BEFORE THE STATE OF NEW JERSEY
OFFICE OF ADMINISTRATIVE LAW
BOARD OF PUBLIC UTILITIES

IN THE MATTER OF THE PETITION	**) BPU DKT. NO. GR09030195**
OF PIVOTAL UTILITY HOLDINGS, INC.	**) OAL DKT. NO. PUC-03655-2009N**
D/B/A ELIZABETHTOWN GAS FOR	**)**
APPROVAL OF INCREASED BASE TARIFF	**)**
RATES AND CHARGES FOR GAS SERVICE	**)**
AND OTHER TARIFF REVISIONS	**)**

DIRECT TESTIMONY OF DAVID NICHOLS
ON BEHALF OF THE
NEW JERSEY DEPARTMENT OF THE PUBLIC ADVOCATE
DIVISION OF RATE COUNSEL

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IN THE MATTER OF THE PETITION OF PIVOTAL UTILITY HOLDINGS, INC. D/B/A ELIZABETHTOWN GAS FOR APPROVAL OF INCREASED BASE TARIFF RATES AND CHARGES FOR GAS SERVICE AND REVISIONS
BPU Docket No. GR09030195
OAL Docket No. PUC 03655-2009N
Direct Testimony of David Nichols

Q. PLEASE STATE YOUR NAME, POSITION, AND ADDRESS.

A. My name is David Nichols. I am an independent energy analyst at 787 Willett Ave., Providence, RI 02915. I am also a Senior Consultant at Synapse Energy Economics, Inc., 22 Pearl St., Cambridge, MA 02139.

Q. ON WHOSE BEHALF ARE YOU APPEARING?

A. I am appearing on behalf of the New Jersey Department of the Public Advocate, Division of Rate Counsel ("Rate Counsel").

Q. WHAT IS THE PURPOSES OF YOUR TESTIMONY?

A. My testimony has two related purposes. Its principal purpose is to address certain energy efficiency/energy conservation expenses included in the rates petition of Elizabethtown Gas ("the Company"), as explained by their witness, Mr. Donald Carter. Additionally, my testimony addresses certain Company statements related to the National Action Plan for Energy Efficiency that are made in the testimony of Mr. Daniel Yardley.

Q. WHAT ARE YOUR QUALIFICATIONS TO ADDRESS THIS SUBJECT?

A. For three decades, I have professionally assessed the costs and benefits of energy efficiency/energy conservation and load management to utility ratepayers; designed energy efficiency programs; evaluated efficiency programs of electric utilities, gas utilities, and state agencies; and analyzed utility cost recovery claims associated with energy efficiency and load management programs. I have presented analyses on these matters in testimony before regulatory commissions in two dozen U.S. states, Canadian provinces, and before the U.S. Federal Energy Regulatory Commission. I have also worked in other energy areas such as rate design. A summary professional biography is appended as Exhibit 3 (DN-3).

In New Jersey, I have provided extensive assistance to the Division of Rate Counsel. My assistance has focused on rate design and on energy efficiency. I testified before the Board of Public Utilities ("Board") on behalf of the Rate Counsel in several dockets involving energy conservation in the 1980s. During the 1990s I assisted the Rate Counsel (formerly, the Division of the Ratepayer Advocate) in reviewing and evaluating the Demand Side Management ("DSM") plan filings, pursuant to the 1991 DSM Rules, of most of the state's regulated electric and gas utilities. On behalf of the Ratepayer Advocate, I testified before this Board in Docket No. ER97020101, involving PSE&G's electric demand side adjustment factor ("DSAF"). I evaluated the gas DSAF levels of the state's four gas utilities in other proceedings. I testified on generic issues regarding DSM and Renewables (Dockets No. EX94120585Y et al.), as well as in the Comprehensive Resource Analysis proceedings. During the past decade I have assisted Rate Counsel with several matters relating to the development and implementation of

the New Jersey Clean Energy Program, including participating in many committee processes and preparing input to numerous Rate Counsel comments for the Office of Clean Energy or the Board.

