

Synapse
Energy Economics, Inc.

TECHNICAL PROPOSAL

Proposal to Provide Consulting Services in Connection with Appalachian Power Company's Petition to Acquire Transferred Resources from Ohio Power Company (PSC Case No. 12-1655-E-PC)

**Submitted to the Consumer Advocate
Division of the Public Service
Commission of West Virginia**

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1. Introduction & Overview of Synapse

Synapse Energy Economics, Inc. (Synapse) is pleased to present this proposal to the Consumer Advocate Division of the West Virginia Public Service Commission (CAD) to provide consulting services in connection with the petition by Appalachian Power Company (APCo, "the Company") for approval to transfer generating resources from Ohio Power Company (OPCo), now before the Public Service Commission of West Virginia (PSC) as Case No. 12-1655-E-PC. APCo and OPCo (collectively, "the Companies") are both affiliates of American Electric Power (AEP).

The goal of our analyses will be to help the CAD determine whether or not APCo's proposed acquisition of 1,647 megawatts (MW) from the Amos and Mitchell facilities is the most cost-effective method of providing service to the Company's customers. The issues raised in this docket are directly related to, and overlap the issues raised in Case No. 11-1775-E-P, APCo's proposed merger with Wheeling Power Company (WPCo), another AEP affiliate.

The key component of our analyses will be a review of the Company's evaluation of generation alternatives in the Resource Plan it filed on December 18, 2012 in Case No. 12-1655-E-PC. This analysis will draw from, and build upon, the evaluation Synapse prepared of the supply plans the Company provided in Case No. 11-1775-E-P, the concurrent merger between APCo and WPCo. Our review will examine the resources and alternatives that the Company considered, the key assumptions the Company used to calculate the present value and rate impacts of those alternatives, and the risks considered or evaluated by the Company.

Synapse is currently concluding an engagement with the WV CAD, in which Synapse evaluated the proposed merger of APCo and WPCo, and the resource plan envisioned and modeled by the Company in that docket. Based on that detailed evaluation, and an initial review of the instant case, we believe that the following points are likely relevant:

- The Company continues to evaluate a limited set of resource options, i.e., the transfer of 1,647 MW of both Amos and Mitchell, the transfer of either Amos or Mitchell and a large new gas purchase in 2018, a new gas purchase in 2018, or market purchases only through 2025. Synapse identified in the merger docket that the Company had not evaluated the full range of resource options available to it at that point. While the range of resource portfolios appears broader in this docket, the Company still includes significant restrictions on the acquisition of balanced portfolio options, the acquisition of existing gas-fired capacity through an RFP process, and/or the acquisition of existing OPCo gas units currently slated to be transferred to the non-regulated AEP Generating Resources (AEPGR) Company.
- The Company's commodity price forecasts appear to be outdated (possibly vintage 2011), and may not reflect the current long-term outlook for natural gas prices.
- The Company's risk analyses ("pricing bands") do not evaluate an appropriate range of risk, and based upon our prior experience with AEP are likely biased towards a status-quo finding.
- The Company evaluates a minimal quantity of demand-side measures, eliminating the review of more aggressive savings presented in the concurrent merger docket.
- Based on our previous review of the Company's use of the *Strategist* model, we expect that AEP has prevented the model from choosing the most cost-effective resources in near-term

years. Equally, if not more important, the Company's model may not correctly simulate the new Power Coordination Agreement (PCA), under which APCO should be acquiring generating resources that are cost-effective from its perspective rather than from the perspective of the AEP Pool.

Synapse is very well-suited to provide CAD with these analyses. In addition to our extensive general experience reviewing and preparing electric utility resource plans throughout the U.S. and Canada, we are very familiar with supply options and market conditions facing utilities operating in West Virginia, and of the AEP utilities in particular. As noted above, we have completed an analysis of the supply resource options available to APCo and WPCo in Case No. 11-1775-E-P. In January 2013 the CAD retained Synapse to provide expert witness services related to the petition for approval of a generation transaction filed by Monongahela Power Company and the Potomac Edison Company before the PSC as Case No. 12-1571-E-PC. In May 2012 we completed an analysis of the supply options available to Kentucky Power, another AEP utility, in order to evaluate the cost-effectiveness of retrofitting Big Sandy coal unit 2. In late 2011, Synapse has also completed two other relevant long-term electricity resource planning projects in Kentucky: one investigating the potential impacts of a renewable and energy efficiency portfolio standard, and one evaluating utility supply planning options.

Synapse has a proven track record of assisting consumer advocates with integrated resource planning (IRP) analyses. In addition to our ongoing projects for the CAD, we have conducted recent IRP analyses for consumer advocates in Hawaii, California, Nevada, Missouri, and Ohio. Synapse has also provided consumer-oriented resource planning analysis and testimony in similar cases in Oregon, Wyoming, Utah, Kentucky, and Indiana. Descriptions of Synapse projects related to integrated resource planning are provided in Section 5 of this proposal, "Selected Relevant Projects."

Synapse has assembled an experienced team for this project. The senior members of the team, Dr. Jeremy Fisher, Rachel Wilson and Rick Hornby have worked together on most of the projects mentioned above. Of particular relevance is the fact that Mr. Hornby and Ms. Wilson worked on the APCo/WPCo merger case and are currently working on the Monongahela Power Company and the Potomac Edison Company case. For this project we are proposing Dr. Fisher and Ms. Wilson as expert witnesses, with Rick Hornby as a senior advisor and potential expert witness. Dr. Fisher will manage this project at Synapse. Our project team brings demonstrated experience in the analyses relevant to this project, including:

- Reviewing and preparing forecasts of energy and demand;
- Analyzing the technical, economic, and environmental attributes of generation resources, both conventional and new, fossil fuel based and renewable; and
- Preparing risk and sensitivity analyses of various resource plans under a range of alternative assumptions and scenarios.

The qualifications of our project team members are discussed further in Section 4 of this proposal, "Project Team and Qualifications."

Required Forms and Cost Proposal

Please note that the required forms provided in the CAD's RFQ have been included as appendices to this Technical Proposal: Appendix A provides Synapse's Certification and Signature Page, Appendix B provides our signed Addendum Acknowledgement Form, and Appendix C provides our notarized Purchasing Affidavit.

Synapse's Cost Proposal, consisting of the required Consulting Bid Form, has been provided in a separate, sealed envelope per the instructions in the CAD's RFQ. No budget or cost information has been included in this Technical Proposal.

About Synapse

Synapse Energy Economics was founded in May 1996 to specialize in consulting on electric industry regulatory, restructuring, and environmental issues. Our firm provides research, testimony, reports, and regulatory support to consumer advocates, environmental organizations, regulatory commissions, state energy offices, and others. Synapse's professional staff has more than 200 years of combined experience in studying the electricity industry, and we are frequently at the forefront of electricity industry regulation and restructuring debates. Synapse is managed by its President and Founder Bruce Biewald, Vice President and Chief Operating Officer Ezra Hausman, and Vice President Tim Woolf.

Synapse works for a wide range of clients throughout the United States, including environmental groups, public utility commissions and their staff, governmental associations, public interest groups, attorneys general, offices of consumer advocates, foundations, and federal governmental organizations such as the U.S. Environmental Protection Agency and the Department of Justice.

Synapse has extensive experience in reviewing and preparing IRPs. This includes an understanding of the capital and operating costs of conventional, renewable, and energy efficiency resources, the lead times associated with bringing those resources into service, and the environmental regulations that will affect their operations. It also includes experience with wholesale markets for electric energy and capacity, and with running production cost models.

2. Conflict of Interest Statement

Synapse does not believe that it has any conflicts of interest with respect to this contract. However, out of an abundance of caution, we advise the CAD that Synapse submitted a proposal to the Sierra Club on February 6, 2013, to provide expert consulting services related to Kentucky Power Company's application before the Kentucky Public Service Commission for a Certificate of Public Convenience and Necessity to purchase a 50 percent interest in Mitchell Generating Station in West Virginia. Synapse proposed to analyze and provide expert witness testimony before the Kentucky PSC regarding alternative options available to Kentucky Power Company, focused specifically on energy efficiency and demand response. Synapse has not yet been awarded this work.

Before bidding on any future work related to the substance or stakeholders associated with this contract, Synapse will consult with the CAD to ensure that there are no real or perceived conflicts of interest.

3. Scope of Work

Synapse proposes to provide the analyses and expert testimony specified in the RFQ regarding the Company's proposed acquisition of approximately 1,647 MW from the Amos and Mitchell facilities. Our consulting services will include:

1. Evaluating the Resource Plan to determine if the Company's proposed acquisition is the most cost-effective strategy for providing service to its customers;
2. Recommending alternative demand-side and/or supply-side resources if we determine the Company's proposal is not the most cost-effective;
3. Evaluating, and supplementing if necessary and possible, the Company's modeling supporting this case, including resource options, commodity and emissions prices, and the structure of the Company's model;
4. Reviewing analyses and testimonies filed by the Companies and other parties; and
5. Preparing and presenting testimony supporting our analysis of the Resource Plan, our recommended alternative, and our critique of analyses of the Companies and other parties.

The Company proposes the acquisition of an additional two-thirds interest in the John E. Amos coal plant and a fifty-percent share of each of two units at the Mitchell coal plant, for a total of 1647 MW. This plan is proposed in conjunction with a major restructuring of the relationships between several of the AEP utilities. This corporate restructuring includes termination of the AEP Pool Agreement, the separation of OPCo generating facilities from the load distribution entity, and the transfer of OPCo's former generating units to AEP's non-regulated merchant operation, AEPGR, as well as to its regulated entities in West Virginia, Virginia, Kentucky and Indiana including the merged APCo/WPCo entity and Kentucky Power Company.. Based on our prior experience with AEP in Kentucky, and most recently in the APCo/WPCo merger case, as well as our initial review of its filings in this case, we have identified the following concerns:

- Whether the Company's evaluation is based upon an accurate modeling of the new PCA,
- Whether the Company has used its model to evaluate the full range of resource options available to it, including existing capacity being divested by OPCo and existing gas fired capacity owned by other parties,
- Whether the Company has evaluated its options using reasonable projections of commodity and emissions prices,
- Whether the proposed resource acquisition meets the capacity and energy needs of its retail customers without burdening them with undue fixed cost risk,
- Whether the Company's risk evaluation is appropriately executed, for example has it evaluated the risk of lower, or no, margins from off-system sales
- Whether the Company has evaluated all cost effective energy efficiency and other demand-side resources,

Based on other recent evaluations of AEP analyses in West Virginia, Kentucky, and elsewhere, these concerns are highly relevant to the outcome of the Company's proposal. It is not clear that the Companies need to acquire 1,647 MW of baseload capacity as opposed to 1,647 of capacity from a mix of baseload, intermediated and peaking resources.. Our brief review of the Company's



modelling indicates that the Companies may have corrected or mitigated some previously identified deficiencies but other deficiencies persist or have emerged anew.

Following is a brief description of our proposed approach to analyzing the Company's proposal and underlying analyses through substantive tasks 1, 2 and 3.

- Synapse will review the Company's Petition and associated resource plan, and request discovery in support for the scenarios and resources evaluated therein, including the modeling inputs and outputs, and associated post-processing work papers utilized by the Company.
- We will acquire the same build and version of the *Strategist* model as used by the Company in this case in order to replicate, modify, and test alternatives to the Company's proposed resource plan.
- We will determine, through discovery, the current distribution and value of resources in the AEP restructuring process, the Company's most recent commodity price and market price forecasts, and the Company's estimate of demand-side resources. We will focus in particular on their projections of natural gas prices, coal prices, electricity market prices, environmental regulations, and performance (i.e., capacity factor and output) for each potential resource.
- We will assess the reasonableness of the Company's range of potential resources and its input assumptions based upon their supporting rationale and our database of resource planning assumptions. That database includes assumptions used by comparable utilities and their consultants as well as projections by independent sources such as the EIA.
- Synapse will prepare and present direct written testimony based on the research and analysis described above. We expect that Jeremy Fisher and Rachel Wilson will be the primary expert witnesses. Mr. Hornby is available to testify if required. We will respond to information requests on the direct testimony and on the analysis.
- Synapse will assist the CAD in the preparation of cross examination questions as required, and will provide a review of the CAD brief if requested.

