**Robert M Wirtshafter, Ph.D.**

**PRESENT POSITION**

President, Wirtshafter Associates, Inc.

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**EDUCATION**

Ph.D. Geography--Clark University 1979

Dissertation: "Shelter Design and Energy Usage: A Methodology for Evaluating the Impact of Residential Space Conditioning Technologies on the Consumer, the Electric Utility, and Society"

B.A. Geography--Clark University 1975

Coursework at Durham University, Durham, England, 1973-74.

**AREAS OF EXPERTISE**

 o Demand Side Management Program Planning and Evaluation

 o Energy Policy for Promoting Conservation and Alternative Energy Sources

 o Market Research, Survey Design and Statistical Analysis

 o Application of Geographic Information Systems for Resource Management

 o Land Development and Impact Fees

 o Energy Policy in China

**PROFESSIONAL EXPERIENCE**

Dr. Robert Wirtshafter, President of Wirtshafter Associates, Inc., combines his extensive experience in program design and evaluation with insightful policy development. He was the first to tackle difficult issues such as the utility/solar interface, incentives for energy efficiency, hook-up fees, assessment of standard performance contracting, and design of third-party initiatives. Dr. Wirtshafter began his career as a planner in the nation’s first utility-sponsored energy-efficiency and renewables program at the Tennessee Valley Authority and the cost-effectiveness model he developed for TVA has evolved into the Total Resource Cost (TRC) test commonly used to assess cost effectiveness of DSM programs. As a professor at the University of Pennsylvania he developed the first courses in energy efficiency program planning and evaluation. Dr. Wirtshafter is nationally recognized for crafting some of the field’s more insightful and innovative evaluations. He produced the definitive work on hookup fees and pioneered the use of GIS in planning and evaluating energy efficiency programs. Dr. Wirtshafter has broad experience doing large scale efficiency assessments in the US, Canada, and China. Dr. Wirtshafter has extensive experience in doing market assessment, impact, and process evaluations in the residential, industrial, and commercial sectors. Dr. Wirtshafter has directed numerous market characterizations, energy audits, and financial assessments. Current studies include a market characterization of New York multifamily new and existing markets; and food service industry in Hawaii. Dr. Wirtshafter is increasingly being asked to assist states as a strategic evaluation adviser. He is the residential evaluation advisor to the Massachusetts EEAC, the council in Massachusetts directing the statewide development of energy efficiency; he is the process, marketing and net-to-gross evaluation coordinator for the Master Evaluation Assistance team overseeing all of NYSERDA’s evaluation work; he provides strategic advice to the Hawaii PUC, and he is the evaluation technical adviser to the Technical Evaluation Committee of the Ontario Energy Board.

1994 to Present

President, Wirtshafter Associates, Inc.

Conducting research in demand-side management planning and evaluation, market research, low-income utility programs, and energy development in rural China. Clients include: The California Board for Energy Efficiency, Enbridge Gas Distribution, Energy Trust of Oregon, Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, Southern California Gas, New Hampshire PUC, Northeast Utilities, National Grid, NSTAR, PECo Energy, PG Energy, PPL Corp, PSE&G, UGI, Peoples Gas, GPU Energy, NYSERDA, Northern States Power-Wisconsin, Union Gas, Vermont Electric Cooperative, Xcel Energy, and The World Bank.

October 1980 - 1996

Associate Director Center for Energy and the Environment, Research Associate Professor, City and Regional Planning Department, University of Pennsylvania, Research Associate Professor, Systems Engineering Department, University of Pennsylvania. Responsibilities included development, implementation, and administration of research activities of the Center for Energy and the Environment; conducting two courses per year, and advising students in the Energy Management and Policy graduate program.

o Research activities in a broad range of interdisciplinary topics centered on energy/environmental issues. Field work in China and the Caribbean.

o After assuming responsibility for coordination of Center's research activities in 1987, I secured almost all of the Center’s research funds. I supervised each project, took an active role in research activities, and administered all manpower and budgetary details. In addition, I helped develop a geographic information laboratory and other computer facilities at the Graduate School of Fine Arts.

o Responsible for teaching energy conservation principles and planning, utility regulation, and computer energy application courses in the Energy Management and Policy Program. Served as principal thesis advisor to over 75 students who received their degrees. Organized annual summer study program to China.

o Provided consulting services to a broad range of clients in diverse areas of resource utilization. Among these include being an expert witness in utility rate matters. Also have provided financial, engineering, regulatory and management services to a number of utilities, industries, firms, and government institutions.

o Provided services to the University of Pennsylvania Facilities Management Department in the management of energy conservation activities at Penn. Organized a student -run project to create a database cataloging campus lighting and to replace inefficient lighting, campus-wide.

 1979 - 1980

Policy Planner, Solar Applications Branch, Tennessee Valley Authority, Chattanooga, Tennessee. Responsible for overall planning and project support for Nation's largest solar energy program. Program grew from 6 to 130 employees and to a budget of $40 million during my tenure.