Q. PLEASE DESCRIBE THE ENERGY EFFICIENCY COSTS THE COMPANY SEEKS TO RECOVER IN THIS CASE.

A. According to the March 3, 2009 pre-filed direct testimony of Mr. Carter (Company Exhibit P-2), the Company is taking several steps responding to Governor Corzine's call for utilities to play a role in economic recovery and to the Global Warming Response Act (the "RGGI" legislation). These include several new energy efficiency ("EE") initiatives. The Company seeks recovery of the bulk of its costs of the new EE initiatives through its RGGI filing in Board Docket No. GR09010057. On page 17, lines 1-16, of his testimony, Mr. Carter explains that the Company is seeking to recover some of the costs of these new EE programs in the present base rate case. As explained by Mr. Carter, three categories of cost are included in this case:

1. Outreach and education costs associated with the second year of the Company's new RGGI EE programs, the first-year costs of which were included in the Company's RGGI filing. This is $400,000 per year.

2. Ongoing annual maintenance costs of the Company's new customer "Dashboard" on-line energy use diagnosis tool, the initial installation costs of which were included in the RGGI filing. Per the Company's response to data

requests RCR-A-111, the specific cost estimate for this element has been increased from the figure in Mr. Carter's testimony, $77,000, to some $114,000 per year.

3. New labor costs triggered by the Company's new EE initiatives. Per the Company's response to data request S-RREV-81, this cost is comprised of $100,000 for an EE program manager described by Mr. Carter, plus an additional $363,200 for four home energy auditors, for a total of some $463,000 per year.

Q. WHAT IS THE FOCUS OF YOUR APPRAISAL OF THESE COSTS?

A. I focus on the question of whether it is appropriate to include these cost categories in base rates. I do not address the appropriateness of the costs themselves except as it relates to the issue of whether they should be included in base rates.

Q. WHAT ARE YOUR RECOMMENDATIONS?

A. I recommend that these costs be excluded from the Company's base rates. The Company should seek recovery of these costs through an appropriate EE rider.

Q. PLEASE DISCUSS EDUCATION AND OUTREACH COSTS.

A. The requested education and outreach costs should not be included in base rates. The Company acknowledges that these costs were occasioned by the same response to Governor Corzine's economic stimulus initiative and the RGGI legislation that led to the new EE programs proposed in the Company's RGGI filing. Indeed, one year's worth of these costs is also included by the Company in

the RGGI filing. The Board recently approved three stipulations – for New Jersey Natural Gas Co. ("NJNG"), South Jersey Gas Co. ("SJG"), and Public Service Electric & Gas Co. -- in which all these utilities' costs for new RGGI programs are included in the utilities' respective RGGI rate riders. The Company's stipulation approved by the Board included all the Company's costs for new RGGI programs save the three above-described categories carved out for recovery in this case. Recovery of EE costs through specific rate riders has been the norm in the State for several years. The Company should seek recovery of these costs through a specific rate rider.

Q. MIGHT EDUCATION AND OUTREACH PROGRAMS AND COSTS CONTINUE IN AN ONGOING FASHION AFTER THE CONCLUSION OF THE SPECIFIC EE PROGRAMS INCLUDED IN THE COMPANY'S RGGI FILING?

A. Yes, they might. However, two factors argue against including these costs in base rates even though such costs might continue to be incurred at some level over time. These are:

1. The Company's detailed response to data request RCR-A-111.01 makes it clear that these costs are in at least significant part in direct support of "new [EE] programs, rebates, and initiatives". Since they support EE programs whose *other* costs largely have been or likely will be proposed for recovery through specific EE rate riders, I see little reason for placing this subset of costs in base rates, as opposed to in the appropriate EE rider.

2. Perhaps more fundamentally, an EE rider tracks costs for approved initiatives as those costs are incurred. If the costs are included in base rates instead, there is little to prevent the utility from reducing EE education and outreach costs once rates are in place. After all, these are discretionary costs in the sense that they are not fundamental to utility operations. Moreover, any such reduction in future outlays would be reflected in a rate rider, but would not be reflected in base rates. For this reason, these costs should be removed from base rates and their recovery sought through an appropriate EE rider.