This proposal assumes a single round of intervenor testimony, as proposed by the Company in the initial petition, and three days of on-site hearing preparation and support, cross-examination support, and direct testimony. Other travel, depositions, and additional rounds of surrebuttal or cross-answering testimony, if required, will be negotiated under a supplemental contract.

4. Project Team and Qualifications

The project team will include the following members:

- Jeremy Fisher, PhD – project manager and witness on resource planning issues and deficiencies (in particular: input commodity and emissions prices, risk analysis, and pre- and post-processing of model data) Rachel Wilson – witness on resource planning modeling (in particular: use and execution of the *Strategist* model, and model structure and constraints)
- Rick Hornby – analysis of resource diversification and financial risk to ratepayers
- Tyler Comings – analysis support for resource options and planning assumptions

- Patrick Knight – analysis and discovery support

Below we offer short bios for each member of the proposed project team. Full resumes are provided in Appendix D.

A. Project Team Bios

Jeremy Fisher – Project Manager

Jeremy Fisher brings a background in global ecosystem modeling and climate impact science to energy system planning and analysis. At Synapse, Dr. Fisher's work has focused on the impact of environmental regulations on the electric sector, air emissions, the development of long-term alternative energy plans at the state and regional levels, and other related issues.

Dr. Fisher evaluates the impact of expected U.S. Environmental Protection Agency regulations on coal-fired power plants, both at the individual-facility and fleet levels. This includes assessing power plant owners' estimates of capital and operation costs to comply with air, solid waste, and water regulations (e.g., CCR, effluent quality, 316(b), tailoring, and ozone); cost estimates for mitigation equipment; consideration of carbon dioxide prices over the long-term; analysis of forward-going economics; and consideration of a full range of viable alternatives to the continued operation of aging coal units.

Dr. Fisher's recent work includes providing expert witness testimony evaluating the prudence and necessity of retrofitting coal plants to meet environmental requirements in Utah, Wyoming, and Oregon; and conducting an extensive review of the current science and policy implications of using biomass for greenhouse gas mitigation in the power sector. He is currently leading the development of a model for the U.S. EPA to project the hourly changes in generation along with the associated changes in air emissions at individual generating units resulting from the introduction of new energy efficiency or renewable energy resources in a specific region.

Over the last decade, Dr. Fisher has been published in nine peer reviewed publications and has written and co-authored more than 30 papers and reports. He has provided expert testimony to the public utility commissions in Wyoming, Utah, Kansas, Oregon, and Kentucky.

Before joining Synapse in 2007, Dr. Fisher researched feedback cycles between the climate and carbon exchange in ecosystems, including determining the footprint of Hurricane Katrina. Dr. Fisher holds a BS in Geology and a BA in Geography from the University of Maryland, and an MS and PhD in Geological Sciences from Brown University. Examples of his current and recent resource planning cases, described in Section 5, include:

- PacifiCorp Utah and Wyoming Applications for CPCN (Project Manager, witness)
- Evaluation of TVA's 2011 Integrated Resource Plan (Project Manager, lead author)
- PacifiCorp Oregon General Rate Case (Project Manager, witness)
- Wisconsin Public Service Corp. Certificate Application for Environmental Retrofits at Weston 3 (Project Manager, witness)
- Evaluation of Kentucky Power Company's Application for Recovery of Cost of FGD and other EPA Regulation Compliance Measures at Big Sandy Coal Plant (Witness)

Rachel Wilson – Associate

Rachel Wilson conducts research and assists in writing testimony and publications. Her work focuses on a variety of issues related to electric utilities, including federal and state clean air policy; emissions from electricity generation; environmental compliance technologies, strategies, and costs; integrated resource planning; valuation of environmental externalities from power plants; and the nexus between water and energy.

As part of her work, Ms. Wilson uses optimization and electricity dispatch models, including *Strategist*, PROMOD, and PROSYM/Market Analytics, to analyze regional energy markets and to evaluate the modeling analyses performed by utilities. She has served as the primary modeling specialist in several recent Synapse projects analyzing proposed retrofits of aging coal-fired power plants, and has testified on related issues before the public utilities commissions of Kentucky and Minnesota.

Since joining Synapse in 2008, Ms. Wilson has contributed to dozens of publications and reports, including: *The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region*, prepared for the Energy Future Coalition; *Comments Regarding MidAmerican Energy Company Filing on Coal-Fired Generation in Iowa*, prepared for the Iowa Office of the Consumer Advocate; and *Global Best Practices: Strategies for Decarbonizing Electric Power Supply*, prepared for the Regulatory Assistance Project.

Prior to joining Synapse, Ms. Wilson worked for an economic and business consulting firm where she focused on issues of energy, the electric industry, and coal production. Ms. Wilson holds a Master of Environmental Management from Yale University and a BA in Environment, Economics, and Politics from Claremont McKenna College.

Examples of her current and recent resource planning cases, described in Section 5, include:

- Evaluation of Kentucky Power Company application for recovery of cost of FGD and other EPA regulation compliance measures at Big Sandy coal plant (review Company *Strategist* runs, re-run *Strategist* for alternative assumptions regarding load and supply resources, witness)
- Evaluation of Louisville Gas & Electric and Kentucky Utilities (the Companies) application for certificates of public convenience and necessity to invest billions of dollars in existing coal-fired power plants to enable them to comply with new, tighter environmental regulations (review Company *Strategist* runs, re-run *Strategist* for alternative assumptions regarding load and supply resources, witness)
- Review of comments regarding potential impacts of EPA regulations on coal-fired generation in Iowa. Ms. Wilson assisted the Iowa OCA by reviewing comments submitted in this docket and preparing comments to submit to the Board.
- Avoided Energy Supply Cost Study 2011 for New England (lead modeler)

Rick Hornby – Senior Consultant

Rick Hornby is a senior consultant at Synapse Energy Economics. He has worked in the energy industry since 1976 as a regulatory consultant, senior civil servant, and project engineer. Mr. Hornby's primary areas of focus are resource planning and ratemaking in the electricity and

natural gas industries. He has provided expert testimony and litigation support on these IRP issues in over 120 proceedings on behalf of utility regulators, consumer advocates, environmental groups, energy marketers, gas producers, and utilities.

Mr. Hornby has a Master of Science in Technology and Policy from the Massachusetts Institute of Technology and a Bachelor of Industrial Engineering from Dalhousie University. Prior to joining Synapse, Mr. Hornby was a Principal with CRA International, formerly Tabors Caramanis & Associates. He also held positions as Director of the Energy Group and Manager of the Natural Gas Program at the Tellus Institute (formerly Energy Systems Research Group). Earlier in his career he served as Assistant Deputy Minister of Energy in the Nova Scotia Department of Mines and Energy and as a Member of the Canada-Nova Scotia Offshore Oil and Gas Board. Mr. Hornby has also been a project engineer responsible for energy management programs in industry.

Since joining Synapse in 2006, Mr. Hornby has analyzed a range of electricity resource planning and ratemaking issues for staff of regulatory commissions, consumer advocates and environmental groups. Examples of his current and recent resource planning cases, described in Section 5, include:

- Analysis of Monongahela Power and Potomac Edison's Petition for Approval of a Generation Resource Transaction (Project Manager, witness)
- Analysis of Apco/Wpco Merger (Project Manager, witness)
- Evaluation of Kentucky Power Company's application for recovery of cost of FGD and other EPA regulation compliance measures at Big Sandy coal plant (Project Manager, witness)
- Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky (Project Manager, editor)
- Avoided Energy Supply Cost Study 2011 for New England (Project Manager, editor)
- Evaluation of Oklahoma Gas & Electric wind power purchase agreements and associated Windspeed Transmission Project (Project Manager, witness)
- Avoided Costs for ACEEE Clean Energy Studies of Ohio, Virginia, Arkansas, North Carolina, and South Carolina (Project Manager)

Tyler Comings - Associate

Tyler Comings is an economic specialist, conducting research on energy system planning and coal plant economics, and performing economic modeling and analysis in support of a wide range of Synapse projects. Mr. Comings has significant experience in performing economic impact and benefit-cost analyses, statistical modeling, and research on environmental issues. His analyses often incorporate the use of economic models such as REMI and IMPLAN.

At Synapse, Mr. Comings has performed economic impact modeling for Vermont's Comprehensive Energy Plan and its energy efficiency investments, and for Kentucky's renewable and energy efficiency portfolio standard. He has evaluated resource adequacy and planning in comments on a generation procurement policy in Maryland and on the Connecticut Department of Energy and Environmental Protection's draft 2012 Integrated Resource Plan. Mr. Comings has

also analyzed coal plant economics for several cases and was lead author on an assessment of the forward-going economics of Midwest Generation coal plants in Illinois compared to forecasts of PJM market prices.

Prior to joining Synapse, Mr. Comings served as a senior associate at ideas42, a think tank specializing in behavioral economics research. There, he performed research on consumer behavior, including conducting case studies of innovative financial products in developing countries and leading studies on behavioral interventions to prevent foreclosure. Prior to that, he served as an economic consultant and research analyst at Economic Development Research Group, Inc., a consulting firm. His responsibilities there included analyzing transportation and environmental policies, creating economic development strategies, and modeling the economic impact of renewable energy and energy efficiency investments.

Mr. Comings holds an MA in Economics from Tufts University and a BA in Mathematics and Economics from Boston University.

Examples of his current and recent resource planning cases, described in Section 5, include:

- Analysis of APCo/WPCo Merger (research on renewable potential)
- Evaluation of TVA's 2011 Integrated Resource Plan (research on renewable potential)
- Evaluation of Kentucky Power Company application for recovery of cost of FGD and other EPA regulation compliance measures at Big Sandy coal plant (research support)
- Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky (economic analysis and modeling)
- Analysis of Illinois Coal Fleet Economics (lead analyst and author)

Patrick Knight – Research Associate

Patrick Knight performs consulting, conducts research, and assists in writing testimony and reports for Synapse. His work covers a range of issues, such as the costs of environmental controls and compliance, coal-fired power plant retirements, forward capacity markets, costs and benefits of energy efficiency programs and measures, water and energy interactions, air emissions of electricity generation, consumer advocacy, and technology strategy within the energy industry.

Mr. Knight's recent work at Synapse includes:

- Building a model for the U.S. EPA to project the hourly changes in generation along with the associated changes in air emissions at individual generating units resulting from the introduction of new energy efficiency or renewable energy resources in a specific region
- Coauthoring a Synapse report on greenhouse gas emissions associated with hydroelectric resources
- Coauthoring Synapse's November 2011 report for the Civil Society Institute, *Toward a Sustainable Future for the U.S. Power Sector: Beyond Business as Usual 2011*
- Designing a model for a study on the economic and environmental impacts of geothermal residential heating and cooling systems

Prior to joining Synapse, Mr. Knight worked for New Ecology, Inc., where he helped develop a utility tracking and management software program. He holds a BS in Geophysics from Boston College, with minors in mathematics and philosophy, and an MA in Urban and Environmental Planning and Policy from Tufts University. Mr. Knight provided research and analysis support for several of the IRP projects described in Section 5, including the Evaluation of Big Rivers Electric Coop's Applications for CPCNs, the Evaluation of Kentucky Power Company's application for recovery of cost of FGD and other EPA regulation compliance measures at Big Sandy coal plant, and the 2011 Avoided Energy Supply Cost Study.

5. Selected Relevant Projects

Synapse is exceptionally well-qualified to provide the CAD with the consulting services outlined in the Scope of Work above. Below we provide descriptions of selected ongoing, recent, and relevant Synapse project work, including details on associated clients.

