

STATE OF ILLINOIS
ILLINOIS COMMERCE COMMISSION

COMMONWEALTH EDISON COMPANY :
: Petition to approve an Advanced Metering :
: Infrastructure Pilot Program and associated tariffs :

No. 09-0263

OFFICIAL FILE

I.C.C. DOCKET NO. 09-0263
1000 Exhibit No. 1000 10.1

Witness _____
Date 8/19/09 Reporter CC

Admi Hed
8/19/09 CES

Rebuttal Testimony of
AHMAD FARUQUI, PH.D.
Principal,
The Brattle Group

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
I. Introduction & Summary.....	1
II. Response to Witness Alexander.....	3
III. Response to Witness Brightwell.....	8
IV. Conclusions.....	10

1 **I. Introduction & Summary**

2 **Q. Please state your name and business address.**

3 A. My name is Ahmad Faruqi. My business address is 353 Sacramento Street, Suite 1140,
4 San Francisco, California.

5 **Q. By whom and in what position are you employed?**

6 A. I am a Principal with The Brattle Group.

7 **Q. On whose behalf are you testifying in this proceeding?**

8 A. I am testifying on behalf of Commonwealth Edison Company (“ComEd”).

9 **Q. Please state your qualifications.**

10 A. I have a doctoral degree in economics from the University of California at Davis and
11 have authored, co-authored or co-edited four books and more than one hundred articles,
12 papers and reports on various aspects of energy policy. A major focus of my work during
13 the past thirty years has been the design and evaluation of pricing experiments. My early
14 work on time-of-use pricing is cited in Professor Bonbright’s text on public utility
15 regulation¹.

16 I was one of the lead designers and evaluators of California’s Statewide Pricing
17 Pilot with time-based pricing. I was also the lead investigator in BGE’s dynamic pricing
18 experiment which ran during the summer of 2008 and is being renewed this summer.
19 And I am the lead designer and evaluator of Northeast Utilities’ time-based pricing
20 experiment which is being carried out in Connecticut this summer. In addition, I have

¹ James C. Bombright, Albert L. Danielsen, David R. Kamerschen, Principles of Public Utility Rates, Public Utility Reports (2^d ed., 1988).

21 been tracking pilots that have been conducted elsewhere in the United States, Canada,
22 Europe and Australia. Several of these are summarized in a paper referenced in footnote
23 5 below.

24 Additional information about my qualifications appears in my resume which is
25 appended to this testimony.

26 **Q. What has been your involvement with the ComEd Customer Applications proposal**
27 **being considered by the Commission in this docket?**

28 A. I had a significant role in preparing the Evaluation Plan associated with the Customer
29 Applications pilot submitted by ComEd.

30 **Q. Please state the purpose of your testimony.**

31 A. The purpose of my testimony is to respond to certain issues that have been raised by AG-
32 AARP witnesses Ms. Barbara Alexander and Staff witness Dr. David Brightwell
33 concerning the Customer Applications portion of ComEd's AMI pilot.

34 **Q. What is the main purpose of ComEd's proposed Customer Applications Pilot?**

35 A. The main purpose is to provide insights into customer behavior associated with utility
36 demand response and energy efficiency programs. These insights can be used by ComEd
37 to inform the cost-benefit analysis of new technologies such as advanced metering
38 infrastructure (AMI), web-based informational feedback, in-home display devices,
39 programmable communicating thermostats, and new rate designs such as dynamic pricing
40 and inclining (sometimes also called increasing) block rates.

41 Well designed customer application pilots can yield valuable information should
42 be considered with other information when looking at whether or not to deploy AMI and
43 associated technologies and rate designs.

44 **II. Response to Witness Alexander**

45 **Q. Witness Barbara Alexander contends that the ComEd experiment will duplicate the**
46 **pilot programs conducted in other states.² Does Witness Alexander's testimony**
47 **present a fair and complete summary of the information that has already developed**
48 **and the studies that have already been done?**

49 **A.** No. She merely states her opinion. Despite decades of experimentation, a great deal of
50 new work needs to be done in the area since new rates and technologies continue to
51 evolve and so does customer behavior. I say that as someone who has been involved in
52 all facets of pilot design during the past three decades and one who has read just about
53 everything that has been written about time-based pricing experiments. ComEd is not
54 proposing to repeat pricing options that have already been explored but to focus on new
55 ones.