Q. PLEASE DISCUSS DASHBOARD MAINTENANCE COSTS.

A. The Dashboard in an on-line tool that permits utility customers to estimate the factors responsible for their level of energy use once they input certain data concerning their home and appliances. They can compare their gas usage with that of other customers. They can receive estimates of the impact of undertaking efficiency improvements. This is a useful tool that is already in place at NJNG and SJG. I understand that the costs the Company would include in base rates are simply the annual maintenance fee charged by the provider of the software. If the Company commits to maintaining the Dashboard in place at least until its next subsequent base rates case, the maintenance cost is not subject to change based on customer participation or to arbitrary change by the utility. While including these costs in base rates would be an option, including them in an appropriate EE rider seems a more consistent and reasonable alternative to me. Given my

recommendations on other EE costs, Dashboard maintenance would be the sole identified EE cost included in base rates. It seems more consistent and straightforward to simply include this one small EE item in an appropriate rider, just as the start-up costs for the Dashboard are already included in the Company's RGGI filing.

Q. PLEASE DISCUSS EE LABOR COSTS.

A. The Company's testimony and data responses make it clear that the positions covered by these costs –for one program manager, already hired, plus four home energy auditors—are in direct support of its new RGGI programs, whose other costs are largely reflected in the RGGI filing. It is hard to see how the Company could administer the new EE programs without a manager. As for the four auditors, they are fundamental to the direct operation of the "Whole House Energy Efficiency Program" in the Company's RGGI filing. In my view, these costs should not be included in base rates. The Company should seek recovery for them through an appropriate EE rider.

Q. MIGHT THESE EE LABOR COSTS CONTINUE IN AN ONGOING FASHION AFTER THE CONCLUSION OF THE SPECIFIC EE PROGRAMS INCLUDED IN THE COMPANY'S RGGI FILING?

A. I think it unlikely that these costs would continue at exactly the same level. For EE programs beyond those in the RGGI filing, it is likely that the Company would file a new petition with the Board, and seek cost recovery through an EE

rate rider mechanism. If these hypothetical subsequent programs were larger in scope than those in the present RGGI filing, more management and auditing than reflected in these five positions might well be required. If they were smaller, less labor might be required. The fact that EE labor costs might continue at some level is a poor reason for segmenting these costs out and including them in base rates. The logic of a properly administered EE rider is that it affords the utility assurance that it will recover its prudently incurred costs for operating approved EE programs, while it protects ratepayers from paying for more than those actual incurred costs. EE programs are subject to market fluctuations –demand can be greater or less than expected—and a properly designed EE rider can appropriately reflect this uncertainty. I recommend the Company seek inclusion of these costs in an EE rider.

Q. PLEASE DISCUSS COMPANY STATEMENTS RELATING TO THE NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY.

A. Mr. Yardley discusses in his testimony the National Action Plan for Energy Efficiency (the "National Action Plan"), a policy framework and resource whose development was facilitated by the U.S. Department of Energy and Environmental Protection Agency. He quotes the original 2006 Plan as encouraging regulators and policymakers to consider modifying traditional ratemaking practices to encourage utility pursuit of energy efficiency, and refers to certain successor reports to that Plan. He appends the executive summary of the National Action Plan to his pre-filed testimony and Schedule DPY-2. He also

appends certain related resolutions by the National Association of Regulatory utility Commissioners ("NARUC") to his testimony as Schedule DPY-3.

Q. DOES THE NATIONAL ACTION PLAN THAT MR. YARDLEY REFERS TO SHOW THAT DECOUPLING IS NECESSARY IF UTILITIES ARE TO EFFECTIVELY PROMOTE EE?

A. No, it does not. The National Action Plan discusses a range of ratemaking issues and options for promoting EE through ratemaking. It acknowledges that decoupling is a controversial issue with pros and cons. It is true that the National Action Plan and successor reports give prominent positive treatment to the case for considering decoupling. That case is merely a policy argument which presumes that decoupling should have positive effects on utility pursuit of EE, while protecting ratepayer interests. Though they refer at points to some of the decoupling schemes which have been tried in the past, the National Action Plan and successor reports present no hard evidence that such schemes have materially improved utility performance in pursuing EE. Moreover the issue of adverse effects on ratepayers is largely absent from these reports. In my view, the National Action Plan gives insufficient attention to the case for strong directive regulation as a means for securing effective utility pursuit of EE. To some extent, this may reflect the prominent role played by investor-owned utility representatives in the overall Plan process.

Q. DO THE NARUC RESOLUTIONS THAT MR. YARDLEY ATTACH SHOW THAT DECOUPLING IS NECESSARY IF UTILITIES ARE TO EFFECTIVELY PROMOTE EE?