 1975-1979

Project Manager, Russell Sage Foundation, New York, New York, and Clark University, Worcester, Massachusetts

**TEACHING EXPERIENCE**

1981 – 1996 --University of Pennsylvania

o Seminar on Electric Utility Deregulation

o Cogeneration Assessment and Development

o Survey Design and Statistical Methods

o Field Research in China

o Utility Regulation

o Energy Conservation Principles

o Advanced Seminar in Energy Conservation

o Energy Efficiency in Large Buildings

o Energy Conservation Planning

o Computer Modeling in Energy Analysis

**Selected Projects in Utility Planning and Demand-Side Management**

**Ontario Energy Board (2012-present)**

Dr. Wirtshafteris the evaluation technical adviser to the Evaluation Advisory Committee and before that the Technical Evaluation Committee overseeing the gas programs of Enbridge and Union Gas. He has provided guidance on all evaluation issues including helping to lead studies on net-to-gross assessment, boiler baseline assumptions, and development of Wiki based Technical Reference Manual.

**NYSERDA (2006-2015)**

Dr. Wirtshafter was the process, marketing and net-to-gross evaluation coordinator for the Master Evaluation Assistance team overseeing all of NYSERDA’s evaluation work. This work involved oversight of all NYSERDA process and market characterization studies and net-to-gross studies. He was also a team member on the process and market effects evaluation team. He led the last three major process and market characterizations of the Multifamily Performance Program, and the Low-Income Weatherization Program. Dr. Wirtshafter developed GIS applications for all of these studies.

**Advisor to the Massachusetts Energy Efficiency Advisory Council (2009-present)**

Dr. Wirtshafter directs all residential retrofit evaluations performed by the program administrators in Massachusetts. In the last three years alone, he had oversight of a portfolio of programs with expenditures topping $800 million. He directed and managed more than 50 evaluation studies and an evaluation budget of $20 million. Many of these studies have been presented at the IEPEC, BECC, ACEEE conferences. He has directed impact, process, and market assessment projects for all new construction, including: Home Energy Services and Heat Loan Program Assessment, CoolSmart Incremental Cost Study, Residential Profile Study, Low Income Multifamily Impact Evaluation High Efficiency Heating Equipment Impact Evaluation, Mass Save Multifamily Program Impact and Process Evaluations, Northeast Residential Lighting Hours-of-Use Study, Ductless Mini-Split Heat Pump Impact Study, Home Energy Service Impact and Process Evaluations, Wi-fi Programmable Thermostat Pilot Program Evaluation, Massachusetts Baseline Study of Single-Family Residential New Construction, Multifamily Program Impact Analysis, Brushless Fan Motor Impact Evaluation, Low Income Single Family Impact and Process Evaluations.

**Advisor to the Connecticut Energy Efficiency Board (2016-present)**

Starting in October 2016, Dr. Wirtshafter became a member of the team overseeing the evaluations of Connecticut’s energy efficiency programs. He is sharing responsibility for planning and oversight of all residential programs, planning future studies, and selecting and overseeing evaluation contractors.

**Advisor to the Delaware Energy Efficiency Advisory Council (2015-present)**

Dr. Wirtshafter is advising the EEAC and the Department of Natural Resources and Environmental Control (DNREC) on statewide evaluation efforts. He has worked with Prime Contractor, Optimal Energy, to establish an evaluation framework and regulations, review evaluation reports, and establish NTG values.

**Adviser to New Hampshire Public Utilities Commission (2018-present)**

Dr. Wirtshafter oversees evaluation of the HPwES and Home Energy Assessment Programs.

**Advisor to Maine Public Utilities Commission (2015-2016)**

Dr. Wirtshafter was the evaluation adviser for the Energy Futures team supporting the PUC’s oversight of Efficiency Maine’s programs.

**Hawaii Energy Evaluation (2010-2014)**

Dr. Wirtshafter was part of the team evaluating Hawaii Energy’s portfolio of programs. He developed a baseline study for C&I customers, and supervised residential evaluation activities. He provided strategic support on alternative methods for measuring net-to-gross impacts. He also evaluated Hawaii Energy’s Market Transformation Portfolio.

**Consumers Energy C&I Evaluation (2009-present)**

Dr. Wirtshafter is part of the team evaluating Consumers Energy C&I programs. He has led the customer baseline survey including sampling plan and crafting of survey. He is working with Consumers to restructure their pilot programs to build in evaluation and to design the pilots so they answer key program uncertainties. This includes studies of new construction, agriculture, industrial performance, improving efficiency for school district, and a business behavioral program. He has also built a GIS system to analyze all of Consumers’ Commercial portfolio.

**Energy Trust of Oregon (2012-14)**

Dr. Wirtshafter participated in two process evaluations of ETO’s Commercial New Construction Program

**NYSERDA Code Compliance Study (2010-11)**

Dr. Wirtshafter was part of a team that investigated the level of energy code compliance in New York State.

**Impact Evaluation of Residential HVAC Tune-up Program (NV Energy 2009)**

Dr. Wirtshafter performed an impact evaluation of the tune up program. Billing data was analyzed using a fixed effects model to estimate electricity savings from a program that paid rebates to contractors who made refrigerant charge and airflow adjustments.