A. Projects for the West Virginia Consumer Advocate Division

Analysis of APCo/WPCo Merger

Client: West Virginia Consumer Advocate Division

Synapse provided analyses to help the Consumer Advocate determine if the proposed merger of Appalachian Power Company (Apco) and Wheeling Power Company (Wpco) would be beneficial for West Virginia ratepayers. The analyses focused primarily on whether the quantities and types of generation capacity the Companies were proposing to acquire between 2014 and 2017 would be beneficial to their ratepayers. Project in final review.

Analysis of Monongahela Power and Potomac Edison's Petition for Approval of a Generation Resource Transaction

Client: West Virginia Consumer Advocate Division

Synapse was recently retained to provide consulting services in connection with the petition for approval of a generation transaction filed by Monongahela Power Company and the Potomac Edison Company (collectively "the Companies") before the Public Service Commission of West Virginia as Case No. 12-1571-E-PC. The goal of Synapse's analyses will be to help the CAD determine whether or not the Companies' proposed acquisition of approximately 1,600 MW from the Harrison facility and sale of approximately 100 MW of the Pleasants facility is the most cost-effective method of providing service to the Companies' customers. Project ongoing

Stranded Costs and Divestiture of Generation Assets

Client: West Virginia Consumer Advocate Division

Synapse and Resource Insight assessed the stranded costs of American Electric Power and Allegheny Power. The results, including a discussion of divestiture of generation assets and the responsibility for stranded costs and gains, were presented in the testimony of Bruce Biewald before the West Virginia Public Service Commission in Case No. 98-0452-E-GI. Project completed in 1999.

Measures to Ensure Fair Competition and Protect Consumers in a Restructured Electricity Industry in West Virginia

Client: West Virginia Consumer Advocate Division

Synapse, with assistance from MacGregor Energy Consultancy, prepared a study of the following consumer protection measures: divestiture of generation, codes of conduct, licensing standards, reliability of distribution services, consumer education, and disclosure of information. The report was presented in the testimony of Tim Woolf before the West Virginia Public Service Commission, Case No. 98-0452-E-GI. Project completed in 1999.

B. Utility Resource Planning Projects

Development of Electric Utility IRP

Client: Hawaii Division of Consumer Advocacy

Synapse is providing expert witness and consulting services to the Hawaii Division of Consumer Advocacy in a proceeding to develop and review integrated resource plans (IRPs) for three electric companies. Project ongoing.

PacifiCorp Utah and Wyoming Applications for CPCN

Client: Sierra Club

Synapse is providing analysis and expert testimony on a plan by PacifiCorp to retrofit two coal units in Wyoming with environmental controls. Synapse is evaluating Company modeling, input assumptions, and transmission costs. Project ongoing.

Evaluation of TVA's 2011 Integrated Resource Plan

Client: Sierra Club

Synapse will evaluate an IRP produced by TVA in March 2011 to determine if all cost effective energy efficiency and reasonable penetrations of renewable energy would substantially change the outcome of the IRP, particularly pertaining to the continued use of potentially non-economic coal plants. Synapse will conduct an extensive literature review on energy efficiency and renewable energy potential in the TVA service territory, re-create the TVA preferred portfolio (and subsequently announced retirements) in a spreadsheet-based analysis, and determine the availability and cost of energy efficiency/renewable energy resources to replace at least four coal-fired plants owned by TVA. Synapse anticipates working with both Sierra Club and TVA in examining future energy efficiency/renewable energy economic potential and its impact in the TVA system. Project ongoing.

Evaluation of Big Rivers Electric Coop's Applications for CPCNs

Client: Sierra Club

On behalf of the Sierra Club, Synapse reviewed and provided expert witness testimony regarding the Big Rivers Electric Cooperative's applications for Certificates of Public Convenience and Necessity (CPCNs) and rate recovery to retrofit nine units at five existing coal-fired power plants in Kentucky. These plants include the D.B. Wilson, R.D. Green, Robert A. Reid, Kenneth Coleman, and City of Henderson facilities. Project completed in 2012.

PacifiCorp Oregon General Rate Case

Client: Sierra Club

Synapse provided expert testimony for a PacifiCorp general rate case in Oregon regarding the prudence of environmental retrofits on existing generating facilities, undertaken in the 2008-2009 timeframe. Sierra Club, Synapse's client, secured a groundbreaking prudence finding and Commission disallowance on the environmental retrofits, finding that the analysis and regulatory justification was deficient. Project completed in 2012.

Wisconsin Public Service Corp. Certificate Application for Environmental Retrofits at Weston 3

Client: Clean Wisconsin

Synapse provided analysis and expert testimony on a plan by WPSC to retrofit the Weston 3 coal unit with a unique emissions control system called ReACT. Synapse and contractors evaluated the risks associated with an unknown technology and supply chain, and the Company's evaluation of the cost efficacy and requirement for this retrofit. Project completed in 2012.

Evaluation of Kentucky Power Company's Application for Recovery of Cost of FGD and other EPA Regulation Compliance Measures at Big Sandy Coal Plant

Client: Sierra Club

In December 2011 Kentucky Power, owned by American Electric Power (AEP), one of the country's largest electric holding companies, requested approval for a Certificate of Public Convenience and Necessity (CPCN) and associated cost recovery to invest approximately \$950 million on environmental compliance measures at its Big Sandy Unit 2, an 800 MW coal unit approximately 40 years old. Synapse, testifying on behalf of the Sierra Club, demonstrated that the proposed investment was not reasonable because it was more cost-effective for Kentucky Power to retire that unit and meet its capacity and energy requirements from other resources. The utility withdrew its request on May 30, 2012, just days before the Kentucky Commission was scheduled to issue its Order. Project completed in 2012.

Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky

Client: Mountain Association for Community Economic Development; Kentucky Sustainable Energy Alliance

Legislation introduced in the Kentucky General Assembly proposes to establish a Renewable and Energy Efficiency Portfolio Standard (REPS) for utilities in the state. Synapse estimated the potential impacts of a REPS on Kentucky's portfolio of electricity resources, average electric rates, and on the state's economy. Project completed January 2012.

Evaluation of Utility Planning and Expenditures in Kentucky

Clients: Sierra Club and the National Resource Defense Council

For this project, Synapse provided expert testimony, comments, and litigation support in three cases before the Kentucky Public Service Commission involving resource planning and environmental upgrade expenditures by Louisville Gas & Electric and Kentucky Utilities (the Companies). In two certificate of public convenience and necessity cases, Synapse reviewed and critiqued the Company's proposals to invest billions of dollars in existing coal-fired power plants to make them compliant with potential environmental regulations that may apply to those plants. Synapse's comments on the Company's 2011 Integrated Resource Plan (IRP) covered the modeling process and assumptions regarding energy efficiency, load forecasts, renewable energy, and other supply-side alternatives. In all of these cases, our review included factors influencing the decision to retire a plant versus the costs of bringing a plant into compliance with anticipated environmental regulations. Project completed in 2011.

Long Term Procurement Plan Rulemaking

Client: California Division of Ratepayer Advocates

Synapse is providing technical and expert witness services to the CA DRA in connection with the Long Term Procurement Plan proceeding affecting the three largest investor-owned utilities in

California. The proceeding embraces both updates to the rules for those plans and reviews of plans to be submitted in 2011 and 2012. Project ongoing.

Energy Efficiency and Integrated Resource Planning in Nevada

Client: Nevada Bureau of Consumer Protection

Synapse is assisting the Bureau of Consumer Protection in reviewing and critiquing Nevada Power and Sierra Pacific Power's energy efficiency programs and triennial integrated resource plans. Analysis will include the review of appropriate energy efficiency budgets, and the role of energy efficiency in complying with the state's renewable portfolio standard. This work may require providing expert testimony before the Nevada Public Utility Commission. Project ongoing.

Analysis of Illinois Coal Fleet Economics

Client: Sierra Club

The Sierra Club contracted with Synapse to provide an assessment of the market viability of Edison International's Illinois coal-fired power plants. Synapse produced a report providing an initial analysis of the forward-going economics facing Edison International's merchant coal units in Illinois (known as Midwest Generation, or MWG), and addressing the reliability implications of coal retirements in the western PJM area. Project completed in 2012.

Minnesota Power Integrated Resource Plan

Client: Minnesota Center for Environmental Advocacy

The purpose of this project was to provide comments on Minnesota Power's 2010 IRP after analyzing the Company's Strategist modeling results and presenting our own modeling scenarios and results. Synapse participated in several rounds of discovery questions asked to MN Power, replicated the five modeling scenarios analyzed by the Company, performed sensitivity analysis modeling on those scenarios, and created a "Synapse Reference Case." Synapse also modeled several retirement scenarios based on the Synapse Reference Case. Project completed in 2011.

Review of comments regarding potential impacts of EPA regulations on coal-fired generation in Iowa

Client: Iowa Office of Consumer Advocate

The Iowa Utilities Board opened Docket No. NOI-2011-0003 and requested comments on the ways in which federal environmental regulations will affect coal-fired power plants in the state. Synapse assisted the Iowa OCA in reviewing comments submitted in this docket, and in preparing comments to submit to the Board. Project completed in 2011.

2011 Avoided Energy Supply Cost Study

Client: AESC 2011 Study Group (New England efficiency program administrators)

Synapse and a team of subcontractors developed projections of marginal energy supply costs that would be avoided due to reductions in electricity, natural gas and other fuels resulting from energy efficiency programs offered to customers. The report provides projections of avoided costs of electricity and natural gas by year from 2012 through 2026 with extrapolations through 2041. In addition to projecting the costs of energy and capacity avoided directly by program participants, the report provides estimates of the Demand-Reduction-Induced Price Effect ("DRIPE") of efficiency programs on wholesale market prices for electric energy and capacity. The report also provides a projection of annual externality costs associated with emissions of CO₂. The 2011 AESC Study was sponsored by a group representing all of the major electric and gas utilities in

New England as well as efficiency program administrators, energy offices and regulators. Project completed July 2011.

Integrated Resource Planning in Missouri

Client: Missouri Office of People's Counsel

Synapse assisted the OPC in reviewing and critiquing the integrated resource plan of Ameren Missouri. Synapse drafted a technical report addressing the following issues: energy efficiency potential and cost-effectiveness, renewable resource potential, costs and risks associated with new nuclear projects, the costs to existing coal plants of new environmental regulations, and proper methodologies for selecting preferred resources plans. Project completed June 2011.

Appalachian Power Company Virginia IRP

Client: Southern Environmental Law Center

On behalf of the Southern Environmental Law Center, the Chesapeake Climate Action Network, Appalachian Voices, and the Virginia Chapter of the Sierra Club, Synapse provided expert testimony regarding the 2009 integrated resource plan filed by the Appalachian Power Company. Project completed in 2010.

Review and Analysis of Delmarva Power Integrated Resource Plan

Client: Delaware Public Service Commission Staff

Synapse evaluated the Integrated Resource Plan filing of Delmarva Power and Light. Synapse reviewed the way in which the plan complied or did not comply with state directives on integrated resource planning and provision of default service supply. Synapse also provided advice to the Commission on related issues with Delaware's RFP for new generation to be long-term contracted with Delmarva. The first phase of the project was completed in 2009, and a second phase was completed in 2010. Project completed in 2010.

Evaluation of Oklahoma Gas & Electric wind power purchase agreements and associated Windspeed Transmission Project

Client: Arkansas Public Service Commission Staff

Oklahoma Gas and Electric Company acquired the OU Spirit wind facility, entered two wind energy purchase agreements and built the Windspeed transmission line to access that new wind generation. Synapse analyzed, and provided testimony on, whether the OU Spirit project and two WEPA's were in the public interest, as well as on the need for and reasonableness of the Windspeed transmission line. Testimony filed November 2010 and March 2011.