A. No. The NARUC resolutions encourage regulators to consider and if possible adopt decoupling, but they largely refer to other policy analyses such as the National Action Plan to motivate their recommendations. As policy resolutions, they do not appear to present any documentary evidence in support of the recommendations.

Moreover, NARUC only recommends consideration of decoupling, and recognizes that local regulatory decisions will be based on local policies and facts. In this case, just such a local consideration of decoupling is occurring. Underscoring this aspect of NARUC's recommendations, NARUC joined with the National Association of State Utility Consumer Advocates ("NASUCA") and other organizations in opposing a decoupling mandate as part of the recent energy legislation approved by the U.S. House of Representatives. See Exhibit 1 (DN-1).

Q. ARE THERE ALTERNATIVE REGULATORY POLICY PERSPECTIVES ON DECOUPLING TO THOSE CONTAINED IN THE NARUC RESOLUTIONS CITED BY MR. YARDLEY?

A. Yes, of course there are. For example, NASUCA issued a thoughtful resolution in 1997. It is attached as Exhibit 2 (DN-2). In my view NASUCA's resolution properly considers risks to ratepayers associated with proposals to implement decoupling, in many cases identifying risks that are underplayed or

omitted from the policy frameworks cited by Mr. Yardley.

Q. DOES THIS COMPLETE YOUR TESTIMONY?

A. Yes, it does.

EXHIBITS

APRIL 27, 2009

The Honorable Henry Waxman
Chairman Committee on Energy & Commerce
United States House of Representatives
Washington, DC 20515

The Honorable Joe Barton
Ranking Member
Committee on Energy & Commerce
United States House of Representatives
Washington, DC 20515

The Honorable Edward Markey
Chairman Subcommittee on Energy & Environment
United States House of Representatives
Washington, DC 20515

The Honorable Fred Upton
Ranking Member
Subcommittee on Energy & Environment
United States House of Representatives Washington, DC 20515

Re: Energy Efficiency Legislation

Dear Congressmen:

On behalf of a diverse group of residential and industrial consumers and state energy officials, we are writing in support of policies to improve the nation's energy efficiency—policies which will help the country achieve its energy security and climate change goals. Our organizations view energy and climate change issues from different perspectives. Nonetheless, we all support policies to improve energy efficiency, but we believe that Congress should not impose a mandatory, national rate structure to drive efficiency improvement, such as revenue decoupling, which may unnecessarily raise the cost of electricity and natural gas. Instead, Congress should allow for flexibility and innovation in the development of efficiency programs at the state level to enable states to reach the energy efficiency goals in the statute in the most cost effective manner possible.

Policies addressing the role of energy utilities in efficiency and climate change should define a least-cost energy plan in order to ensure that costs are minimized and that energy savings are genuine. Specifically, such plans should:

- Be comprehensive: Energy efficiency legislation should accommodate all options that lead to the lowest projected long-term net cost instead of options that seek to guarantee earnings for utilities.

- Recognize Market Imperfections and the Deficiencies in Relying on High Prices Alone to Achieve Efficiency: A cost effective policy must recognize that there are numerous market imperfections in the energy sector, which means that simple reliance on higher prices will impose unnecessarily high costs on consumers.

- Allow for Flexibility in Implementation. To ensure effective implementation, states should be given the flexibility to choose the approaches that best fit their needs. One size does not fit all. Federal legislation should not mandate specific practices or approaches to achieve the targeted efficiency goals. Federal legislation should allow the states to design programs that best achieve energy efficiency in a manner that best fits the state, and allow states to choose utility or non-utility-based approaches, and consider a wide range of incentive/penalty structures.

  Several states have implemented successful efficiency programs establishing non-utility entities whose mission is to improve energy efficiency. In addition, while several states have adopted and retain "revenue decoupling" rate programs as their preferred approach for increasing energy efficiency, others have terminated the program, determining that it was not working effectively, or was not adequately addressing consumer needs. This is not unexpected, as states have found that their individual circumstances vary, and varying approaches are needed to address those circumstances. Whatever the pros and cons of implementing decoupling mechanisms, we believe retail ratemaking policies do not lend themselves to a top-down federal solution. Providing the proper incentives for energy efficiency requires careful consideration through each state's individual regulatory process.