**Impact Evaluation of California Training Center Programs (CPUC 2007-2009)**

Dr. Wirtshafter was part of the Opinion Dynamics team that conducted the first statewide impact evaluation of the nine utility-sponsored training centers. Dr. Wirtshafter contributed on all aspects of the project including overall design, development of instructor and participant data collection instruments, and analysis approaches.

**Evaluation of NYSERDA EmPower Low-Income Program (NYSERDA 2008-2010)**

Wirtshafter Associates, as a subcontractor to Research Into Action, performed three process evaluations of the EmPower Program. This project includes determination of best marketing approaches for getting low-income customers to enroll in program, and assessment of the workshops, and assessment of communication with program contractors. GIS analysis is also being used to assess the appropriateness of training locations.

**Impact Evaluation and Market Assessment of Xcel Energy’s Colorado Business Lighting Program (Xcel Energy 2008-2009)**

Dr. Wirtshafter lead an evaluation of Xcel Energy’s Lighting Program. The project includes derivation of net to gross adjustments to savings calculations using protocols developed for the California evaluations. The study is also surveying 400 businesses and interviewing 25 lighting suppliers.

**Process Evaluation Support for Sempra Residential and C&I Programs (Sempra 2007-2008; and 2011-12)**

As a subcontractor for ECONorthwest (residential) and KEMA (C&I), Wirtshafter Associates supported a process evaluation for San Diego Gas and Electric and Southern California Gas programs. Wirtshafter Associates assumed the lead on the Lighting Exchange, Residential Rebate, and HVAC equipment programs. We also assessed the degree to which programs fit into the overall strategic plan of the utility.

**Evaluation of NYSERDA Multi-family Performance Program (NYSERDA 2006-2008; 2013-2014)**

Wirtshafter Associates led the process evaluations of the Multifamily Performance Program and the Assisted Multifamily Program. Dr. Wirtshafter conceived the idea to use tax records to characterize the multifamily market. He obtained the public tax parcel data from the state and used it as the basis of the market assessment. He built a GIS to find trends in participation across New York. He also directed an enhanced process evaluation that included in-depth interviews of stakeholders, surveys of owners, participant and non-participant trade allies.

**Massachusetts and Rhode Island CoolSmart Program (National Grid 2005-08)**

Wirtshafter Associates and Performance Systems Development assessed the efficiency savings associated with this HVAC contractor performance program. The program encourages HVAC contractors to perform Quality Installation Verification performance tests on all air-conditioning units that they install. The evaluation did an extensive set of on-site visits of treated and untreated homes to determine program savings. Interviews and surveys of contractors were also performed to identify barriers that explain why participation rates have been unexpectedly low.

**Impact Evaluation of California’s Low-Income Energy Efficiency Program (SCE 2004-2007)**

Working with West Hill Energy and Computing on Statewide impact evaluations. Providing guidance on study approach and methodological issues and conducted ride alongs and analysis of on-site data study of 400 households.

**Evaluation of California’s 20/20 Demand Response Program (SDG&E 2006)**

Wirtshafter Associates led the initial process and impact evaluations of these demand response programs. The 20/20 programs are the first demand response initiatives offered to residential and small C&I customers. The programs did not require enrollment to be eligible, and this created several challenges for estimating program attributable savings. The study used a broad survey of successful and unsuccessful customers to feed an informed billing analysis. The study also did an impact and process evaluation of a day-ahead notification program offered to small C&I customers by SDG&E.

**Evaluation of California’s Statewide Training and Education Centers (SCE 2004-05)**

Wirtshafter Associates with subcontractor KEMA performed a series of case study evaluations of Center programs. The study also investigated best practice performance at other adult training centers to help guide the CA centers. Wirtshafter Associates also teamed with ASW to measure the energy savings generated from the HVAC courses that are given at the SCE centers.

**Study of Hard-to-Reach Residential Customers in California (SCE 2004-05)**

Wirtshafter Associates used a geographic information system to identify the characteristics of all four California investor owner utilities for all residential rebate programs in 2002-03. The distribution of benefits was assessed relative to predefined characteristics that the CaPUC determined made customers hard to reach.

**Evaluation of Building Energy Code Training (ConSol 2004-05)**

Wirtshafter Associates provided process and market assessment support to ConSol in the delivery of building code training.

**Evaluation of Community Energy Efficiency Program (ConSol 2004-05)**

Wirtshafter Associates provided process and market assessment support to ConSol in the delivery of the Community Energy Efficiency Program.

**Evaluation of California’s Statewide Multi-family Rebate Programs (SDGE 2003-2004)**

Dr. Wirtshafter directed the impact and process evaluation of this new program. One highlight was the innovative use of GIS to define how well the program was serving hard-to-reach customers. Program contract was renewed for 2004.

**Study of California’s Hard-to-Reach Residential Customers SCE (2004)**

This innovative project assembled all of the participant data for all California residential energy efficiency programs in 2003 and 2002. The study used GIS to locate the US Census block-group for each participant and using the underlying characteristics associated with the block-group determined the general characteristics of participants. The study then identified classes of customers in California that are under and over-represented by the portfolio of current programs.

**Evaluation of California Statewide Education, Training, and Services Program (SCE 2004).**

Wirtshafter Associates with KEMA Inc. evaluated the programs offered by the six utility training centers. Study included two measurements of energy savings resulting from information only programs: Pacific Energy Center’s Tool Lending Library and CTAC’s portfolio of HVAC courses.