Review of Dominion Virginia Power's IRP

Client: Southern Environmental Law Center

Synapse provided expert testimony on the IRP submitted to the Virginia PUC by Dominion. Key issues included energy efficiency programs, conservation voltage reduction and supply portfolios. Project completed June 2010.

Railbelt Integrated Resource Plan

Client: Alaska Conservation Alliance

Alaska Energy Authority hired Black and Veatch (B&V) to develop an IRP for the Railbelt region of Alaska. This is the region that covers the area from roughly Fairbanks to Seward and where the bulk of Alaska's population resides. B&V's IRP evaluated the resources it believes Alaska will require over the next 50 years to meet its energy demand. Synapse developed comments for the

client that included an assessment of generation technologies (including renewables), their costs and benefits, transmission and reliability requirements, and what Alaska should consider in its resource planning. Project completed May 2010.

Review and Critique of FirstEnergy Company's Proposed SSO Procurement

Client: Ohio Office of Consumer Counsel

Synapse, as a subcontractor to Resource Insight, Inc., provided expert testimony on portfolio management alternatives to the Company's proposed declining clock auction for rolling three-year, slice of system contracts. Project completed in 2010.

Carbon Constrained Electric System Integrated Resource Plan

Client: Nova Scotia Utility and Review Board

Synapse was retained to collaborate with Nova Scotia Power on an update to its Integrated Resource Planning process. The planning was done subject to a hard cap on system carbon dioxide emissions, and other constraints. The resulting reference plan included aggressive development of wind and biomass, and rapid ramp-up of energy efficiency programs. Project completed February 2010.

Analysis of Ontario Power Authority Integrated Power System Plan

Client: Pollution Probe

This project reviewed, critiqued, and provided expert testimony on distributed generation and demand response aspects of Ontario Power Authority's proposed "Integrated Power System Plan." Project completed 2010.

Sierra Pacific Integrated Resource Planning Case

Clients: Environmental Defense, Western Resource Advocates

Synapse prepared testimony related to carbon price and escalation of construction costs for coal plants. Synapse testified before the Nevada Public Service Commission regarding our findings, and developed a report based on our testimony. Project completed September 2008.

Mississippi Integrated Resource Plan Testimony

Client: Sierra Club

The Sierra Club retained Synapse to provide testimony on the proper goals, approach, and methods for IRP preparation by Mississippi's electric utilities. Synapse provided prefiled and oral testimony on IRP, supply planning, T&D issues, energy efficiency and load control, and related topics in the Mississippi Commission's generic proceeding on resource planning. Project completed in 2008.

Integrated Resource Planning in Arkansas

Client: Arkansas Public Service Commission Staff

Synapse assisted the General Staff of the Arkansas Public Service Commission to address resource planning and power procurement issues. Synapse reviewed the filings made by each of the four investor-owned electric utilities in Arkansas for compliance. As part of this review, Synapse evaluated each utility's financial and production costing models, energy supply forecasting, demand analysis, load forecasting, and other pertinent data and issues. Project completed in June 2005.

Appendix A: Certification and Signature Page

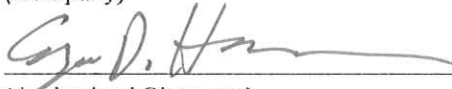
Synapse's signed and authorized Certification and Signature Page is provided on the following page.

CERTIFICATION AND SIGNATURE PAGE

By signing below, I certify that I have reviewed this Solicitation in its entirety; understand the requirements, terms and conditions, and other information contained herein; that I am submitting this bid or proposal for review and consideration; that I am authorized by the bidder to execute this bid or any documents related thereto on bidder's behalf; that I am authorized to bind the bidder in a contractual relationship; and that to the best of my knowledge, the bidder has properly registered with any State agency that may require registration.

Synapse Energy Economics, Inc.

(Company)



(Authorized Signature)

Ezra Hausman, Chief Operating Officer

(Representative Name, Title)

617-661-3248

(Phone Number)

617-661-0599

(Fax Number)

February 13, 2013

(Date)

Appendix B: Addendum Acknowledgement Form

The Addendum Acknowledgement Form provided on the following page serves to acknowledge Synapse's receipt of all addenda issued with Solicitation No. PSC13533.

ADDENDUM ACKNOWLEDGEMENT FORM

SOLICITATION NO.: PSC13533

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:

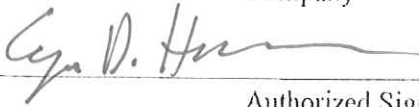
(Check the box next to each addendum received)

- | | |
|---|--|
| <input type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6 |
| <input type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7 |
| <input type="checkbox"/> Addendum No. 3 | <input type="checkbox"/> Addendum No. 8 |
| <input type="checkbox"/> Addendum No. 4 | <input type="checkbox"/> Addendum No. 9 |
| <input type="checkbox"/> Addendum No. 5 | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Synapse Energy Economics, Inc.

Company



Authorized Signature

February 13, 2013

Date

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.

Appendix C: Purchasing Affidavit

The Purchasing Affidavit provided on the following page serves to certify that neither Synapse nor a related party owe a debt to the State of West Virginia in excess of \$1,000.

STATE OF WEST VIRGINIA
Purchasing Division
PURCHASING AFFIDAVIT

West Virginia Code §5A-3-10a states: No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owed is an amount greater than one thousand dollars in the aggregate.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.


"Debtor" means any individual, corporation, partnership, association, limited liability company or any other form or business association owing a debt to the state or any of its political subdivisions. "Political subdivision" means any county commission; municipality; county board of education; any instrumentality established by a county or municipality; any separate corporation or instrumentality established by one or more counties or municipalities, as permitted by law; or any public body charged by law with the performance of a government function or whose jurisdiction is coextensive with one or more counties or municipalities. "Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceeds five percent of the total contract amount.

EXCEPTION: The prohibition of this section does not apply where a vendor has contested any tax administered pursuant to chapter eleven of this code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

Under penalty of law for false swearing (*West Virginia Code §61-5-3*), it is hereby certified that the vendor affirms and acknowledges the information in this affidavit and is in compliance with the requirements as stated.

WITNESS THE FOLLOWING SIGNATURE

Vendor's Name: Synapse Energy Economics, Inc.

Authorized Signature:  Date: February 11, 2103

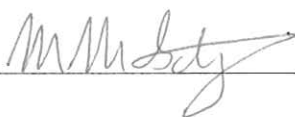
State of Massachusetts

County of Middlesex, to-wit:

Taken, subscribed, and sworn to before me this 11 day of February, 2013.

My Commission expires July 27, 2018.

AFFIX SEAL. HERE

NOTARY PUBLIC 



MELISSA SCHULTZ
Notary Public
Commonwealth of Massachusetts
My Commission Expires
July 27, 2018

Appendix D: Project Team Resumes

On the following pages we provide resumes for Synapse's project team: Jeremy Fisher, Rachel Wilson, Rick Hornby, Tyler Comings, and Patrick Knight.

Jeremy Fisher, Ph.D.

Scientist

Synapse Energy Economics, Inc.

485 Massachusetts Ave., Suite 2, Cambridge, MA 02139

(617) 453-7045 • fax: (617)-661-0599

jfisher@synapse-energy.com

www.synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Cambridge MA. Scientist, 2007-present

Consulting on economic analysis of climate change and energy, carbon, and emissions policies. Quantitative evaluations of regional climate change impact, energy efficiency programs, long- and short-term electric industry planning, carbon reduction planning, and emissions compliance programs.

Tulane University, Ecology and Evolutionary Biology. Postdoctoral Research Scientist, 2006-2007

Determining Hurricane Katrina's impact on Gulf Coast ecosystems using satellite and field data.

University of New Hampshire, Earth, Oceans, and Space. Postdoctoral Research Scientist, 2006-2007

Organizing team synthesis review of causes and rates of natural rainforest loss in the Amazon basin.

Brown University, Watson Institute for International Studies. Visiting Fellow, 2007-2008.

Designing study to examine migratory bird response to climate variability in the Middle East.

Brown University, Department of Geological Sciences. Research Assistant, 2001-2006

Tracking impact of climate change on New England forests from satellites. Working with West African communities to determine impact of climate change and practice on landscape. Modeling coastal power plant effluent from satellite data.

EDUCATION

Brown University, Ph.D. in Geological Sciences, 2006

Brown University, M.S. in Geological Sciences, 2003

University of Maryland, College Park, B.S. in Geography and Geology, 2003

FELLOWSHIPS & AWARDS

2007 Visiting Fellow, Watson Institute for International Studies, Brown University

2007 Finalist, Congressional Fellowship, American Institute of Physics and Geological Society of America

2003 Fellow, National Science Foundation East Asia Summer Institute (EASI)

2003 Fellow, Henry Luce Foundation at the Watson Institute for International Studies, Brown University

TESTIMONY

Oregon Public Utility Commission. *In the Matter of PacifiCorp's Filing of Revised Tariff Schedules for Electric Service in Oregon*. Direct Testimony of Jeremy Fisher, PhD. On Behalf of Sierra Club. June 20, 2012. Docket UE 246

Kentucky Public Service Commission. *Application of Kentucky Power Company for Approval of its 2011 Environmental Compliance Plan, for Approval of its Amended Environmental Cost Recovery Surcharge Tariff, and for the Granting of a Certificate of Public Convenience And Necessity for the Construction and Acquisition of Related Facilities*. Direct Testimony of Jeremy Fisher, PhD. On Behalf of Sierra Club. March 12, 2012. Docket 2011-00401

Kentucky Public Service Commission. *The Application of Kentucky Utilities / Louisville Gas and Electric Company for Certificates of Public Convenience and Necessity and Approval of its 2011 Compliance Plan for Recovery by Environmental Surcharge*. Direct Testimony of Jeremy Fisher, PhD. On Behalf of Sierra Club and Natural Resources Defense Council. September 16, 2011. Dockets 2011-00161 / 2011-00162

Kansas Corporation Commission. *In the Matter of the Petition of Kansas City Power & Light Company ("KCP&L") for Determination of the Ratemaking Principles and Treatment that will Apply to the Recovery in Rates of the Cost to be Incurred by KCP&L for Certain Electric Generating Facilities Under K.S.A. 66-1239*. Direct Testimony of Jeremy Fisher, PhD. On Behalf of Sierra Club. June 3, 2011. Docket 11-KCPE-581-PRE.

Utah Public Service Commission. *In the Matter of the Application of Rocky Mountain Power for Authority to Increase its Retail Electric Utility Service Rates in Utah and Approval of its Proposed Electric Service Schedules and Electric Service Regulations*. Direct Testimony of Jeremy Fisher, PhD. On Behalf of Sierra Club. May 26, 2011. Docket 10-035-124.

Wyoming Public Service Commission. *In the Matter of the Application of Rocky Mountain Power for Authority to Increase its Retail Electric Utility Rates in Wyoming Approximately \$97.9 Million per Year or an Average Overall Increase of 17.3 Percent*. Direct Testimony of Jeremy Fisher, PhD. On Behalf of Powder River Basin Resource Council. April 11, 2011. Docket 20000-384-ER-10.

WHITE PAPERS

Fisher, J.I., K. Takahashi. 2012. *TVA Coal in Crisis: Using Energy Efficiency to Replace TVA's Highly Non-Economic Coal Units*. Whitepaper. Synapse Energy Economics.

Fisher, J.I., S. Jackson, B. Biewald. 2012. *The Carbon Footprint of Electricity from Biomass: A Review of the Current State of Science and Policy*. Whitepaper. Synapse Energy Economics.

Fisher, J.I., C. James, N. Hughes, D. White, R. Wilson, B. Biewald. 2011. *Emissions Reductions from Renewable Energy and Energy Efficiency in California Air Quality Management Districts. Prepared for the California Energy Commission Public Interest Research (PIER) Program*. Synapse Energy Economics

Fisher, J.I., F. Ackerman. 2011. *The Water-Energy Nexus in the Western States: Projections to 2100*. Prepared for the Stockholm Environment Institute. Synapse Energy Economics.