In conclusion, we support policies to increase energy efficiency, but we believe there are many ways to achieve that goal in a least cost manner that are flexible enough to work effectively for states and consumers. We look forward to working with you and your committees to develop legislation to achieve the efficiency gains we all seek.

American Forest & Paper Association
Consumer Federation of America
Electricity Consumers Resource Council (ELCON)
Industrial Energy Consumers of America
National Association of State Energy Officials
National Association of State Utility Consumer Advocates
National Association of Regulatory Utility Commissioners
National Community Action Foundation
National Consumer Law Center, on behalf of its low-income clients
Public Citizen

Exhibit 2 (DN-2)

THE NATIONAL ASSOCIATION OF STATE UTILITY CONSUMER ADVOCATES
RESOLUTION 2007-01

NASUCA ENERGY CONSERVATION AND DECOUPLING RESOLUTION

Whereas, the provision and promotion of energy efficiency measures are increasingly viewed by state commissions as a necessary component of utility service;

Whereas, many states are now encouraging rate-regulated utilities to adopt energy efficiency programs and other demand-side measures to decrease the number of units of energy each utility's customers purchase from the utility;

Whereas NASUCA has long supported the adoption of effective energy efficiency programs;

Whereas recent proposals by rate-regulated public utilities for the initiation or expansion of energy efficiency measures have featured utility rate incentives or revenue "decoupling" mechanisms that guarantee utilities a predetermined amount of revenues regardless of the number of units of energy sold;

Whereas, the utilities proposing decoupling measures seek guarantees from public utilities commissions that they will receive their allowed level of revenues;

Whereas, these utilities justify this departure from traditional rate-making principles on the theory they are being asked to help their customers purchase fewer energy units from them by promoting energy efficiency measures and other demand-side measures, thereby reducing their revenues and, consequently, their returns to their shareholders, and that decoupling mechanisms compensate utilities for revenues lost due to conservation;

Whereas, these utilities contend that because these measures reduce their revenues, they have a disincentive to encourage programs that aid their customers in purchasing fewer units of energy;

Whereas, historically, rates have been set in periodic rate cases by matching test-year revenues with test-year expenses, adding pro forma adjustments and allowing the utilities an opportunity to earn a reasonable rate of return on their investments in exchange for a state-protected monopoly;

Whereas revenue guarantee mechanisms allow rate adjustments to occur based upon one element that affects a utility's revenue requirement, without supervision or review of other factors that may offset the need for such a rate change;

Whereas, historically, rate-regulated utilities were not guaranteed they would earn the allowed return; rather, earnings depended on capable management operating the utilities in an efficient manner;

Whereas, many utilities proposing revenue decoupling request compensation for revenue lost per customer, implying that sales volumes are declining, when in fact these utilities' total energy sales revenues are stable or increasing;

Whereas, there are a number of factors that may cause a utility to sell fewer units of energy over a period of time, including weather, changing economic conditions, shifts in population, loss of large customers and switches to other types of energy, as well as energy efficiency and other demand-side measures;

Whereas many utilities have been offering cost-effective energy efficiency programs and actively marketing these programs for years without proposing or implementing rate incentives or revenue guarantee mechanisms such as decoupling, and have continued to enjoy financial health;

Whereas past experience has shown that revenue guarantee mechanisms such as decoupling may result in significant rate increases to customers;

Whereas some utilities have referenced the benefit of encouraging energy efficiency programs as a justification for revenue guarantee mechanisms without in fact offering any energy efficiency programs, indicating that the revenue guarantee mechanisms are attractive to utilities for reasons other than their interest in promoting energy conservation;

Whereas past experience has shown that rate increases prompted by revenue guarantee mechanisms such as decoupling are often driven not so much by reduced consumption caused by utility energy efficiency programs, as by reduced consumption due to normal business risks such as changes in weather, price sensitivity, or changes in the state of the economy;

Whereas utilities are better situated than are consumers or state regulators to anticipate, plan for, and respond to changes in revenue prompted by normal business risks, and the shifting of normal business risks away from utilities insulates them from business changes and reduces their incentive to operate efficiently and effectively;

Whereas the traditional ratemaking process has historically compensated utilities for experiencing revenue variations associated with normal business risks;

NOW THEREFORE NASUCA RESOLVES:

To continue its long tradition of support for the adoption of effective energy efficiency programs;

And to oppose decoupling mechanisms that would guarantee utilities the recovery of a predetermined level of revenue without regard to the number of energy units sold and the cause of lost revenue between rate cases;