**Evaluation of SCE’s Local Government Initiative (SCE 2003-2004)**

Dr. Wirtshafter led a team that assessed the effectiveness of this local initiative. This included detailed interviews with utility staff, builders, local code officials, and other stakeholders. Program contract was renewed for 2004.

**Low-Income Universal Service Programs Process Evaluation (PPL Corp 2002).**

Dr. Wirtshafter performed a process evaluation of PPL’s low income program including customer assistance and weatherization.

**Statewide Evaluation of New Jersey Utilities Residential Energy Efficiency Programs (Seven NJ utilities, 2002).**

Dr. Wirtshafter led a team that conducted market assessment and process evaluation research for statewide new construction, HVAC, Energy Star products, and Web-based audit programs in New Jersey.

**Impact and Process Evaluation of Citizens Vermont Low-income Program (CES 2001)**

Dr. Wirtshafter conducted a full evaluation of CES’s low-income energy efficiency program. This included customer survey, billing analysis, and cost-effective analysis.

**Evaluation of California Residential New Construction Program Training Activities (PG&E 2001)**

Conducted in-depth interviews with builders and others involved in new residential construction to determine effectiveness of training and impact of new building codes on construction practices.

**Evaluation of California Residential Contractor Program. SCE and CBEE (1999 to 2001).**

Wirtshafter Associates, Inc. was the prime contractor to evaluate the RCP program in California. The study included process evaluation of program, surveys of homeowners, survey with contractors, ride-alongs, a market segmentation of contractors, establishment of the market tracking indicators, and implementation of a GIS to detect income and demographic characteristics of participants and market coverage of participant builders.

**Evaluation of California Residential Standard Performance Contract Programs –California Board for Energy Efficiency and Pacific Gas and Electric (1998 to 2000)**

Wirtshafter Associates, Inc. was the prime contractor on an evaluation of the four residential SPC contracts in California. The evaluation determined the theoretical basis for the SPC program, established baseline values, and assessed the implementation of the first year effort. Using interviews, focus groups, and surveys, the evaluation also suggested modifications that became the Residential Contractor Program.

**Study on Incorporating Innovation into the Third Party Initiative Program—Southern California Edison. (1999)**

Robert Wirtshafter, Lester Baxter, and Rob Bordner investigated foundations, government agencies, and utilities to see how the organizations encourage innovation in their program solicitations**.**

**Planning Support for Residential Contractor Program—Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, and Southern California Gas (1999)**

Wirtshafter Associates, Inc. conducted eight focus groups with homeowners and provided planning support for a new program concept.

**Planning Support for PECo Energy’s Competition Pilot (1998)**

Wirtshafter Associates, Inc. helped PECo develop the Electric Choice pilot program and developed the method for selecting the customers who would be eligible for the first electric generation choice program in Pennsylvania.

**Onsite Inspection of Northern States Power-Wisconsin’s Water Heating Energy Efficiency Program (1998)**

Wirtshafter Associates, Inc. performed 100 audits of participants in NSPW’s water heating program. An impact evaluation was also completed.

**Impact Evaluations for Residential New Construction Programs—NEPSCo; EUA, and Northeast Utilities (1995 to 1999)**

These projects were impact evaluations of these utilities’ new residential construction programs. Savings estimates, including spillover were calculated. In the case of NEPSCo and NU, repeat evaluations were completed a in 1996, 1997, and 1998. The project also include builder interviews and onsite inspection of all participant homes. Tests included blower door and duct blaster testing.

**Market Baseline Study For New Residential Construction -- NEPSCo, Northeast Utilities, EUA, Commonwealth Electric, and Boston Edison (1994-1995)**

This project was designed to measure the market impacts of new residential efficiency programs. The project included development of a market baseline and capture of indirect program effects on the market for energy efficiency in new construction. This project explored the difficulties inherent in measuring spillover effects of DSM programs. Impact evaluations of the savings of NEPSCo’s, EUA’s, and NU’s new residential construction programs were also performed.

**Low-Income Customer Assistance Programs - Planning and Evaluation – Columbia Gas, Pennsylvania Electric Company, Peoples Gas Company, Metropolitan Edison Company, PG Energy, UGI, Philadelphia Gas Works, PP&L Gas Division (1993 to 2001)**

Dr. Wirtshafter assisted the establishment of pilot Customer Assistance Programs at the above utilities. These programs sought to test the feasibility and cost-effectiveness of “percentage-of-income” payment plans for low-income customers. As the programs progress, he will be the principal evaluator. The evaluations focused on determining the implementation costs, pre- and post-program changes in revenue patterns and the operational effectiveness of the CAP approach.