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- Averyt, K., **J.I. Fisher**, A. Huber-Lee, A. Lewis, J. Macknick, N. Madden, J. Rogers, S. Tellinghuisen. 2011. *Freshwater use by U.S. power plants: Electricity's thirst for a precious resource*. A report of the Energy and Water in a Warming World initiative. Cambridge, MA: Union of Concerned Scientists. November.
- White, D., D. Hurley, **J.I. Fisher**. 2011. *Economic Analysis of Schiller Station Coal Units*. Prepared for Conservation Law Foundation. Synapse Energy Economics.
- Fisher, J.I.**, R. Wilson, N. Hughes, M. Wittenstein, B. Biewald. 2011. *Benefits of Beyond BAU: Human, Social, and Environmental Damages Avoided through the Retirement of the U.S. Coal Fleet*. Prepared for Civil Society Institute. Synapse Energy Economics.
- Fisher, J.I.**, B. Biewald. 2011. *Environmental Controls and the WECC Coal Fleet: Estimating the forward-going economic merit of coal-fired power plants in the West with new environmental controls*. Synapse Energy Economics
- Hausman, E.D., V. Sabodash, N. Hughes, **J.I. Fisher**. 2011. *Economic Impact Analysis of New Mexico's Greenhouse Gas Emissions Rule*. Prepared for New Energy Economy. Synapse Energy Economics
- Fisher, J.I.**, F. Ackerman. 2011. *The Water-Energy Nexus in the Western States: Projections to 2100*. Prepared for Stockholm Environment Institute. Synapse Energy Economics
- Fisher, J.I.**, 2011. *A Green Future for Los Angeles Department of Water and Power: Phasing out Coal in LA by 2020*. Prepared for Sierra Club.
- Fisher, J.I.**, J. Levy, Y. Nishioka, P. Kirshen, R. Wilson, M. Chang, J. Kallay, C. James. 2010. *Co-Benefits of Energy Efficiency and Renewable Energy in Utah: Air Quality, Health and Water Benefits*. Prepared for State of Utah Energy Office. Synapse Energy Economics, Harvard School of Public Health, Tufts University.
- Hausman, E.D., **J.I. Fisher**, L.A. Mancinelli, B. Biewald. 2009. *Productive and Unproductive Costs of CO₂ Cap-and-Trade: Impacts on Electricity Consumers and Producers*. Prepared for the National Association of Regulatory Utility Commissioners, The National Association of State Utility Consumer Advocates (NASUCA), The National Rural Electric Cooperative Association (NRECA), The American Public Power Association (APPA). Synapse Energy Economics.
- Biewald, B., **J.I. Fisher**, C. James, L. Johnston, D. Schlissel, R. Wilson. 2009. *Energy Future: A Green Energy Alternative for Michigan*. Prepared for Sierra Club. Synapse Energy Economics.
- James, C., **J.I. Fisher**, K. Takahashi. 2009. *Alaska Climate Change Strategy's Mitigation Advisory Group Final Report: Greenhouse Gas Inventory and Forecast and Policy Recommendations Addressing Greenhouse Gas Reduction in Alaska. Energy Supply and Demand Sectors*. Submitted to the Alaska Climate Change Sub-Cabinet.
- James, C., **J.I. Fisher**, K. Takahashi, B. Warfield. 2009. *No Need to Wait: Using Energy Efficiency and Offsets to Meet Early Electric Sector Greenhouse Gas Targets*. Prepared for Environmental Defense Fund. Synapse Energy Economics
- James, C., **J.I. Fisher**. 2008 *Reducing Emissions in Connecticut on High Electric Demand Days (HEDD)*. Prepared for the CT Department of Environmental Protection and the US Environmental Protection Agency. Synapse Energy Economics.

Hausman, E.D., **J.I. Fisher**, B. Biewald. **2008** *Analysis of Indirect Emissions Benefits of Wind, Landfill Gas, and Municipal Solid Waste Generation*. Prepared for US. Environmental Protection Agency. Synapse Energy Economics.

Schlissel, D., **J.I. Fisher**. **2008** *A preliminary analysis of the relationship between CO₂ emission allowance prices and the price of natural gas*. Prepared for the Energy Foundation. Synapse Energy Economics.

Fisher, J.I., B. Biewald. **2008** Costly Changes to the Energy Sector. in F. Ackerman and E.A. Stanton. *The Cost of Climate Change*. National Resources Defense Council.

Fisher, J.I., B. Biewald. **2007** Electricity Sector. in E.A. Stanton and F. Ackerman. *Florida and Climate Change: The Costs of Inaction*. Tufts University.

PEER-REVIEWED PUBLICATIONS

Morisette, J. T., A. D. Richardson, A. K. Knapp, **J.I. Fisher**, E. Graham, J. Abatzoglou, B.E. Wilson, D. D. Breshears, G. M. Henebry, J. M. Hanes, and L. Liang. **2009**. "Tracking the rhythm of the seasons in the face of global change: Challenges and opportunities for phenological research in the 21st Century." In Press at *Frontiers in Ecology*.

Fisher, J.I., G.C. Hurtt, J.Q. Chambers, Q. Thomas. **2008** "Clustered disturbances lead to bias in large-scale estimates based on forest sample plots." *Ecology Letters*. 11:6:554-563.

Chambers, J.Q., **J.I. Fisher**, H. Zeng, E.L. Chapman, D.B. Baker, and G.C. Hurtt. **2007** "Hurricane Katrina's Carbon Footprint on U.S. Gulf Coast Forests." *Science*. 318:1107

Fisher, J.I., A.D. Richardson, and J.F. Mustard. **2007** "Phenology model from surface meteorology does not capture satellite-based greenup estimations." *Global Change Biology* 13:707-721

Fisher, J.I., J.F. Mustard. **2007** "Cross-scalar satellite phenology from ground, Landsat, and MODIS data." *Remote Sensing of Environment* 109:261-273

Fisher, J.I., J.F. Mustard, and M. Vadeboncoeur. **2006** "Green leaf phenology at Landsat resolution: Scaling from the field to the satellite." *Remote Sensing of Environment*. 100:2:265-279

Fisher, J.I., J.F. Mustard. **2004** "High spatial resolution sea surface climatology from Landsat thermal infrared data." *Remote Sensing of Environment*. 90:293-307.

Fisher, J.I., J. F. Mustard, and P. Sanou. **2004** "Policy imprints in Sudanian forests: Trajectories of vegetation change under land management practices in West Africa." *Submitted, International J. Remote Sensing*

Fisher, J.I., S.J. Goetz. **2001** "Considerations in the use of high spatial resolution imagery: an applications research assessment." *American Society for Photogrammetry and Remote Sensing (ASPRS) Conference Proceedings*, St. Louis, MO.

SELECTED ABSTRACTS

Fisher, J.I., "Phenological indicators of forest composition in northern deciduous forests." *American Geophysical Union*. San Francisco, CA. December 2007.

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- Fisher, J.I.**, A.D. Richardson, and J.F. Mustard. "Phenology model from weather station meteorology does not predict satellite-based onset." *American Geophysical Union*. San Francisco, CA. December 2006.
- Chambers, J., **J.I. Fisher**, G Hurtt, T. Baker, P. Camargo, R. Campanella, *et al.*, "Charting the Impacts of Disturbance on Biomass Accumulation in Old-Growth Amazon Forests." *American Geophysical Union*. San Francisco, CA. December 2006.
- Fisher, J.I.**, A.D. Richardson, and J.F. Mustard. "Phenology model from surface meteorology does not capture satellite-based greenup estimations." *American Geophysical Union. Eos Trans.* 87(52). San Francisco, CA. December 2006.
- Fisher, J.I.**, J.F. Mustard, and M. Vadeboncoeur. "Green leaf phenology at Landsat resolution: scaling from the plot to satellite." *American Geophysical Union. Eos Trans.* 86(52). San Francisco, CA. December 2005.
- Fisher, J.I.**, J.F. Mustard. "Riparian forest loss and landscape-scale change in Sudanian West Africa." *Ecological Association of America*. Portland, Oregon. August 2004.
- Fisher, J.I.**, J.F. Mustard. "High spatial resolution sea surface climatology from Landsat thermal infrared data." *American Society for Photogrammetry and Remote Sensing (ASPRS) New England Region Technical Meeting*. Kingston, Rhode Island. November, 2004.
- Fisher, J.I.**, J.F. Mustard, and P. Sanou. "Trajectories of vegetation change under controlled land-use in Sudanian West Africa." *American Geophysical Union. Eos Trans.* 85(47). San Francisco, CA. December 2004.
- Fisher, J.I.**, J.F. Mustard. "Constructing a climatology of Narragansett Bay surface temperature with satellite thermal imagery." *The Rhode Island Natural History Survey Conference*. Cranston, RI. March, 2003.
- Fisher, J.I.**, J.F. Mustard. "Constructing a high resolution sea surface climatology of Southern New England using satellite thermal imagery." *New England Estuarine Research Society*. Fairhaven, MA. May, 2003.
- Fisher, J.I.**, J.F. Mustard. "High spatial resolution sea surface climatology from Landsat thermal infrared data." *Ecological Society of America Conference*. Savannah, GA. August, 2003.
- Fisher, J.I.**, S.J. Goetz. "Considerations in the use of high spatial resolution imagery: an applications research assessment." *American Society for Photogrammetry and Remote Sensing (ASPRS) Conference Proceedings*, St. Louis, MO. March, 2001.

SEMINARS AND PRESENTATIONS

- Fisher, J.I.**, "Emissions Reductions from Renewable Energy and Energy Efficiency in California Air Districts for EPA State Climate and Energy Program." June 14, 2011.
- Fisher, J.I.**, B. Biewald, "WECC Coal Plant Retirement Based On Forward-Going Economic Merit." Presentation for Western Grid Group. WECC, January 10, 2011.
- Fisher, J.I.**, "Protecting Electricity and Water Consumers in a Water-Constrained World." National Association of State Utility Consumer Advocates. November 16, 2010.
- James, C., **J.I. Fisher**, D. White, and N. Hughes, "Quantifying Criteria Emissions Reductions in CA from Efficiency and Renewables." CEC / PIER Air Quality Webinar Series. October 12, 2010.

Fisher, J.I., “Climate Change, Water, and Risk in Electricity Planning.” National Association of Regulatory Utility Commissioners (NARUC), Portland, OR. July 22, 2008.

Fisher, J.I., E. Hausman, and C. James, “Emissions Behavior in the Northeast from the EPA Acid Rain Monitoring Dataset.” Northeast States for Coordinated Air Use Management (NESCAUM), Boston, MA. January 30, 2008.

Fisher, J.I., J.F. Mustard, and M. Vadeboncoeur, “Climate and phenological variability from satellite data. Ecology and Evolutionary Biology,” Tulane University. March 24, 2006.

Fisher, J.I., J.F. Mustard, and M. Vadeboncoeur, “Anthropogenic and climatic influences on green leaf phenology: new observations from Landsat data.” Ecosystems Center at the Marine Biological Laboratory. Woods Hole, MA. Seminar, September 27, 2005.

Fisher, J.I., J.F. Mustard, “High resolution phenological modeling in Southern New England.” Woods Hole Research Center. Woods Hole, MA. Seminar, March 16, 2005.

Dated September 2012

Rachel Wilson

Associate

Synapse Energy Economics

485 Massachusetts Ave., Suite 2, Cambridge, MA 02139

(617) 453-7044 • fax: (617) 661-0599

www.synapse-energy.com

rwilson@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. Associate, 2010 – present, Research Associate, 2008 – 2010.

- Performs consulting, conducts research, and assists in writing testimony and reports on a wide range of issues relating to electric utilities, including: federal and state clean air policies; emissions from electricity generation; environmental compliance technologies, strategies, and costs; integrated resource planning; valuation of environmental externalities from power plants; and the nexus between water and energy.
- Uses optimization and electricity dispatch models, including Strategist, PROMOD, PROSYM/Market Analytics, and PLEXOS to conduct analyses of utility service territories and regional energy markets.