56 **Q. Do you and Witness Alexander approach the question of evaluating past experience**
57 **and future study design from the same background?**

58 **A.** No. We have very different qualifications and experiences. My degrees are in
59 economics with a heavy emphasis on econometrics and quantitative methods. I have
60 three decades of experience in designing and evaluating pricing experiments. Her
61 degrees are in political science and law. As best as I can determine, she has not had an

² Alexander, lines 507-8, page 25.

62 opportunity to study the economics of dynamic pricing in detail and to have first-hand
63 experience in designing and evaluating pricing experiments to the same extent as I have.

64 **Q. Is Witness Alexander correct in saying that it is unnecessary for ComEd to conduct**
65 **its own dynamic pricing pilot as outlined in ComEd's application?**

66 A. No. She is not correct. It would not be possible for ComEd or the Commission to arrive
67 at a definitive conclusion about the costs and benefits of a full scale AMI and customer
68 application deployment in the absence of this pilot. That is in part because of the factors
69 unique to ComEd and its service territory. Every utility service area has unique
70 conditions that impede the en masse importation of results from other service areas,
71 especially if they are far removed geographically. Factors that vary across service areas
72 include the socio-demographic characteristics of customers, economic conditions, past
73 and current rate history and climate. Each of these factors can make a significant
74 difference in the amount of demand response one is likely to observe at different price
75 points in a specific service area.³

76 My conclusion is also based on my understanding of the limitations of the pilots
77 completed to date and the uniquely desirable characteristics of the proposed ComEd
78 investigation. I am very familiar with the pilot programs conducted in other jurisdictions.
79 ComEd's pilot will answer several questions that remain unresolved based on prior work.
80 For example, what is the impact of inclining block rates on energy efficiency? What is
81 the impact of different ways of providing feedback to customers on the cost of using

³ For a summary of the experimental evidence, consult Ahmad Faruqui and Sanem Sergici, "Household Response to Dynamic Pricing of Electricity –A Survey of the Experimental Evidence," January 10, 2009. <http://www.hks.harvard.edu/hepg/>

82 energy at various times? How do these various treatments interact with each other? How
83 do they interact with dynamic pricing? How do critical peak pricing and peak time
84 rebates work when they are overlaid on a real time pricing rate? There is little prior
85 evidence with which to answer these important policy questions.

86 For all these reasons, I believe that it is imperative that the Commission approve
87 ComEd's proposed study.

88 **Q. Witness Alexander says that California's statewide pricing pilot included peak**
89 **time rebates.⁴ Is she correct?**

90 **A.** No. I was a principle designer of that pilot and have intimate and first hand knowledge
91 of what was studied in it. I spent three years designing and evaluating it and presenting,
92 interpreting and defending the results to a large working group drawn from all facets of
93 the industry. The California experiment she cites did not in fact include peak time
94 rebates and therefore provided no direct evidence on their impact. Peak time rebates
95 were tested for the first time in a small pilot carried out by the City of Anaheim in
96 California. Versions of peak-time rebate have also been subsequently tested in Ottawa,
97 Canada; Baltimore, Maryland; and Washington, D.C., although under different conditions
98 than ComEd proposes. Imprecise results were obtained from the Ottawa experiment and
99 the Washington, DC pilot has not yet published its results. The small number of studies
100 and their limitations reinforce my recommendation that that it would be beneficial for
101 ComEd to do its own study.

⁴ Alexander, line 552, page 27.