**Demand Side Management and Low-Income Program Evaluations -- New York State Electric and Gas: (1993)**

Dr. Wirtshafter, directed a University of Pennsylvania team, served as a subcontractor to XENERGY for an evaluation of NYSEG's residential DSM programs. He designed and implemented a baseline market assessment of NYSEG residential new home market, including a comparison between NYSE-Star homes and other construction. The study included, 100 on-sites of non-participant homes, and home occupant surveys from both types of home occupants. An analysis included detailed running of DOE-II building simulation models and survey results. Responsibilities also included the design of sampling protocols and development of a master random non-participant telephone survey. He also designed and implemented on-site audits and verification strategies for the residential lighting. This included the first large-scale test of run-time meters for verification of use and demand data in residential lighting programs. In addition, he designed a trade ally survey for the high efficiency water heating program.

**Residential Lighting Evaluation Methodology Study -- New York Power Pool: (1992)**

Dr. Wirtshafter directed an assessment of current residential lighting evaluation methods. A survey of over 180 utilities revealed that 110 different residential lighting programs and a comparably wide variety of evaluation methods exist. The plans, reports, and survey methods for each program were reviewed in detail. Recommendations on how to improve residential lighting evaluations were suggested.

**Performance-Based Hook-up Fees Study -- New York Power Pool: (1990)**

As Research Director at the University of Pennsylvania’s Center for Energy, Dr. Wirtshafter investigated the feasibility of implementing performance-based hook-up fees for new construction. These fees would charge inefficient buildings a penalty for connecting to the system. A national survey of utilities, public utility commissions, and state energy offices was conducted. Several alternative fee structures were proposed. Impacts of the hook-up-fee approach were modeled using the DOE 2.1D computer model. Additionally, an extensive survey of the building industry was conducted.

**Steam Condensate Recovery Alternative Study-- Consolidated Edison: (1993-94)**

This innovative project, conducted with the engineering firm Goldman Copeland Associates, analyzed the potential for recovering steam condensate in ConEd’s system. The 100 largest steam users in New York City were audited to determine current recovery practices and potential retrofits for additional recovery. Technical feasibility and cost-effectiveness analyses were performed to identify economically attractive opportunities for condensate recovery throughout the system.

**Publications**

“Reaching the Most Unreachable: Implications of Deeply Understanding the Truly Hardest-to-Reach,” with L. Schauer, et. al., *2020 ACEEE Summer Study on Energy Efficiency in Buildings;* Asilomar, CA 2020.

*“*Comprehensive Research for a Full View of Barriers for Residential Hard-to-Reach Customers*,”* with T. Dyke-Redmond et. al*., 2020 ACEEE Summer Study on Energy Efficiency in Buildings;* Asilomar, CA 2020.

“Integrating Open Source Data into Utility Customer Systems for Locational Analytics and Customer-Tailored Energy Efficiency Program Targeting,” with Rich Crowley et al., 2019 *International Energy Program Evaluation Conference,* Denver, CO 2019.

“An Early Retirement Spiderweb – The Threads That Connect Markets to Evaluation”, with Lisa Obear et. Al., 2019 *International Energy Program Evaluation Conference,* Denver, CO 2019.

“Multifamily Program Design Opportunities and Where to Find Them: Discovering Customer Insights from Diverse Data Sources,” with Riley Hastings et.al., 2019 *International Energy Program Evaluation Conference,* Denver, CO 2019.

*“Pushing the Market: Measuring Market Effects in Residential New Construction,” with* Jared Powell et.al, 2019 *International Energy Program Evaluation Conference,* Denver, CO 2019.

“Duckhunt! Benefits and risks of load disaggregation and end use metering for determining end use loadshapes”, with Terese Decker et. Al., 2017 *International Energy Program Evaluation Conference,* Baltimore, MD 2017*.*

“How’s that for Performance? Changes in New Construction Practices Over Time,” with Z. Tyler and A. Larson, 2017 *International Energy Program Evaluation Conference,* Baltimore, MD 2017*.*

“A Case Study of How a Market Transforming Program Claims Spillover and Market Effects,” with J. Fagan and B Tannenbaum, 2013 *International Energy Program Evaluation Conference,* Chicago, IL, 2013.

 “The Regulatory Relationship between Free Ridership and Equity for Public Goods Programs,” *2012 ACEEE Summer Study on Energy Efficiency in Buildings*, Asilomar, CA, 2012.

“Improved Code Enforcement – a Powerful Policy Tool Lessons Learned from New York State” with B. Harper et. al.,*2012 ACEEE Summer Study on Energy Efficiency in Buildings*, Asilomar, CA, 2012.

“Training the Next Generation of Energy Efficiency Evaluators: A Report from the Field”, with E. Vine et. al. *In Proceedings of the 2012 International Energy Program Evaluation Conference. Rome, Italy:*

“What an Opportunity: Four New England States Conducting Residential New Construction Baseline Studies at the Same Time!, with D. Conant et al. 2011 *International Energy Program Evaluation Conference,* Boston, MA, 2011.

“The Costs and Benefits of Measuring if States Meet 90% Compliance with Building Codes” 2011 *International Energy Program Evaluation Conference,* Boston, MA, 2011.

“Different but the Same: Assessing the Statewide Standardization of Historically Independent Programs,” with Doug Bruchs and Gail Azulay, 2011 *International Energy Program Evaluation Conference,* Boston, MA, 2011.

“Savings from Codes and Standards Activities: Developing an Evaluation Mechanism in Massachusetts ” , with B. Tolkin et.al., *2010 ACEEE Summer Study on Energy Efficiency in Buildings*, Asilomar, CA, 2010.