Analysis Group, Inc., Boston, MA. Associate, Energy Practice, 2007 - 2008.

- Supported an expert witness asked to opine on various topics in the electric industry as they applied to merchant generators and provided incentives for their behavior in the late 1990s and early 2000s.
- Analyzed data related to coal production on Indian land and contractual royalties paid to the tribe over a 25 year period to determine if discrepancies exist between these values for the purposes of potential litigation.
- Examined Canadian policies relating to carbon dioxide, and assisted with research on linkage of international tradable permit systems.
- Managed analysts' work processes and evaluated work products.

Senior Analyst Intern, Energy Practice, 2006 - 2007.

- Supported an expert witness in litigation involving whether a defendant power company could financially absorb a greater investment in pollution control under its debt structure while still offering competitive rates. Analyzed impacts of federal and state clean air laws on energy generators and providers. Built a quantitative model showing the costs of these clean air policies to the defendant over a 30 year period. Built a financial model calculating impacts of various pollution control investment requirements.
- Researched the economics of art; assisted in damage calculations in arbitration between an artist and his publisher.

Yale Center for Environmental Law and Policy, New Haven, CT. Research Assistant, 2005 – 2007.

-
- Gathered and managed data for the Environmental Performance Index, presented at the 2006 World Economic Forum. Interpreted statistical output, wrote critical analyses of results, and edited report drafts.
 - Part of the team that produced *Green to Gold*, an award-winning book on corporate environmental management and strategy. Managed data, conducted research, and implemented marketing strategy.

CERES, Boston, MA. Student Consultant, Spring 2006.

- As part of a four-person team, made strategic recommendations on all aspects of messaging and engagement to encourage corporate directors to act on the issue of climate change. First strategic recommendation was sustainable governance forums, which were profiled in New York Times article “Global Warming Subject for Directors at Big Companies” on September 21, 2006.

Marsh Risk and Insurance Services, Inc., Los Angeles, CA. Risk Analyst, Casualty Department, 2003 – 2005.

- Evaluated Fortune 500 clients’ risk management programs/requirements and formulated strategic plans and recommendations for customized risk solutions.
- Supported the placement of \$2 million in insurance premiums in the first year and \$3 million in the second year.
- Utilized quantitative models to create loss forecasts, cash flow analyses and benchmarking reports.
- Completed a year-long Graduate Training Program in risk management; ranked #1 in the western region of the US and shared #1 national ranking in a class of 200 young professionals.

EDUCATION

Yale School of Forestry & Environmental Studies, Master of Environmental Management, New Haven, Connecticut, 2007.

Concentration in Law, Economics, and Policy with a focus on energy issues and markets.

Claremont McKenna College, Bachelor of Arts in Environment, Economics, Politics (EEP) Claremont, California, 2003.

cum laude and EEP departmental honors.

School for International Training Quito, Ecuador. Spring 2002.

Semester abroad studying Comparative Ecology. Microfinance Intern – Viviendas del Hogar de Cristo in Guayaquil, Ecuador.

SKILLS AND ACCOMPLISHMENTS

Microsoft Office Suite, Lexis-Nexis, Platts Energy Database, Strategist, PROMOD, PROSYM/Market Analytics, and PLEXOS, some SAS and STATA.

Competent in oral and written Spanish.

Hold the Associate in Risk Management (ARM) professional designation.

PUBLICATIONS AND PRESENTATIONS

Wilson R., P. Luckow, B. Biewald, F. Ackerman, E.D. Hausman, *2012 Carbon Dioxide Price Forecast*. Synapse Energy Economics, October 2012.

Hornby R., R. Fagan, D. White, J. Rosenkranz, P. Knight, R. Wilson, *Potential Impacts of Replacing Retiring Coal Capacity in the Midwest Independent System Operator (MISO) Region with Natural Gas or Wind Capacity*. Synapse Energy Economics for the Iowa Utilities Board. September 2012.

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

Wilson R., *Comments Regarding MidAmerican Energy Company Filing on Coal-Fired Generation in Iowa*. Synapse Energy Economics for the Iowa Office of the Consumer Advocate. December 2011.

Johnston L., R. Wilson, *Global Best Practices: Strategies for Decarbonizing Electric Power Supply*. Synapse Energy Economics for Regulatory Assistance Project (RAP). December 2011.

Hausman E., T. Comings, R. Wilson, and D. White, *Electricity Scenario Analysis for the Vermont Comprehensive Energy Plan 2011*. Synapse Energy Economics for the Vermont Department of Public Service. September 2011.

Hornby R., P. Chernick, C. Swanson, D. White, J. Gifford, M. Chang, N. Hughes, M. Wittenstein, R. Wilson, B. Biewald, *Avoided Energy Supply Costs in New England: 2011 Report*. Synapse Energy Economics for the Avoided-Energy-Supply-Component (AESC) Study Group, July 2011.

Wilson R., P. Peterson, *A Brief Survey of State Integrated Resource Planning Rules and Requirements*. Synapse Energy Economics for the American Clean Skies Foundation, April 2011.

Johnston L., E. Hausman., B. Biewald, R. Wilson, D. White, *2011 Carbon Dioxide Price Forecast*. Synapse Energy Economics, February 2011.

Fisher J., R. Wilson, N. Hughes, M. Wittenstein, B. Biewald, *Benefits of Beyond BAU: Human, Social, and Environmental Damages Avoided Through the Retirement of the US Coal Fleet*. Synapse Energy Economics for the Civil Society Institute, January 2011.

Peterson P., V. Sabodash, R. Wilson, D. Hurley, *Public Policy Impacts on Transmission Planning*. Synapse Energy Economics for Earthjustice, December 2010.

Fisher J., S. Levy, Y. Nishioka, P. Kirshen, R. Wilson, M. Chang, J. Kallay, C. James, *Co-Benefits of Energy Efficiency and Renewable Energy in Utah*. Synapse Energy Economics for the State Energy Office of Utah, March 2010.

Wilson R., *The Energy-Water Nexus: Interactions, Challenges, and Policy Solutions*. Synapse Energy Economics presented at the National Drinking Water Symposium 2009, October 2009.

Fisher J., C. James, L. Johnston, D. Schlissel, R. Wilson, *Energy Future: A Green Alternative for Michigan*. Synapse Energy Economics for Natural Resources Defense Council and Energy Foundation, August 2009.

Schlissel, D., R. Wilson, L. Johnston, D. White, *An Assessment of Santee Cooper's 2008 Resource Planning*. Synapse Energy Economics for the Rockefeller Family Fund, April 2009.

Schlissel, D., A. Smith, R. Wilson, *Coal-Fired Power Plant Construction Costs*. Synapse Energy Economics, July 2008.

TESTIMONY

State of Indiana, Indiana Utility Regulatory Commission, Direct testimony Regarding Duke Energy Indiana's Certificates of Public Convenience and Necessity on behalf of Citizens Action Coalition, Sierra Club, Save the Valley, and Valley Watch, November 29, 2012

Kentucky Public Service Commission. Direct testimony before the Commission on behalf of the Sierra Club. July 23, 2012

Kentucky Public Service Commission. Direct testimony before the Commission on behalf of the Sierra Club. Testimony included discussion of STRATEGIST modeling relating to the application of Kentucky Power Company for a Certificate of Public Convenience and Necessity, and for approval of its 2011 environmental compliance plan and amended environmental cost recovery surcharge. March 12, 2012.

Kentucky Public Service Commission. Direct testimony before the Commission on behalf of Sierra Club and Natural Resources Defense Council. Testimony included discussion of STRATEGIST modeling relating to the applications of Kentucky Utilities Company, and Louisville Gas and Electric Company for Certificates of Public Convenience and Necessity, and approval of its 2011 compliance plan for recovery by environmental surcharge. September 16, 2011.

Minnesota Public Utilities Commission. Rebuttal testimony before the Commission on behalf of Izaak Walton League of America, Fresh Energy, Sierra Club, and Minnesota Center for Environmental Advocacy. Testimony described STRATEGIST modeling performed in the docket considering Otter Tail Power's application for an Advanced Determination of Prudence for BART retrofits at its Big Stone plant. September 7, 2011.

Resume dated October 2012.

James Richard Hornby

Senior Consultant

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA.

Senior Consultant, 2006 to present.

Provides analysis and expert testimony regarding planning, market structure, ratemaking and supply contracting issues in the electricity and natural gas industries. Planning cases include evaluation of resource options for meeting tighter air emission standards (e.g. retrofit vs. retire coal units) in Kentucky, West Virginia and U.S. Midwest as well as development of long-term projections of avoided costs of electricity and natural gas in New England. Ratemaking cases include electric utility load retention rate in NS, various gas utility rate cases and evaluation of proposals for advanced metering infrastructure (smart grid or AMI) and dynamic pricing in MD, PA, NJ, AR, ME, NV, DC and IL.

Charles River Associates (formerly Tabors Caramanis & Associates), Cambridge, MA.

Principal, 2004-2006, *Senior Consultant*, 1998-2004.

Expert testimony and litigation support in energy contract price arbitration proceedings and various ratemaking proceedings. Productivity improvement project for electric distribution companies in Abu Dhabi. Analyzed market structure and contracting issues in wholesale electricity markets.

Tellus Institute, Boston, MA.

Vice President and Director of Energy Group, 1997-1998.

Manager of Natural Gas Program, 1986-1997.

Presented expert testimony on rates for unbundled retail services, analyzed the options for purchasing electricity and gas in deregulated markets, prepared testimony and reports on a range of gas industry issues including market structure, strategic planning, market analyses, and supply planning.

Nova Scotia Department of Mines and Energy, Halifax, Canada.

Member, Canada-Nova Scotia Offshore Oil and Gas Board, 1983-1986.

Assistant Deputy Minister of Energy 1983-1986.

Director of Energy Resources 1982-1983

Assistant to the Deputy Minister 1981-1982

Nova Scotia Research Foundation, Dartmouth, Canada, *Consultant*, 1978-1981.

Canadian Keyes Fibre, Hantsport, Canada, *Project Engineer*, 1975-1977.

Imperial Group Limited, Bristol, England, *Management Consultant*, 1973-1975.

EDUCATION

M.S., Technology and Policy (Energy), Massachusetts Institute of Technology, 1979.