102 Q. **Witness Alexander asserts that ComEd should not test critical-peak pricing rates in**
103 **the experiment because they are “potentially dangerous” and “will make essential**
104 **electricity service more volatile and less stable for the average customer.”⁵ Is that**
105 **assertion accurate or supported?**

106 A. No. California’s experiment did not produce any backlash on critical-peak pricing nor
107 did Maryland’s experiment. Witness Alexander assumes that critical-peak pricing rates
108 are inherently un-attractive to customers but provides no proof to support her contention.
109 The very opposite may well be true. Because they offer lower off-prices than peak-time
110 rebates, critical-peak pricing rates can be designed to yield higher savings on a per-
111 customer basis. And if they are coupled with a guarantee that the customer will pay a bill
112 no higher than what they would have paid on standard rates, they can be made as risk-
113 free as peak time rebates. Various other methods of making a transition to dynamic
114 pricing are discussed in an article I wrote for the Public Utilities Fortnightly.⁶ The
115 Commission – and other stakeholders and regulators – should consider the relative
116 desirability of offering critical peak pricing or peak time rebates based on results from
117 ComEd’s proposed pilot. Conjecture and speculation, however artfully worded, are a
118 dangerous basis for policy making. The allegation that critical peak pricing rates are
119 “dangerous” is therefore not only misplaced but is likely to impede progress toward
120 reforming rate design in Illinois.

121 Q. **What data does Ms. Alexander point to support her position?**

⁵ Alexander, lines 667-8, page 34.

⁶ Ahmad Faruqui and Ryan Hledik, “Transitioning to Dynamic Pricing,” *The Public Utilities Fortnightly*, March 2009.

122 A. Rather than provide any evidence of “danger” or undesirable volatility, she simply cites
123 the BGE Smart Energy Pilot to argue that since critical-peak pricing rates and peak-time
124 rebates provide similar responses on a per-customer basis, there is no need to test both of
125 them in the ComEd pilot. She further argues that peak time rebates are the superior rate
126 design since they are likely to yield greater amounts of aggregate demand response since
127 more customers are likely to take part in them.

128 Q. **Are these claims reasons to reject or modify ComEd’s proposal?**

129 A. No. While it is true in the BGE pilot critical-peak pricing rates and peak-time rebates
130 were found to have the same degree of price responsiveness (as measured by their
131 underlying price elasticities), this conclusion has not been uniformly established across a
132 wide range of pilot programs. Results are still pending from the PowerCents DC pilot
133 that was carried out last summer in the District of Columbia. Moreover, because of
134 differences in rate and study design, it is a bit premature to conclude definitively that
135 peak time rebates and critical peak pricing would produce the same comparable response
136 in northern Illinois as they did in Maryland.

137 Q. **Witness Alexander argues that ComEd should focus the pilot on higher usage
138 residential customers. She asserts that 65.5% of the customers without electric heat
139 use less than 700 kWh a month and they are not in a position to reduce or shift
140 usage.⁷ Is she correct?**

141 A. No. In California, the average customer who uses less than 700 kWh a month reduced
142 his or her peak demand on critical days by 13.1 percent. Customers who used half as

⁷ Alexander, 643-652, page 33.

143 much energy as the average customer displayed a drop in demand of 12.2 percent and
144 those who used twice as much energy as the average customer displayed a drop in
145 demand of 14.7 percent.⁸ It is important for ComEd to study how customer response
146 varies by customer size in its service area. The response of smaller users should not be
147 predetermined to be zero. It should be the object of experimental inquiry.

148 **Q. Witness Alexander concludes that “the Commission order ComEd not to subsidize**
149 **the costs of providing a variety of in-home display devices to participating**
150 **customers, but instead allow ComEd to offer customers a variety of device and**
151 **functional options from manufacturers who might therefore be willing to provide a**
152 **reduced price on the equipment for this pilot program.” Do you agree with her**
153 **conclusion?**

154 **A.** No, it is not practical to adopt her approach in a pilot setting. It would create
155 unacceptable risks since no customers may chose to buy those technologies if the burden
156 of purchase is put on them. The effects of these technologies on electricity consumption
157 would then remain unmeasured, severely undermining the value of information coming
158 out of the pilot.

159 **III. Response to Witness Dr. Brightwell.**

160 **Q. Witness Brightwell states that “other pilots did not use AMI meters and two-way**
161 **communications to inform customers about usage” and suggests this is one of the**
162 **new features of the ComEd pilot.⁹ Do you agree?**

⁸ Alunad Faruqui and Stephen S. George, “Quantifying Customer Response to Dynamic Pricing,” *The Electricity Journal*, May 2005.

⁹ Brightwell, lines 96-97, page 5.