“Education and Training Programs: An Evaluation of the Energy Benefits”, with Tami Buhr, Wendy Todd, and Pamela Wellner, 2009 *International Energy Program Evaluation Conference,* Portland, OR, 2009

“Desperately Seeking Savings from Small Scale Demand Response: The California Experience,” with Kathryn Parlin, David Hungerford, Kevin McKinley, and Rob Bordner; 2007 *International Energy Program Evaluation Conference,* Chicago, 2007

“Do Quality Installation Verification Programs for Residential Air Conditioners Make Sense in New England?” *with Greg Thomas, Gail Azulay, William Blake, and Ralph Prahl;* ; 2007  *International Energy Program Evaluation Conference,* Chicago, 2007

 “Who Are the Real Non-Participants in California: A Two Year Examination of California’s Residential Energy Efficiency Portfolio,” 2005 *International Energy Program Evaluation Conference,* New York, 2005

“Multifamily Markets: Hard-to-Reach and Hard-to-Serve, “ with Robert Bordner and M. Wold, *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session,* ACEEE, Washington DC, 2004.

“The Trend towards Outsourcing of Energy Services: Implications for Recruiting Participants in Utility C&I Programs,” with R. Bordner, P Landry, and M Rufo, *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session,* ACEEE, Washington DC, 2002

“Using Geographic Information Systems to Establish Who Is Hard to Reach, 2001 *International Energy Program Evaluation Conference,* Salt Lake City, 2001.

“Strategies for Promoting Innovation through PGC-funded Programs**,”** with R. Bordner, P Landry, and L Baxter, 2003 *International Energy Program Evaluation Conference,* Salt Lake City, 2001

**“**Incorporating GIS into Energy Efficiency Market Transformation Programs” *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session,* ACEEE, Washington DC, 2000.

“Percentage of Income Programs: How Well Do They Work?” *1999 International Energy Program Evaluation Conference*, Denver, August 1999.

“Rethinking Performance Based Measurement: Implications for Market Transformation Programs” *1999 International Energy Program Evaluation Conference*, Denver, August 1999.

“Moving the New Construction Baseline? A Regional Approach to Assessing the Market Impacts of the Energy Crafted Home Program”, with C. Gondek, H. Powell, A. Sorrentino, *Energy Program Evaluation: Uses, Methods, and Results, 1995 International Energy Program Evaluation Conference*, Chicago, August 1995.

"Demand-Side Management Program Evaluation and Public Utility Commissions " in Walsh and Heilman, *Energizing the Energy Policy Process: The Impact of Evaluation* , Greenwood Press, 1994.

 “Proving Causality in DSM Market Transformation Programs: Issues and Alternatives”, with A. Sorrentino, *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session,* ACEEE, Washington DC, 1994.

“Market Research: The First Essential Step in DSM Market Transformation,” with K. Oswald and A. Sorrentino. *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session***,** ACEEE, Washington DC, 1994.

“Energy Performance-Based Hookup Fees for Buildings”, *Energy Sources*, Volume 16, pp.483-501, 1994

“Incorporating DSM Uncertainty and Flexibility into Integrated Resource Planning,” with E. Hildebrandt, *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session***,** ACEEE, Washington DC, 1994.

 “The Dramatic Growth in Demand Side Management: A Note of Caution From an Early Advocate", *The Electricity Journal,* Nov. 1992, pp.36-46.

"How Many DSM Evaluators Does It Take to Screw in a Compact Fluorescent Lamp: A Review of Residential Evaluation Methods", The 1993 DSM Evaluation Conference, Chicago 1993.

"Establishing Incentives for School District Energy Conservation" with A. Denver, *Energy Policy,* June 1991.

“Establishing Priorities For Future Evaluation Efforts”, with L. Baxter, *1991 International Energy Program Evaluation Conference*, Chicago, August 1991

"Determinants of Household Energy Efficiency and Demand," with L. Baxter, A. Schinnar and S. Feldman in *Energy Efficiency: Perspective on Individual Behavior*, edited by W. Kempton and M. Neiman, American Council for An Energy Efficient Economy, 1987.

"An Efficiency Analysis of Household Energy Use," with L. Baxter, A. Schinnar, and S. Feldman, *Energy Economics*, Vol. 8, #2, April 1986.

"Non-participants in Utility Conservation Programs," in *Energy Policy*, April 1985, pp. 143-155.

"Energy Conservation in Gas Utilities: An Opportunity for Industry." *Public Utility Fortnightly*, Vol. 111, No. 2, January 20, 1983.

**Experience in Development of Renewable Energy and Energy Efficiency Technologies**

Dr. Wirtshafter has been involved in the commercialization of several key energy technologies. His major contribution has been in developing demonstrations or case studies that exhibit the market potential, and in creating incentives to promote the market development. At the Tennessee Valley Authority, he helped plan the first large-scale solar energy programs. He also conducted one of the first feasibility studies of packaged cogeneration systems, and later a study of gas air conditioning. He has been involved in more than 50 audits of large buildings, including development of a program at the University of Pennsylvania to systematically increase lighting efficiency. For many years, Dr. Wirtshafter was a technical adviser to Philadelphia area BOMA members on energy efficiency and utility rate matters.