BE IT FURTHER RESOLVED:

NASUCA urges Public Utilities Commissions to disallow revenue true-ups between rate cases that violate the matching principle, the prohibition against retroactive ratemaking, the prohibition against single-issue ratemaking, or that diminish the incentives to control costs that would otherwise apply between rate cases;

NASUCA urges State legislatures and Public Utilities Commissions to, prior to using decoupling as a means to blunt utility opposition to energy efficiency and other demand-side measures, (1) consider alternative measures that more efficiently promote energy efficiency and other demand side measures; (2) evaluate whether a utility proposing the adoption of a revenue decoupling mechanism has demonstrated a commitment to energy efficiency programs in the recent past; and (3) examine whether a utility proposing the adoption of a revenue decoupling mechanism has a history of prudently and reasonably utilizing alternative ratemaking tools;

If decoupling is allowed by any state commission, NASUCA recommends that the mechanism be structured to (1) prevent over-earning and provide a significant downward adjustment to the utilities' ROE in recognition of the significant reduction in risk associated with the use of a decoupling mechanism, (2) ensure the utility engages in incremental conservation efforts, such as including conservation targets and reduced or withheld recovery should the utility fail to meet those targets, and (3) require utilities to demonstrate that the reduced usage reflected in monthly revenue decoupling adjustments are specifically linked to the utility's promotion of energy efficiency programs.

NASUCA authorizes its Standing Committees to develop specific positions and to take appropriate actions consistent with the terms of this resolution to secure its implementation, with the approval of the Executive Committee of NASUCA. The Standing Committees or the Executive Committee shall notify the membership of any action taken pursuant to this resolution.

Approved by NASUCA:
Denver, Colorado

June 12, 2007

Submitted by:
NASUCA Consumer Protection Committee

June 11, 2007

Opposed:
Ohio
Indiana
Colorado
Wyoming

Abstained:
Massachusetts
California

Exhibit 3 (DN-3)

Biographical Information
David Nichols

David Nichols is an independent energy analyst in Providence, Rhode Island. He is also a senior consultant with Synapse Energy Economics, Cambridge, Massachusetts. For over two decades Nichols was vice president of Tellus Institute, which he cofounded. Before that he was associate professor at the State University of New York (Albany).

Nichols works throughout the U.S., as well as internationally. His energy work includes efficiency studies, technology assessment, cost benefit analysis, design and evaluation of demand-side load response and efficiency programs, and policy analysis. He has testified before regulatory commissions in the U.S. and Canada on rate design, renewable energy, energy efficiency, and other issues. Current and recent work includes:

- Training of midlevel professionals in India and Indonesia on electric resources planning and demand-side management. This work was done for the U.S. Agency for International Development through the Institute of International Education.
- Comprehensive reports on states' policy and regulatory treatment of renewable energy and energy efficiency, for the American Council for an Energy-Efficient Economy, the Colorado Governor's Office of Energy Management, E-Source, and others.
- Study of the achievable potential from new electric energy efficiency and load response measures in Utah, completed for an Advisory Group to the Public Service Commission.
- Heading the team that developed performance indicators for the Climate Change programs (renewables and energy efficiency) of the Global Environment Facility.
- Lead author for the World Commission on Dams' *Thematic Review of Planning Approaches* on enabling stakeholder participation in planning, mitigating impacts though energy/water conservation, and better siting and operating practices.
- Analyses of utility cost recovery and incentives for ratepayer-funded energy efficiency, for the Regional Environmental Councils of Quebec, West Kootenay Power Co., Enbridge Gas Ltd., Nova Scotia Utility and Review Board, and others.

Nichols has participated in task forces, advisory groups, collaborative processes, workshops, working groups and settlement discussions on oil, gas, and electric energy efficiency, as well as rate design. In these working group processes he assisted such stakeholders as energy utilities, commission staffs, consumer advocates, energy offices, and environmental organizations.

Nichols' articles have appeared in *Electricity Journal*, *Industry and Environment Review*, *Pace Environmental Law Review*, *Polity*, and conference proceedings published by the American Council for an Energy Efficient Economy, Electric Power Research Institute, and others. He was educated at Clark University, the University of Chicago, and Massachusetts Institute of Technology, where he received his Ph.D.