163 A. Yes, that is one of the many unique features of this pilot which make it worth doing.
 164 While other pilots have tested the impact of in-home displays,¹⁰ they have not tested the
 165 combined effect of in-home displays (and other informational treatments) with innovative
 166 rate designs in a manner that the ComEd pilot sets out to do.

167 Q. **Witness Dr. Brightwell recommends that the Commission not approve including**
 168 **inclining block rates in the study.¹¹ Do you agree with that conclusion?**

169 A. No, I don't. The impact of inclining block rates on energy efficiency is an under-
 170 researched topic. Two-thirds of the residential customers in the United States buy their
 171 power on declining block rates or flat rates. At the same time, utilities and states are
 172 ramping up their rebate-based energy efficiency programs. This is equivalent to pressing
 173 the gas pedal and the brake at the same time while driving a car. Inclining block rates
 174 can play a significant role in enhancing energy efficiency, possibly at lower cost and with
 175 higher sustainability.¹² They can influence both short term behavior and long term
 176 appliance purchases (by shortening the payback period).

177 However, they need to be studied rigorously because their impact on energy
 178 consumption is somewhat uncertain and their impact on peak demand is virtually
 179 unknown. While there is a large body of knowledge on how customers respond to
 180 general price increases, there is hardly any information on price elasticities by tier and on
 181 the impact of moving from flat or declining block rates to inclining block rates. It is

¹⁰ Results from a dozen pilots are summarized in Ahmad Faruqui, Saem Sergici and Ahmed Sharif, "The impact of informational feedback on electricity consumption –A survey of the experimental evidence." *Energy: The International Journal*, Special Issue on Demand Response, 2009, forthcoming.

¹¹ Brightwell, lines 115-116, page 6.

¹² Ahmad Faruqui, "Inclining toward efficiency," *The Public Utilities Fortnightly*, August 2008.

Ryan Hedrick
 OK

182 indeed true, as stated by Dr. Ross Hemphill and cited by Dr. Brightwell, that California
183 has many years of experience with inclining block rates. But there is limited evidence on
184 the impact of these rates since they were not offered in an experimental setting with
185 randomly chosen and balanced treatment and control groups. They were born in the
186 aftermath of the California Energy Crisis, as a legislated means of recovering costs
187 associated with the crisis.¹³

188 The ComEd design would allow measurement of the response of customers to
189 inclining block rates coupled with various informational treatments such as web portals
190 and in-home displays. Some analysts have argued that inclining block rates can be an
191 effective means of lowering peak demand because they target higher uses which
192 generally occur during peak hours and are associated with the use of central air
193 conditioning. The ComEd design would allow for this hypothesis to be tested and for the
194 impact on peak demand associated with inclining block rates to be compared with the
195 impact of dynamic pricing rates that specifically target peak demand.

196 **IV. Conclusions**

197 **Q. From the perspective of an expert economist and study designer, is ComEd's**
198 **experimental design is too large?**

199 **A.** No. I believe the size is consistent with the number of hypotheses it is testing about
200 customer behavior and I believe each of the hypotheses are valuable and worth testing.
201 Indeed, one could argue that the proposed design is not large enough. Other pricing
202 experiments including those in California, Connecticut and Maryland have included two

¹³ Brightwell, lines 179-181, pages 8-9.

203 price levels within the same treatment cell in order to precisely measure customer price
204 elasticities. A new pilot in Ireland is testing five pricing levels. ComEd has only
205 included a single price level per cell in order to contain costs.

206 Q. **From the perspective of an expert economist and study designer, is ComEd's**
207 **experiment unreasonably expensive?**

208 A. No. It is reasonably priced for its size and scope. The experiment has a cost of \$14.8
209 million and features some 8,000 customers in its various treatment and control groups
210 and it is testing many more cells than California's Statewide Pricing Pilot which cost \$20
211 million and featured some 2,500 customers. The California pilot was estimated to yield
212 information that was more than ten times as valuable as its cost.¹⁴ While it is difficult to
213 know whether the same ten-fold multiple would hold in ComEd's case, I would also
214 expect the benefits to significantly outweigh the costs.