Among the projects are:

* An assessment of the market demand for green power in Pennsylvania
* Assessment of solar energy impacts on utility loads.
* Impact of solar tax credits
* Customer attitude study of owners of residential solar systems.
* Energy audit of Jamaica’s cement plant.
* Energy audits of several large meat packing facilities.
* Energy audit and cogeneration assessment of Philadelphia Water Department Waste Treatment facility (project led to installation of large digester gas cogenerator).
* Feasibility study of Amtrak/University of Pennsylvania Cogeneration Plant.
* Energy adviser to University of Pennsylvania
* Energy audit of large retail clothing stores.
* Provided onsite inspections of over 1,000 residential homes

**Publications:**

*On the Economics of Solar Energy: The Public Utility Interface*, with S. L. Feldman, Lexington Books, Lexington, MA 1980.

“The Residential Market Potential for Renewables and Energy Conservation in Pennsylvania”, Wirtshafter Associates, Inc., 1998.

"Living with Solar Energy: Changing Attitudes and Assessment of Solar Adopters," with S. Sawyer, *Journal of Environmental Systems*, Vol. 15, No. 1, 1985-1986, pp. 59-72.

"Market Stimulation by Renewable Energy Tax Incentives," with S. Sawyer, *Energy: The International Journal*, Vol. 9, No. 11-12, 1984, pp. 1017-1022.

"Solar Adoption Patterns in U.S.," with S. Sawyer, and A. Sorrentino, *Energy Systems and Policy*, Vol. 8, No. 2, 1984, pp. 161-182.

"The Advantages of Automated Spreadsheets for Cogeneration Financial Analysis", *Energy Engineering* Vol. 89, No.1, pp. 57-70, 1992.

"Marketing Efforts By Gas Utilities to Promote Cogeneration and Gas Air-conditioning," with R. Shinn, published in *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session*, Santa Cruz, CA, 1988

"Extending the TVA Power Credit Methodology to Other Utilities," with A.L. Larson and M.J. Maguire, in *The Proceedings of the 1980 Annual Meeting of the International Solar Energy Society*, Phoenix, Arizona.

"Rationale for the TVA Solar Energy Program," with F.P. Koster and M.J. Maguire, in *On the Rise II, The Proceedings of the 1979 Annual Meeting of the International Solar Energy Society*, Atlanta Georgia.

"The Effect of Solar Buildings on Peak Load," with S. Feldman and E. Wessler, *Electric World*, March 15, 1978.

"The Effect of Solar Buildings on Peak Loads of Electric Utilities," with S. Feldman, E. Wessler and B. Anderson, in *The Proceedings of the Third Workshop on the Use of Solar Energy for Cooling of Buildings*, San Francisco, CA, 1978.

"The Economic Tradeoffs Between Active and Passive Solar Heating and Energy Conservation on Residential Buildings" with M. Abrash and P. Sullivan, in *Proceedings of the 1978 Annual Meeting of the American Section of the International Solar Energy Society*, Denver, Colorado, 1978.

"Modeling Solar Passive Buildings Using TRNSYS," with M. Abrash, P. Sullivan, and J. Kohler, in *Passive Solar, State-of-the-Art, Proceedings of Second National Passive Solar Conference*, Philadelphia, PA, 1978.

"The Impact of Active and Passive Buildings on Utility Peak Loads," in *Passive Solar, State-of-the-Art, Proceedings of Second National Passive Solar Conference*, Philadelphia, PA, 1978.

**Experience in Resource Planning and Development of Geographic Information Systems**

Dr. Wirtshafter performed the most comprehensive study of the effectiveness of unit-based pricing of residential solid waste. Dr. Wirtshafter has recently headed a Penn based planning effort that designed a township extension for rural Intercourse, PA. The township is the center of the Amish community in Pennsylvania. Pressure exists to expand services without sacrificing valuable farmland. Designs for the community needed to consider the special desires of the Amish and still accommodate the 1 million visitors each year. The design developed through a corroborative effort of developers, local community, and planners was presented a design award by *Progressive Architecture*. Dr. Wirtshafter also has extensively researched the application of geographic information systems for assessing resource allocation issues. His work with the Organization of American States was one of the first demonstrations of the power of GIS as a planning tool. Dr. Wirtshafter helped establish the GIS laboratory at the University of Pennsylvania and has continued to consult on numerous GIS studies.

**Publications:**

“Who Are the Real Non-Participants in California: A Two Year Examination of California’s Residential Energy Efficiency Portfolio,” 2005  *International Energy Program Evaluation Conference,* New York, 2005

“Using Geographic Information Systems to Establish Who Is Hard to Reach, 2003  *International Energy Program Evaluation Conference,* Salt Lake City, 2001.

 “Incorporating GIS into Energy Efficiency Market Transformation Programs” *Proceedings of American Council for an Energy-Efficient Economy Summer Study Session,* ACEEE, Washington DC,2000

“Evaluation of Unit-Based Pricing Programs for Residential Solid Waste Services”, for EPA Region 3, 1998.

