. (2012-2015)
- Vermont Public Interest Research Group. Conducted comparative analysis of the economic and environmental impacts of fuel-switching from oil/propane heating to either natural gas or efficient, cold climate electric heat pumps. Filed regulatory testimony on findings. (2014-2015)
- New Hampshire Electric Co-op. Led assessment of the co-op's environmental and social responsibility programs' promotion of whole building efficiency retrofits, cold climate heat pumps and renewable energy systems. Presented recommendations to the co-op Board. (2014)
- National Association of Regulatory Utility Commissioners (NARUC). Assessed alternatives to first year savings goals to eliminate disincentives to invest in longer-lived measures and programs. (2013)
- California Investor-Owned Utility. Senior advisor on EFG project to compare the cost of saved energy across ~10 leading U.S. utility portfolios. The research sought to determine if there are discernable differences in the cost of saved energy related to utility spending in specific non-incentive categories, including administration, marketing, and EM&V. (2013)
- DC Department of the Environment (Washington DC). Part of VEIC team administering the DC Sustainable Energy Utility (SEU). Helped characterize the DC efficiency market and supporting the design of efficiency programs that the SEU will be implementing. (2011 to 2012)
- Ohio Sierra Club. Filed and defended expert witness testimony on the implications of not fully bidding all efficiency resources into the PJM capacity market. (2012)
- Regulatory Assistance Project – Global. Assisted RAP in framing several global research reports. Co-authored the first report – an extensive "best practices guide" on government policies for achieving energy efficiency objectives, drawing on experience with a variety of policy mechanism employed around the world. (2011)
- Tennessee Valley Authority. Assisted CSG team providing input to TVA on the redesign of its residential efficiency program portfolio to meet aggressive new five-year savings goals. (2010)

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- New York State Energy Research and Development Authority (NYSERDA). Led residential & renewables portions of several statewide efficiency potential studies. (2001 to 2010)
- Ohio Public Utilities Commission. Senior Advisor to a project to develop a web-based Technical Reference Manual (TRM). The TRM includes deemed savings assumptions, deemed calculated savings algorithms and custom savings protocols. It was designed to serve as the basis for all electric and gas efficiency program savings claims in the state. (2009 to 2010)
- Vermont Electric Power Company. Led residential portion of efficiency potential study to assess alternatives to new transmission line. Testified before Public Service Board. (2001-2003)
- Efficiency Vermont. Served on Sr. Management team. Supported initial project start-up. Oversaw residential planning, input to regulators on evaluation, input to regional EM&V forum, development of M&V plan and other aspects of bidding efficiency into New England's Forward Capacity Market (FCM), and development and updating of nation's first TRM. (2000 to 2010)
- Long Island Power Authority Clean Energy Plan. Led team that designed the four major residential programs (three efficiency, one PV) incorporated into the plan in 1999. Oversaw extensive technical support to the implementation of those programs. This involved assistance with the development of goals and budgets, development of savings algorithms, cost-effectiveness screening, and on-going program design refinements. (1998 to 2009)