215 Q. Does this complete your ^{Rebuttal} ~~direct~~ testimony?

216 A. Yes.

Ryan H Ledek

¹⁴ Ahmad Faruqui, Sanem Sergici and Ahmed Sharif, "Piloting the Smart Grid," *The Electricity Journal*, August 2009.

STATE OF ILLINOIS
ILLINOIS COMMERCE COMMISSION

COMMONWEALTH EDISON COMPANY :
 :
Petition to approve an Advanced Metering : No. 09-0263
Infrastructure Pilot Program and associated tariffs :

VERIFICATION

I, Ahmad Faruqi, being first duly sworn, states that he is Principal with The Brattle Group and has provided rebuttal testimony, identified as ComEd Ex. 10.0, on behalf of Commonwealth Edison Company ("ComEd"). ComEd Ex. 10.0 was prepared by Mr. Faruqi or under his direction and control. Under penalties as provided by law pursuant to Section 1-109 of the Code of Civil Procedure, the undersigned certifies that the statements set forth in this instrument are true and correct, except as to matters therein stated to be on information and belief and as to such matters the undersigned certifies as aforesaid that he verily believes the same to be true.



Ahmad Faruqi

Admi Neal
8/19/09
CNS

AHMAD FARUQUI

PRINCIPAL

Dr. Faruqui is one of the world's leading experts on the design and evaluation of innovative energy programs involving the customer, such as dynamic pricing, block rate design, demand response and energy efficiency. His other areas of expertise include load forecasting and cost-benefit analysis, especially as it relates to advanced metering infrastructure (AMI) and smart grid systems.

His recent engagements include:

- Led a state-by-state assessment of demand response potential in the United States for the Federal Energy Regulatory Commission which was filed with Congress
- Assisted the Midwest ISO and ISO-New England foster price responsive demand
- Analyzed the impacts of BGE's Smart Energy Pricing pilot
- Designed Northeast Utilities' Plan-It Wise pilot with dynamic pricing
- Assisted a Midwestern utility redesign a residential real-time pricing program
- Assisted the Bonneville Power Administration and Portland General Electric in evaluating the potential for demand response
- Developed a long range assessment for EPRI of the likely impact of energy efficiency and demand response programs on U.S. customer electricity demand
- Wrote a whitepaper on dynamic pricing for the Demand Response Research Center
- Assisted the California Energy Commission in assessing the potential impact of load management standards in the state
- Led the design and impact evaluation of California's award-winning Statewide Pricing Pilot (SPP), which informed the development of AMI business cases for the state's three investor-owned utilities
- Sponsored expert testimony on demand response before the California Public Utilities Commission on behalf of the state's two largest investor-owned utilities
- Designed experiments and focus groups to assess customer response and acceptance of new pricing designs for two utilities located on the East coast
- Conducted cost-benefit analyses of dynamic pricing and AMI for utilities in the Pacific Northwest, the Southwest, the Midwest, the Mid-Atlantic and the Southeast
- Assisted the PJM regional transmission operator and utilities in the Southwest and Western regions to assess the accuracy of their load forecasts
- Worked with a large utility in the Southeast to assess alternative incentive mechanisms to reward shareholders for energy efficiency programs
- Wrote a whitepaper for the Edison Electric Institute on third party administration of energy efficiency programs
- Assessed the feasibility of using biofuels in the power plants of a western utility to meet the state's new stringent renewable portfolio standards

AHMAD FARUQUI
Principal

2

Dr. Faruqui has appeared on energy matters before the state senates in California and Minnesota, the city council in the District of Columbia and state regulatory commissions in California, Delaware, Illinois, Ontario (Canada), and Maryland.

He has written whitepapers that discuss state-of-the-art pricing designs and policy actions for transitioning to those designs for the California Energy Commission, the Demand Response Research Center (DRRC), the Edison Electric Institute (EEI), and the Electric Power Research Institute (EPRI). His work for the DRRC was cited by the California Public Utilities Commission in its landmark decision in August 2008 making dynamic pricing the default rate design in California once AMI has been fully deployed.