B.Eng., Industrial Engineering (with Distinction), Dalhousie University, Canada, 1973

TESTIMONY

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Kentucky	Kentucky Power Company	2011-00401	March 2012	CPCN for Big Sandy Unit 2
Nova Scotia	Heritage Gas	NG-HG-R-11	September 2011 and May 2012	Cost allocation and rate design
Arkansas	Oklahoma Gas & Electric	10-109-U	May 2011 and June 2011	Advanced metering infrastructure (AMI)
Texas	Texas-New Mexico Power	PUC 38306	April 2011	Advanced metering infrastructure (AMI)
Arkansas	Oklahoma Gas & Electric	10-067-U	March 2011	Windspeed transmission line
Pennsylvania	PECO Energy	M-2009-2123944	December 2010 and January 2011	Dynamic Pricing
Arkansas	Oklahoma Gas & Electric	10-073-U	November 2010	Wind power purchase agreement
Indiana	Vectren Energy Delivery of Indiana	Cause No. 43839	July 2010	Sales Reconciliation Adjustment

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Alaska	Enstar Natural Gas	U-09-069 and U-09-070	March 2010	Rate Design
Pennsylvania	Allegheny Power	M-2009-2123951	March 2010 and October 2009.	Smart meters / advanced metering infrastructure (AMI)
Massachusetts	All Massachusetts regulated electric and gas utilities	D.P.U. 09-125 et al.	December 2009	Avoided Energy Supply Costs in New England
Pennsylvania	Metropolitan Edison Company	M-2009-2123950	October 2009.	Smart meters / AMI
Maryland	Potomac Electric Power	No. 9207	October 2009 and July 2011.	Smart meters / AMI
Maryland	Baltimore Gas and Electric	No. 9208	October 2009 and July 2010.	Smart meters / AMI
New Jersey	Jersey Central Power & Light	EO08050326 and EO08080542	July 2009	Demand response programs
Minnesota	CenterPoint Energy	G-008/GR-08-1075	June 2009.	Conservation Enabling Rider

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
South Carolina	Progress Energy Carolinas	2008-251-E	January 2009.	Compensation for efficiency programs
North Carolina	Progress Energy Carolinas	No. E-2 sub 931	December 2008.	Compensation for efficiency programs
Maine	Central Maine Power	2007 – 215	October 2008.	Smart meters / AMI
North Carolina	Duke Energy Carolinas	E-7 Sub 831	June 2008	Compensation for efficiency programs (save-a-watt)
Indiana	Duke Energy Indiana	No. 43374	May 2008.	Compensation for efficiency programs (save-a-watt)
Pennsylvania	PECO Energy Company	P-2008-2032333	June 2008.	Residential Real Time Pricing pilot
Arkansas	Entergy Arkansas	06-152-U Phase II A	October 2007	Interim tolling agreement and proposed allocation of Ouachita Power capacity
Washington	Avista Utilities	UE-070804 and UG-070805	September 2007.	Cost allocation, rate design
Arkansas	Entergy Arkansas	06-152-U	January 2007.	Need for load-following capacity
Michigan	Consumers Energy Company	U-14992	December 2006.	Proposed sale of Palisades nuclear plant and associated power purchase

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Connecticut	Connecticut Natural Gas Corporation	06-03-04PH01	November 2006.	Gas supply strategy and proposed rate recovery
Michigan	Consumers Energy Company	U-14274-R	October 2006.	Purchases from Midland Cogeneration Venture Limited Partnership
Illinois	WPS Resources and Peoples Energy Corporation	Docket No. 06-0540	October and December 2006.	Service quality metrics and benchmarks
Arizona	Arizona Public Service	E-01345A-05-0816	August 2006 and September 2006.	Hedging strategy and base fuel recovery amount
Ontario	Transalta Energy Corporation versus Bayer Inc.	Private arbitration	January 2006.	Price for steam under a 20-year contract
Nova Scotia	Nova Scotia Power vs Shell	Private arbitration	October 2005.	New natural gas price under a 10-year supply contract
New York	Consolidated Edison of New York, New York State Electric and Gas	Case 00-M-0504	September and October 2002.	Rates for unbundled supply, distribution, metering and billing services

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
New Jersey	Public Service Electric and Gas	BPU Docket GM00080564	April 2001.	Proposed transfer of gas contracts to an unregulated affiliate and supply contract associated with that transfer.
Nova Scotia	Sempra	NSUARB-NG- SEMPRA-SEM-00-08	February 2001.	Proposed distribution service tariff rates including market-based rates
New Jersey	Generic proceeding	BPU Docket EX99009676	March 2000.	Design and pricing of unbundled customer account services
United States of America	Bonneville Power Administration	BPA Docket WP-02	November 1999.	Functionalization of communication plant
South Carolina	South Carolina Electric and Gas	99-006-G	October 1999.	Purchased gas costs
New Jersey	Public Service Electric & Gas, South Jersey Gas, New Jersey Natural Gas and Elizabethtown Gas	GO99030122– GO99030125	July and September 1999.	Service unbundling policies and rates

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Maine	Northern Utilities Inc.	Docket 97-393	September and December 1998.	Rate redesign and partial unbundling
Pennsylvania	Peoples Natural Gas	R-00984281; A-12250F0008	May 1998.	Purchased gas costs and proposal to transfer production assets to affiliate
New Jersey	Rockland Electric Company	BPU E09707 0465 OAL PUC-7309-97 BPU E09707 0464 OAL PUC-7310-97	January and March 1998.	Rate unbundling
New Jersey	Jersey Central Power & Light d/b/a GPU Energy.	BPU EO9707 0459 OAL PUC- 7308-97 BPU E09707 0458 OAL PUC-7307-97	November 1997.	Rate unbundling
Pennsylvania	Equitable Gas Company	R-00963858	June and July 1997.	Rate structure proposals
Pennsylvania	Peoples Natural Gas Company	R-00973896 and A-0012250F-0007	May 1997.	Purchased gas costs, proposal to transfer producing assets to CNG Producing Company and proposed Migration Rider

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
South Carolina	South Carolina Pipeline Corporation	97-009-G	April 1997.	Reasonableness of proposal to acquire additional pipeline capacity
FERC	Transcontinental Gas Pipeline	RP95-197-001; RP97-71-000	March 1997.	Review of proposed rolled-in ratemaking for Leidy Line incremental facilities
Arkansas	Arkla	95-401-U	September 1996.	Gas purchasing and transportation plan
Maine	Northern Utilities Inc. and Granite State Gas Transmission	95-480; 95-481	April 1996	Precedent Agreement for LNG Storage Service and PNGTS Transportation Service
Rhode Island	ProvGas	2025	November 1995	Settlement Agreement
Pennsylvania	T.W. Phillips Gas and Oil	R-953406	October 1995	Cost allocation, rate design
Illinois	Northern Illinois Gas	95-0219	August 1995	Cost allocation, rate design
Pennsylvania	Columbia Gas of Pennsylvania	R-953316	May 1995	Purchased gas costs
Pennsylvania	Peoples Natural Gas	R-943252	May 1995	Cost allocation, rate design

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
South Carolina	South Carolina Pipeline Corporation.	94-007-G	April 1995	1994 purchased gas costs
Pennsylvania	National Fuel Gas Distribution Corp	R-943207	March 1995	1995 Purchased Gas Adjustment filing
Pennsylvania	UGI Utilities	R-00943063	December 1994	FERC Order 636 transition cost tariff
South Carolina	South Carolina Electric and Gas Co.	94-008-G	October 1994	1994 Purchased Gas Adjustment
Oklahoma	Public Service of Oklahoma	PUD 920 001342	September and November 1994	Gas supply strategy, transportation and agency services and rate mechanism
Pennsylvania	Pennsylvania Gas and Water	R-943078	September 1994	Market Sensitive Sales Service
Massachusetts	Generic proceeding	D.P.U. 93-141-A	September 1994	Policies on interruptible transportation and capacity release
Hawaii	HELCO	7259	August 1994	DSM programs for competitive energy end-use markets, multi-attribute analysis

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Pennsylvania	Pennsylvania Gas and Water	R-00943066	July 1994	1994 Purchased Gas Adjustment
Pennsylvania	Pennsylvania Gas and Water	R-942993; R-942993 C0001-C0004	May 1994	Take-or-Pay Cost Recovery
Pennsylvania	Columbia Gas of Pennsylvania	R-943001	May 1994	Cost allocation, rate design
Pennsylvania	Columbia Gas of Pennsylvania	R-943029	May 1994	1994 Purchased Gas Adjustment; Negotiated Sales Service
Pennsylvania	Peoples Natural Gas	R-932866; R-932915	March 1994	Cost allocation, rate design
Kansas	Generic proceeding	180; 056-U	February 1994	IRP rules for gas utilities
Arizona	Citizens Utility Company Arizona Gas Division	E-1032-93-111	December 1993	Cost allocation, rate design
Hawaii	HECO	7257	December 1993	Residential sector water heating program
Hawaii	GASCO	7261	September 1993	IRP

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI -P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Pennsylvania	Pennsylvania Gas and Water	R-932655; R-932655 C001; R-932655 C002	September 1993	Balancing service
Pennsylvania	Pennsylvania Gas and Water	R-932676	July 1993	1993 Purchased Gas Adjustment filing
Rhode Island	Providence Gas Company	2025	April 1993	IRP
Pennsylvania	Equitable	I-900009; C-913669	March 1993	Charges for transportation service and cost allocation methods in general
Arkansas	Arkla Energy Resources, Arkansas Louisiana Gas	92-178-U	August 1992	Gas cost and purchasing practices
Colorado	Generic proceeding	91R-642EG	August 1992	Gas integrated resource planning rule
Pennsylvania	Pennsylvania Gas and Water	R-00922324	July 1992	1992 Purchased Gas Adjustment filing
Pennsylvania	Peoples Natural Gas Company	R-922180	May 1992	Cost allocation, rate design
Michigan	Consumers Power Company	U-10030	April 1992	Gas Cost Recovery Plan, role of demand-side management as a resource in five-year forecast

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
				and supply plan
Pennsylvania	T.W. Phillips	R-912140	March 1992	1992 Purchased Gas Adjustment
FERC	Columbia Gas Transmission and Columbia Gulf Transmission	RP91-161-000 et al RP91-160-000 et al.	February 1992	Cost allocation, rate design
Arkansas	Arkla Energy Resources	91-093-U	February 1992	Base cost of gas
New Hampshire	Energy North Natural Gas	DR90-183	January 1992	Cost allocation, rate design
Arizona	Southwest Gas Corporation	U-1551-89-102 & U-1551-89-103; U-1551-91-069	September 1991	Gas Procurement Practices and Purchased Gas Costs
Maryland	Baltimore Gas and Electric	8339	July 1991	Cost allocation, rate design
Rhode Island	Bristol and Warren Gas	1727	June 1991	Gas procurement
New Mexico	Gas Company of New Mexico	2367	June 1991	Gas transportation policies

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Pennsylvania	T.W. Phillips	R-911889	March 1991	Gas supply
Michigan	Michigan Gas Company	U-9752	March 1991	Gas Cost Recovery Plan
Arkansas	Arkla	90-036-U	August and September 1990	Gas supply contracts, including Arkla-Arkoma transactions
Arizona	Southern Union Gas	U-1240-90-051	August 1990	Cost Allocation and Rate Design
Utah	Mountain Fuel Supply	89-057-15	July 1990	Cost Allocation and Rate Design
Pennsylvania	Equitable Gas Company	R-901595	June 1990	Cost Allocation and Rate Design
West Virginia	APS	90-196-E-GI ; 90-197-E-GI	May 1990	Coal supply strategy
Pennsylvania	T.W. Phillips Gas and Oil Co.	R-891572	March 1990	Purchased Gas Costs
Colorado	Generic proceeding	89R-702G	January 1990	Policies and rules for gas transportation service

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
Arizona	Generic proceeding	U-1551-89-102 and U-1551-89-103	October 1989	Regulatory Oversight of Purchased Gas Costs
Rhode Island	Narragansett Electric Company	1938	October 1989	Sales Forecast, Cost Allocation, rate design
Pennsylvania	Pennsylvania Gas and Water	R891293	July 1989	Purchased Gas Costs
Pennsylvania	Columbia Gas of Pennsylvania	R891236	May 1989	Take-or-Pay Cost Recovery
New Jersey	Elizabethtown Gas Company	GR 88081-019	December 1988and February 1989	Take-or-Pay Cost Recovery
Montana	Montana-Dakota Utilities	87.7.33; 88.2.4; 88.5.10; 88.8.23	December 1988	Gas Procurement, Transportation Service Gas Adjustment Clause

Jurisdiction	Company	Docket	Date	Issue
Illinois	Ameren Illinois	12-0244	August 2012	Advanced metering infrastructure (AMI)
Nova Scotia	Nova Scotia Power	NSPI –P-203/M04862	June 2012	Load retention rate
Illinois	Commonwealth Edison	12-0298	May 2012	Advanced metering infrastructure (AMI)
New Jersey	South Jersey Gas Company	GR 88081-019 and GR 88080-913-	November 1988 and February 1989	Take-or-Pay Cost Recovery
New Jersey	Public Service Electric and Gas	GR 88070-877	October 1988 and February 1989	Take-or-Pay Cost Recovery
District of Columbia	District of Columbia Natural Gas	Formal Case 874	September 1988	Gas Acquisition, Gas Cost Allocation, take or pay-costs; Regulatory Oversight
Illinois	Generic proceeding	88-0103	July 1988	Take-or-Pay Cost Recovery
West Virginia	Generic proceeding	240-G	June 1988	Gas Transportation Rate Design
Pennsylvania	Pennsylvania Gas & Water	R-880958	June 1988	Purchased Gas Adjustment
Utah	Mountain Fuel Supply	86-057-07	March 1988	Gas Transportation Rate Design
South Carolina	South Carolina Electric & Gas	87-227-G	September 1987	Gas Supply and Rate Design
Arizona		U-1345-87-069	September 1987	Fuel Adjustment Clause

Tyler Comings

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PROFESSIONAL EXPERIENCE

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

Provides consulting services, conducts research, and performs economic impact analysis of renewable energy and energy efficiency investments. Recent work includes developing economic impacts of energy efficiency programs in Vermont and a scenario of clean energy investments for the U.S.