## Selected Publications and Reports

- *National Standard Practice Manual for Assessing Cost-Effectiveness of Distributed Energy Resources*, August 2020, (with Tim Woolf and others)
- *Reducing $CO_2$ Emissions from Vermont Buildings: Potential and Cost-Effectiveness of Select Program Options*, Regulatory Assistance Project, February 13, 2019 (with Richard Faesy)
- *Pumping Energy Savings: Recommendations for Accelerating Heat Pump Adoption in Ontario's Electrically Heated Multi-Residential Buildings*, Toronto Atmospheric Fund, July 2018 (with Devon Calder, Brian Purcell and Judy Simon)
- *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources*, Edition 1, Spring 2017 (with Tim Woolf, Marty Kushler, Steven Schiller and Tom Eckman)
- *The Next Quantum Leap in Efficiency: 30% Electricity Savings in 10 Years*, Proceedings of the 2016 ACEEE Summer Study on Energy Efficiency in Buildings, Volume 9, pp. 1-14 (with Jim Grevatt, Rich Sedano and Dave Farnsworth)
- *The Next Quantum Leap in Efficiency: 30% Electricity Savings in Ten Years*, published by the Regulatory Assistance Project, February 2016 (with Jim Grevatt)
- *Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments*, published by Northeast Energy Efficiency Partnerships, January 9, 2015 (with Jim Grevatt)
- *Unleashing Energy Efficiency: The Best Way to Comply with EPA's Clean Power Plan*, Public Utilities Fortnightly, October 2014, pp. 30-38 (with Tim Woolf, Erin Malone and Robin LeBaron)
- *The Resource Value Framework: Reforming Energy Efficiency Cost-Effectiveness Screening*, published by the National Efficiency Screening Project, August 2014 (with Tim Woolf et al.)
- *U.S. Experience with Participation of Energy Efficiency in Electric Capacity Markets*, Regulatory Assistance Project, August 2014 (with Richard Cowart)
- *The Positive Effects of Energy Efficiency on the German Electricity Sector*, IEPEC 2014 Conference, September 2014 (with Friedrich Seefeldt et al.)
- *Final Report: Alternative Michigan Energy Savings Goals to Promote Longer Term Savings and Address Small Utility Challenges*, prepared for the Michigan Public Service Commission, September 13, 2013 (with Optimal Energy)
- *Energy Efficiency Feed-in-Tariffs: Key Policy and Design Considerations*, Proceedings of ECEEE 2013 Summer Study, pp 305-315 (with Richard Cowart)
- *Can Competition Accelerate Energy Savings? Options and Challenges for Efficiency Feed-in-Tariffs*, published in Energy & Environment, Volume 24, No. 1-2, February 2013 (with Richard Cowart)
- *An Energy Efficiency Feed-in-Tariff: Key Policy and Design Considerations*, published by the Regulatory Assistance Project, March/April 2012 (with Richard Cowart)

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- *U.S. Experience with Efficiency as a Transmission and Distribution System Resource*, published by the Regulatory Assistance Project, February 2012 (with Rich Sedano)
- *Achieving Energy Efficiency: A Global Best Practices Guide on Government Policies*, published by the Regulatory Assistance Project, February 2012 (with Nancy Wasserman)
- *Residential Efficiency Retrofits: A Roadmap for the Future*, published by the Regulatory Assistance Project, May 2011 (with Meg Gottstein and Blair Hamilton)
- *Is it Time to Ditch the TRC?* Proceedings of ACEEE 2010 Summer Study on Energy Efficiency in Buildings, Volume 5 (with Marty Kushler)
- *Energy Efficiency as a Resource in the ISO New England Forward Capacity Market*, in Energy Efficiency, published on line 06 June 2010 (with Cheryl Jenkins and Shawn Enterline)
- *A Comparison of Energy Efficiency Programmes for Existing Homes in Eleven Countries*, prepared for the British Department of Energy and Climate Change, 19 February, 2010 (with Blair Hamilton et al.)
- *Energy Efficiency as a Resource in the ISO New England Forward Capacity Market*, Proceedings of the 2009 European Council on an Energy Efficient Economy Summer Study, pp. 175-183 (with Cheryl Jenkins and Shawn Enterline)
- *Playing with the Big Boys: Energy Efficiency as a Resource in the ISO New England Forward Capacity Market*, Proceedings of ACEEE 2008 Summer Study Conference on Energy Efficiency in Buildings, Volume 5 (with Cheryl Jenkins and Blair Hamilton)
- *Recommendations for Community-Based Energy Program Strategies, Final Report*, developed for the Energy Trust of Oregon, June 1, 2005 (with Dave Hewitt et al.)
- *Shareholder Incentives for Gas DSM: Experience with One Canadian Utility*, Proceedings of ACEEE 2004 Summer Study on Energy Efficiency in Buildings, Volume 5 (with Kai Millyard)
- *Cost Effective Contributions to New York's Greenhouse Gas Emission Reduction Targets from Enegy Efficiency and Renewable Energy Resources*, ACEEE 2004 Summer Study Proceedings, Volume 8 (with David Hill et al.)
- *Opportunities for Accelerated Electric Energy Efficiency Potential in Quebec: 2005-2012*, prepared for Regroupement national des conseils regionaux de l'environnement du Quebec, Regroupement des organisms environnementaux energie and Regroupement pour la responsabilite sociale des enterprises, May 16, 2004 (with Eric Belliveau, John Plunkett and Phil Dunsky)
- *Review of Connecticut's Conservation and Load Management Administrator Performance, Plans and Incentives*, for Connecticut Office of Consumer Counsel, October 31, 2003 (with John Plunkett, Phil Mosenthal, Stuart Slote, Francis Wyatt, Bill Kallock and Paul Horowitz)
- *Energy Efficiency and Renewable Energy Resource Development Potential in New York State*, for New York Energy Research and Development Authority, August 2003 (with John Plunkett, Phil Mosenthal, Stave Nadel, Neal Elliott, David Hill and Christine Donovan)