His work has been prominently featured in the mass media. He has been quoted in *Business Week*, *Christian Science Monitor*, *Forbes*, *Newsweek*, *National Geographic*, *The Economist*, *Technology Review*, *The Wall Street Journal*, and *USA Today*. He has also appeared on Fox Business News and National Public Radio.

He has spoken at events sponsored by the Commonwealth Club of California, DR Expo, EEI, EPRI, EUCI, GridWeek, Infocast, Indiana Smart Grid, Illinois Smart Grid, NARUC, , The Sopris Foundation, and the U.S. Department of Energy.

Dr. Faruqui has co-edited four books on energy pricing, forecasting, and customer choice and authored or co-authored more than a hundred papers in various U.S., European, Middle Eastern, African, and South Asian periodicals. He has taught economics at the University of California at Davis, San Jose State University, and the University of Karachi, Pakistan. In addition, he has given guest lectures at Carnegie Mellon University, Michigan State University, New Mexico State University, Rutgers University, The University of California at Berkeley, The University of San Francisco, Stanford University, and Utah State University.

He holds a doctoral degree in economics from the University of California at Davis, where he was a Regents fellow and where he wrote his dissertation on demand forecasting under a grant from the Kellogg Foundation. He holds bachelors and masters, degrees from the University of Karachi, Pakistan where he was awarded a Gold Medal in economics.

AHMAD FARUQUI
Principal

3

AREAS OF EXPERTISE

- *Regulatory strategy.* He has helped design forward-looking programs and services that exploit recent advances in rate design and digital technologies in order to lower customer bills and improve utility earnings while lowering the carbon footprint and preserving system reliability.
- *Cost-benefit analysis of advanced metering infrastructure.* He has assessed the feasibility of introducing smart meters and other devices, such as programmable communicating thermostats that promote demand response, into the energy marketplace, in addition to new appliances, buildings, and industrial processes that improve energy efficiency.
- *Demand forecasting and weather normalization.* He has pioneered the use of a wide variety of models for forecasting product demand in the near-, medium-, and long-term, using econometric, time series, and engineering methods. These models have been used to bid into energy procurement auctions, plan capacity additions, design customer-side programs, and weather normalize sales.
- *Customer choice.* He has developed methods for surveying customers in order to elicit their preferences for alternative energy products and alternative energy suppliers. These methods have been used to predict the market size of these products and to estimate the market share of specific suppliers.
- *Hedging, risk management, and market design.* He has helped design a wide range of financial products that help customers and utilities cope with the unique opportunities and challenges posed by a competitive market for electricity. He conducted a widely-cited market simulation to show that real-time pricing of electricity could have saved Californians millions of dollars during the Energy Crisis by lowering peak demands and prices in the wholesale market.
- *Competitive strategy.* He has helped clients develop and implement competitive marketing strategies by drawing on his knowledge of the energy needs of end-use customers, their values and decision-making practices, and their competitive options. He has helped companies reshape and transform their marketing organization and reposition themselves for a competitive marketplace. He has also helped government-owned entities in the developing world prepare for

AHMAD FARUQUI
Principal

4

privatization by benchmarking their planning, retailing, and distribution processes against industry best practices, and suggesting improvements by specifying quantitative metrics and follow-up procedures.

- *Design and evaluation of marketing programs.* He has helped generate ideas for new products and services, identified successful design characteristics through customer surveys and focus groups, and test marketed new concepts through pilots and experiments.
- *Expert witness.* He has testified before state commissions in California and Iowa and helped clients testify before commissions in Colorado, Delmarva, the District of Columbia, Georgia, Maryland, Minnesota, and Ontario, Canada. He has made presentations to the California Energy Commission, the California Senate, the Congressional Office of Technology Assessment, the Minnesota Department of Commerce, the Minnesota Senate, the Missouri Public Service Commission, and the Electricity Pricing Collaborative in the state of Washington. In addition, he has led a variety of professional seminars and workshops on public utility economics around the world and taught economics at the university level.

RELEVANT EXPERIENCE

- 2008-2009 *National Assessment of Demand Response Potential: Federal Energy Regulatory Commission.*

Led a team of consultants to assess the economic and achievable potential for demand response programs on a state-by-state basis. The assessment was filed with the U.S. Congress, as required by the Energy Independence and Security Act of 2007.