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

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

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

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

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

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

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

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

EDUCATION

Tufts University, Medford, MA, MA Economics, 2007.

Graduate work in micro- and macroeconomics, econometrics, development economics, and international finance (Fletcher School of Law and Diplomacy).

Boston University, Boston, MA, BA Mathematics and Economics, 2002. *Cum Laude*, Dean's Scholar.

ADDITIONAL SKILLS

Software: MS Office, STATA, SPSS, SAS, REMI, IMPLAN, Mathematica

Programming: C++

Languages: Conversant in French

RELEVANT REPORTS

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

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

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

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

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

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

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

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

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

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

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

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

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

EDR Group, *Economic Assessment of Proposed Brockton Power Facility*. September 2009.

Howland J., D. Murrow, L. Petraglia, T. Comings, *Energy Efficiency: Engine of Economic Growth*. Environment Northeast and EDR Group, 2009.

EDR Group, KEMA, *Economic Benefits of Connecticut's Clean Energy Program*. EDR Group and KEMA for Connecticut Clean Energy Fund, April and May 2009.

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

EDR Group, Navigant Consulting, *Economic Potential of an Advanced Biofuels Sector in Massachusetts*, EDR Group and Navigant Consulting for Massachusetts Office of Energy and Environmental Affairs, spring 2008.

EDR Group, *Environmental Impacts of Massachusetts Turnpike and Central Artery/Tunnel Projects*, EDR Group for Massachusetts Turnpike Authority, spring 2006

Resume dated October 2012.

Patrick Knight

Research Associate

Synapse Energy Economics

485 Massachusetts Ave., Suite 2, Cambridge, MA 02139

(617) 453-7051 • fax: (617) 661-0599

www.synapse-energy.com

pknight@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. Research Associate, 2010 – present. Performs consulting, conducts research, and assists in writing testimony and reports on a wide range of issues including economic technologies and policies, water and energy interactions, air emissions of electricity generation, consumer advocacy, costs and benefits of energy efficiency programs and measures, and environmental compliance and technology strategy within the energy industry.

New Ecology, Inc., Boston, MA. Associate, 2009.

Wrote reports for project managers and clients on how to economically make green energy improvements for low-income housing projects. Designed content, tested programming, and wrote business presentations for WegoWise, an in-house utility tracking and management software system. Prepared documentation for LEED Credits and other green certification programs.

Save the Harbor / Save the Bay, South Boston, MA. Senior Marine Educator, Summer 2008. Led outreach programs from local Boys and Girls Clubs, YMCAs, and other youth groups in marine biology at Piers Park and Constitution Beach in East Boston. Educated twenty to thirty East Boston students between the ages of six and fourteen on marine biology in the Boston Harbor Explorers program.

ACTIVITIES

Beyond Solar Energy – Exploring Urban Renewable Energy Sources in Boston Field Project, Medford, MA, Spring 2009.

Studied the efficacy and viability of urban wind and biomass generators in conjunction with Boston's Department of Energy. Interviewed wind power stakeholders in the public, private and nonprofit sectors and created a final report and presentation.

Solar Decathlon Team – Tufts University / Boston Architectural College, Medford, MA, Fall 2008 – Fall 2009.

Developed a web-based analytic software tool used for finding the cost and payback time for solar panels in any location in the United States based on costs, rebates, and solar input. Aided in the research and planning of a zero-energy house that participated in the National Solar Decathlon competition in Washington, DC. Researched regulations and incentives that would

help to make a zero-energy house affordable and would allow it to be sited in Boston. Designed and managed web content for the competition.

ADDITIONAL EXPERIENCE

Tufts University Department of Urban and Environmental Policy and Planning Web Manager, 2008 – 2010

Boston College Geology and Geophysics Research Assistant, Fall 2007 – Spring 2008

Boston College Student Tutor, Spring 2007 – Spring 2008

EDUCATION

Tufts University, Master of Arts in Urban and Environmental Planning and Policy, Medford, MA, 2010.

Boston College, Bachelor of Science in Geophysics, Chestnut Hill, MA, 2008.

Minors in mathematics and philosophy. Dean's List all semesters. Best Undergraduate Presentation; BC Geology and Geophysics Dept. Student Colloquium 2006. Member of Golden Key International Honor Society, Slavic Honor Society.

PUBLICATIONS

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

Hornby R., B. Fagan, D. White, J. Rosenkranz, P. Knight, R. Wilson. *Potential Impact of Replacing Retiring Coal Capacity in the Midwest Independent System Operator (MISO) Region with Natural Gas or Wind Capacity.* Synapse Energy Economics for the Iowa Utilities Board (IUB), September 2012.

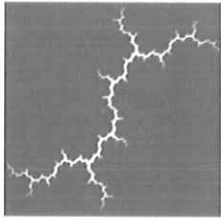
Fagan B., M. Chang, P. Knight, M. Schultz, T. Comings, E. Hausman, R. Wilson. *The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region.* Synapse Energy Economics for Energy Future Coalition, August 2012.

Chang M., D. White, P. Knight, B. Biewald. *Energy Benefits Resulting from the Investment of 2010 RGGI Auction Revenues in Energy Efficiency.* Synapse Energy Economics for Regulatory Assistance Project, February 2012.

Steinhurst W., P. Knight, M. Schultz. *Hydropower Greenhouse Gas Emissions: State of the Research.* Synapse Energy Economics for Conservation Law Foundation, and Pew Research Center, February 2012.

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

Resume dated October 2012



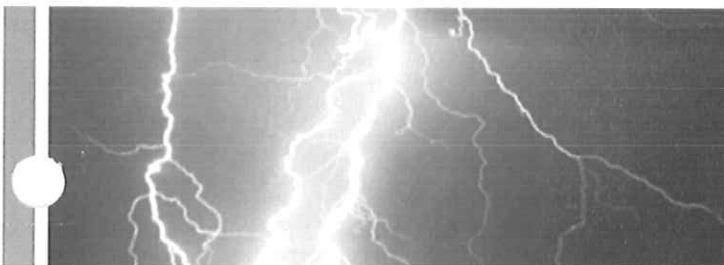
Synapse
Energy Economics, Inc.

COST PROPOSAL

**Proposal to Provide
Consulting Services in
Connection with Appalachian
Power Company's Petition to
Acquire Transferred
Resources from Ohio Power
Company
(PSC Case No. 12-1655-E-PC)**

**Submitted to the Consumer Advocate
Division of the Public Service
Commission of West Virginia**

February 14, 2013



485 Massachusetts Ave.
Suite 2
Cambridge, MA 02139

617.661.3248
www.synapse-energy.com

Consulting Bid Form

Following is Synapse's completed Consulting Bid Form for this proposal. Please note that the hourly rates listed below have been "loaded" to include all expenses, per the RFQ.

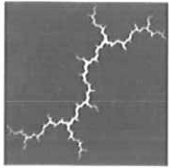
PSC13532 – CONSULTING BID FORM			
Employee/Title	Not to Exceed Number of Hours*	Hourly Rate	Extended Price
Jeremy Fisher, scientist	132	\$220	\$29,040
Rachel Wilson, associate	140	\$180	\$25,200
Rick Hornby, senior consultant	60	\$240	\$14,400
Tyler Comings, associate	68	\$155	\$10,540
Patrick Knight, research associate	48	\$130	\$6,240
		Total	\$85,420
Bidder / Vendor Information: Name: Synapse Energy Economics, Inc. Address: 485 Massachusetts Ave, Suite 2 Cambridge, MA 02139 Phone #: 617-661-3248 Email Address: admin@synapse-energy.com			
Contact Coordinator Information: Name: Jeremy Fisher, project manager Address: Same as above Phone #: 617-453-7045 Email Address: jfisher@synapse-energy.com			
The Consultant will not be reimbursed for hours that exceed the total hours for each Employee/Title.			

The following table provides a more detailed breakdown of Synapse's proposed budget by staff member and task.

Proposed Budget by Task and Staff Member

	Fisher	Wilson	Hornby	Comings	Knight	Total
Hourly Rate (US\$/Hr)	\$220	\$180	\$240	\$155	\$130	
Staff Effort - Hours, Total						
1. Review case materials; issue and review discovery.	20	20	12	8	0	60
2. Conduct review of resource plan assumptions and inputs (loads and resources, commodity prices, DSM, restructuring plan, plant values); prepare and conduct alternative Strategist model runs.	24	32	8	16	24	104
3. Prepare direct testimony supporting analysis of resource plan, recommended alternatives and critique of analyses.	32	32	16	16	16	112
4. Review analyses and testimonies filed by Company and other parties	16	16	8	12	0	52
5. Present testimony at hearings; support development of cross examination and briefings as required.	40	40	16	16	8	120
Total Hours	132	140	60	68	48	448

Staff Costs - \$						
1. Review case materials; issue and review discovery.	\$4,400	\$3,600	\$2,880	\$1,240	\$0	\$12,120
2. Conduct review of resource plan assumptions and inputs (loads and resources, commodity prices, DSM, restructuring plan, plant values); prepare and conduct alternative Strategist model runs.	\$5,280	\$5,760	\$1,920	\$2,480	\$3,120	\$18,560
3. Prepare direct testimony supporting analysis of resource plan, recommended alternatives and critique of analyses.	\$7,040	\$5,760	\$3,840	\$2,480	\$2,080	\$21,200
4. Review analyses and testimonies filed by Company and other parties	\$3,520	\$2,880	\$1,920	\$1,860	\$0	\$10,180
5. Present testimony at hearings; support development of cross examination and briefings as required.	\$8,800	\$7,200	\$3,840	\$2,480	\$1,040	\$23,360
Total: Including Estimated Travel Costs	\$29,040	\$25,200	\$14,400	\$10,540	\$6,240	\$85,420



Synapse
Energy Economics, Inc.

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February 13, 2013

Department of Administration, Purchasing Division
2019 Washington Street East
P.O. Box 50130
Charleston, WV 25305-0130

RE: Solicitation No. PSC13533

To Whom it May Concern:

Enclosed please find the proposal from Synapse Energy Economics, Inc. (Synapse) to the Consumer Advocate Division of the West Virginia Public Service Commission (CAD) to provide consulting services in connection with the petition for approval of a generation resource transaction filed by Appalachian Power Company before the Public Service Commission of West Virginia as Case No. 12-1655-E-PC.

Per the instructions in the RFQ, we have enclosed one original Technical Proposal and one original Cost Proposal in separate, sealed envelopes. Please note that our Certification and Signature Page, Addendum Acknowledgement Form, and Purchasing Affidavit have been provided as appendices to our Technical Proposal.

The primary contact for this proposal is Jeremy Fisher, Synapse's project manager for this work. Dr. Fisher can be reached at 617-453-7045 or jfisher@synapse-energy.com.

Please let us know if you have any questions concerning the proposed work, if you need additional descriptive information on the services proposed, or if additional qualifications information is required. We look forward to the opportunity of assisting the CAD in this matter.

Sincerely,

Bruce Biewald, President
Synapse Energy Economics, Inc.