- *Assessment of Economically Deliverable Transmission Capacity from Targeted Energy Efficiency Investments in the Inner and Metro-Area and Northwest and Northwest/Central Load Zones", for Vermont Electric Power Company, Final Report: April 2003* (with John Plunkett et al.)
- *Residential HVAC Quality Installation: New Partnership Opportunities and Approaches*, Proceedings of ACEEE 2002 Summer Study Conference on Energy Efficiency in Buildings, Volume 6 (with Rebecca Foster, Mia South, George Edgar and Put Murphy)
- *A Modified Delphi Approach to Predict Market Transformation Program Effects*, Proceedings of ACEEE 2000 Summer Study Conference on Energy Efficiency in Buildings, Volume 6 (with Phil Mosenthal et al.)
- *Using Targeted Energy Efficiency Programs to Reduce Peak Electrical Demand and Address Electric System Reliability Problems*, published by the American Council for an Energy Efficient Economy, November 2000 (with Steve Nadel and Fred Gordon)
- *Energy Savings Potential from Addressing Residential Air Conditioner and Heat Pump Installation Problems*, American Council for an Energy Efficient Economy, February 1999 (with John Proctor and Steve Nadel)
- *Promoting High Efficiency Residential HVAC Equipment: Lessons Learned from Leading Utility Programs*, Proceedings of ACEEE 1998 Summer Study Conference on Energy Efficiency in Buildings, Volume 2 (with Jane Peters and Denise Rouleau)
- *PowerSaver Home Program Impact Evaluation*, report to Potomac Edison, February 1998 (with Andy Shapiro, Ken Tohinaka and Karl Goetze)
- *A Tale of Two States: Detailed Characterization of Residential New Construction Practices in Vermont and Iowa*, Proceedings of ACEEE 1996 Summery Study Conference on Energy Efficiency in Buildings, Volume 2 (with Blair Hamilton, Paul Erickson, Peter Lind and Todd Presson)
- *New Smart Protocols to Avoid Lost Opportunities and Maximize Impact of Residential Retrofit Programs*, in Proceedings of ACEEE 1994 Summer Study on Energy Efficiency in Buildings (with Blair Hamilton and Ken Tohinaka
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**CERTIFICATE OF SERVICE**

I hereby certify that a true copy of the foregoing *Testimony of Chris Neme, Energy Futures Group, Submitted by the Environmental Law & Policy Center* was served by electronic mail, upon the Parties of Record on April 20, 2021.

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Summary: Testimony of Chris Neme, Energy Futures Group, electronically filed by Mr. Robert Kelter on behalf of Environmental Law & Policy Center