- 2008 *Cost-Benefit Analysis of the Smart Grid: Rocky Mountain Utility.*

Reviewed the leading studies on the economics of the smart grid and used the findings to assess the likely cost-effectiveness of deploying the smart grid in one geographical location.

AHMAD FARUQUI**Principal**

5

- 2008 *Impact Evaluation of a Residential Dynamic Pricing Experiment: Mid-Atlantic Utility.*

Designed the pilot and carried out an impact evaluation with the purpose of measuring the impact of critical peak pricing (CPP) and peak time rebates (PTR) on residential customer consumption patterns. The pilot also tested the influence of the Energy Orb and switches that remotely adjust the duty cycle of central air conditioners.

- 2008 *Impact Simulation of Ameren Illinois Utilities' Power Smart Pricing Program.*

Simulated the potential demand response of residential customers enrolled to real-time prices. Results of this simulation were presented to the Midwest ISO's Supply Adequacy Working Group (SAWG) to explore alternative ways of introducing price responsive demand in the region.

- 2008 *The Economics of Biofuels.*

For a western utility that is facing stringent renewable portfolio standards and that is heavily dependent on imported fossil fuels, carried out a systematic assessment of the technical and economic ability of biofuels to replace fossil fuels.

- 2007-2008 *The Case for Dynamic Pricing: Demand Response Research Center.*

Led a project involving the California Public Utilities Commission, the California Energy Commission, the state's three investor-owned utilities, and other stakeholders in the rate design process. Identified key issues and barriers associated with the development of time-based rates. Revisited the fundamental objectives of rate design, including efficiency and equity, with a special emphasis on meeting the state's strongly-articulated needs for demand response and energy efficiency. Developed a score-card for evaluating competing rate designs and applied it to a set of illustrative rates that were created for four customer classes using actual utility data. The work was reviewed by a national peer-review panel.

AHMAD FARUQUI
Principal

6

- 2007 *Evaluation of the Demand Response Benefits of Advanced Metering Infrastructure: Mid-Atlantic Utility.*

Conducted a comprehensive assessment of the benefits of advanced metering infrastructure (AMI) by developing dynamic pricing rates that are enabled by AMI. The analysis focused on customers in the residential class and commercial and industrial customers under 600 kW load.

- 2006-2007 *Developed a Customer Price Response Model: Large Eastern Utility.*

Specified, estimated, tested, and validated a large-scale model that analyzes the response of some 2,000 large commercial customers to rising steam prices. The model includes a module for analyzing conservation behavior, another module for forecasting fuel switching behavior, and a module for forecasting sales and peak demand.

- 2006 *Comprehensive Review of Load Forecasting Methodology: Large Regional Transmission Organization (RTO).*

Conducted a comprehensive review of models for forecasting peak demand and re-estimated new models to validate recommendations. Individual models were developed for 18 transmission zones as well as a model for the RTO system.

- 2006 *Developed Models for Forecasting Hourly Loads: Merchant Generation and Trading Company.*

Using primary data on customer loads, weather conditions, and economic activity, developed models for forecasting hourly loads for residential, commercial, and industrial customers for three utilities in a Midwestern state. The information was used to develop bids into an auction for supplying basic generation services.

- 2002-2006 *Estimation of Demand Response Impacts: Major California Utility.*

Worked with the staff of this electric utility in designing dynamic pricing options for residential and small commercial and industrial customers. These options were designed to promote demand response during critical peak days. The analysis supported the utility's advanced metering infrastructure (AMI) filing with the

AHMAD FARUQUI
Principal

7

California Public Utilities Commission. Subsequently, the commission unanimously approved a \$1.7 billion plan for rolling out nine million electric and gas meters based in part on this project work.

- 2002-2004 *Assessment of Demand-Side Management and Rate Design Options: Large Middle Eastern Electric Utility.*

Prepared an assessment of demand-side management and rate design options for the four operating areas and six market segments. Quantified the potential gains in economic efficiency that would result from such options and identified high priority programs for pilot testing and implementation. Held workshops and seminars for senior management, managers, and staff to explain the methodology, data, results, and policy implications.