"Energy Performance-Based Hook-up Fees", *Energy Sources,* Vol. 16, pp. 483-501.

"Energy Performance Based Connection Fees: A Case Study for New York State", *Energy Policy*, Vol. 20, No. 12, Dec. 1992, pp. 1161-1173.

*"*An Application of Linear Programming and Geographic Information Systems: Crop Land Allocation in Antigua", with J. Campbell, J.Gless, and J. Radke, *Environment and Planning A* Vol. 24, pp. 536-549, 1992*.*

"Land Conservation in Small Developing Countries: Computer Assisted Studies in Saint Lucia," with E. Rojas, J. Radke, and R. Hosier, *Ambio* Vol. 17, No. 4 1988.

"Computer Based Geographic Information System for Integrated Land Management in the Eastern Caribbean," with E. Rojas and J. Radke, in proceedings of *Piecing the Puzzle Together: A Conference on Integrated Data for Decisionmaking*, ed. Linda Allison and Richard Olson, Oak Ridge National Laboratory, February 1988.

**Experience in Energy Planning and Assessment in the People’s Republic of China**

**Market Assessment of Photovoltaic Systems in Un-Electrified Regions of China -- 1998**

A market assessment of small photovoltaic systems (10-80 watts) is being conducted in china. The assessment includes focus groups of herdsmen and farmers in rural china, surveys of households in these areas, surveys of households with pv systems, and surveys of institutional markets such as schools, hospitals, and government buildings.

**Rural Energy Enterprise Building--Rockefeller Foundation -- 1993-1995**

This multi-phase program, organized and managed by Dr. Wirtshafter, is a joint effort of the University of Pennsylvania and The Ministry of Agriculture, Department of Environmental Protection and Energy. The program began with a two-month training course in the US for eight Chinese administrators of the 100 County Integrated Rural Energy Development Program (IREDP) on the topics of project management, database development, program evaluation and business development. The second phase of the project has included a week long seminar on small business development for a select group of 30 of the best firms among the 1900 included in the IREDP. Detailed site visits of ten of these firms were made to interview management and prepare development plans. Additional training was then provided to two Chinese from MOA and the Energy Research Institute of the State Planning Commission (ERI) to convert this information into standard business development plans. Four of these projects were revisited and final business plans and specific investment requests will be submitted to the Rockefeller Foundation in January 1995. The ultimate goal of this project is help the rural firms in the IREDP to develop business skills and to develop capabilities within MOA to package groups of potential investments by rural energy firms for application to external funding sources.

**Assessment of the Integrated Rural Energy Development Program --The World Bank -- 1994**

Dr. Wirtshafter along with Deng Keyun of MOA and Zhang Zhengmin of ERI drafted a case study of China’s 100 county rural energy program as part of a Bank study of rural energy policy. The paper explored the development and organization of the IREDP. It emphasized the organizational structure of the IREDP and the division of responsibility between the Central, provincial, and local governments and individual firms and peasants.

**Feasibility Study for Reducing Greenhouse Gas Emissions Through Substitution of Coal in China -- World Bank -- 1993-1994**

Dr. Wirtshafter directed the section of the report addressing residential and commercial energy efficiency opportunities, including three large surveys of energy use in the residential sector, the commercial sector, and in small boilers in Taiyuan, Shanxi Province. He also drafted the final report on the alternatives to coal-fired electric generation and the direct use of coal. The surveys in Taiyuan were conducted for 500 homes, 200 commercial establishments, and 200 boilers.

**Support of Rural Energy Development Project -- The World Bank -- 1989-1990**

Dr. Wirtshafter provided training and assisted in the planning and analysis of the data collection studies that led to the formation of the Integrated Rural Energy Development Program. A three month training program in household energy data collection and analysis was provided to four Chinese. A household energy survey of 1800 households in three rural counties was the focus of the analysis. A second survey of three more counties was also designed based on the experiences gained in analyzing the first survey.

**Field Studies and Organization of Summer Study Program in Henan Province -- 1985-1989**

Dr. Wirtshafter made numerous trips to Henan Province to study energy efficiency and renewable energy development in China. This included the organization of three seven-week summer field-work courses on rural energy issues jointly sponsored by the Energy Management and Policy Program, the Appropriate Technology Program and the City and Regional Planning Department at the University of Pennsylvania.

**Publications:**

 “Evaluation Issues for DSM and Renewable Energy Development in China: How Applicable Is Our Present Knowledge Base, with S. Nadel, *Energy Program Evaluation: Uses, Methods, and Results, 1995 International Energy Program Evaluation Conference*, Chicago, August 1995.

“An Assessment of China’s Integrated Rural Energy Development Project” World Bank 1995.

Feasibility of Reducing Greenhouse Gas Emissions in the Residential and Commercial Sectors of China, World Bank 1994.

"Small Power Plants in China: Is Small Beautiful?" with E. Shih, *World Development* Vol. 18, No. 4, April 1990.

Rural Household Energy Use in China, World Bank, 1989.

“Energy Conservation Standards for Buildings in China", *Energy the International Journal,* Vol. 13 No. 3, 1988.

"Energy Conservation in Chinese Housing," with Chang Song-ying, *Energy Policy* April 1987.

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