- 2002-2005 *Design an Impact Evaluation of the Statewide Pricing Pilot: Three California Utilities.*

Working with a consortium of California's three investor-owned utilities to design a statewide pricing pilot to test the efficacy of dynamic pricing options for mass-market customers. The pilot was designed using scientific principles of experimental design and measured changes in usage induced by dynamic pricing for over 2,500 residential and small commercial and industrial customers. The impact evaluation was carried out using state-of-the-art econometric models. Information from the pilot was used by all three utilities in their business cases for advanced metering infrastructure (AMI). The project was conducted through a public process involving the state's two regulatory commissions, the power agency, and several other parties.

- 2002-2007 *Economics of Dynamic Pricing: Two California Utilities.*

Reviewed a wide range of dynamic pricing options for mass-market customers. Conducted an initial cost-effectiveness analysis and updated the analysis with new estimates of avoided costs and results from a survey of customers that yielded estimates of likely participation rates.

AHMAD FARUQUI
Principal

8

- 2001-2002 *Economics of Time-of-Use Pricing: A Pacific Northwest Utility.*

This utility ran the nation's largest time-of-use pricing pilot program. Assessed the cost-effectiveness of alternative pricing options from a variety of different perspectives. Options included a standard three-part time-of-use rate and a quasi-real-time variant where the prices vary by day. Worked with the client in developing a regulatory strategy. Worked later with a collaborative to analyze the program's economics under a variety of scenarios of the market environment.

- 2001-2002 *Economics of Dynamic Pricing Options for Mass Market Customers*
Client: A Multi-State Utility.

Identified a variety of pricing options suited to meet the needs of mass-market customers, and assessed their cost-effectiveness. Options included standard three-part time-of-use rates, critical peak pricing, and extreme-day pricing. Developed plans for implementing a pilot program to obtain primary data on customer acceptance and load shifting potential. Worked with the client in developing a regulatory strategy.

- 2001-2002 *Real-Time Pricing in California*
Client: California Energy Commission.

Surveyed the national experience with real-time pricing of electricity, directed at large power customers. Identified lessons learned and reviewed the reasons why California was unable to implement real-time pricing. Catalogued the barriers to implementing real-time pricing in California, and developed a program of research for mitigating the impacts of these barriers.

- 2001-2002 *Likely Future Impact of Demand-Side Programs on Carbon Emissions*
Client: The Keystone Center.

As part of the Keystone Dialogue on Climate Change, developed scenarios of future demand-side program impacts, and assessed the impact of these programs on carbon emissions. The analysis was carried out at the national level for the U.S. economy, and involved a bottom-up approach involving many different types of programs including dynamic pricing, energy efficiency, and traditional load management.

AHMAD FARUQUI
Principal

9

- 1999-2000 *Risk-Based Pricing*
 Client: Midwestern Utility.

Developed and tested new pricing products for this utility that allowed it to offer risk management services to its customers. One of the products dealt with weather risk; another one dealt with risk that real-time prices might peak on a day when the customer does not find it economically viable to cut back operations.

- 1998-1999 *Market-Based Pricing of Electricity*
 Client: A Large Southern Utility.

Reviewed pricing methodologies in a variety of competitive industries including airlines, beverages, and automobiles. Recommended a path that could be used to transition from a regulated utility environment to an open market environment featuring customer choice in both wholesale and retail markets. Held a series of seminars for senior management and their staffs on the new methodologies.

- 1997-1998 *Tools for Electricity Pricing*
 Client: Consortium of Several U.S. and Foreign Utilities.

Developed Product Mix, a software package that uses modern finance theory and econometrics to establish a profit-maximizing menu of pricing products. The products range from the traditional fixed-price product to time-of-use prices to hourly real-time prices, and also include products that can hedge customers' risks based on financial derivatives. Outputs include market share, gross revenues, and profits by product and provider. The calculations are performed using probabilistic simulation, and results are provided as means and standard deviations. Additional results include delta and gamma parameters that can be used for corporate risk management. The software relies on a database of customer load response to various pricing options called StatsBank. This database was created by metering the hourly loads of about one thousand commercial and industrial customers in the United States and the United Kingdom.

AHMAD FARUQUI**Principal**

10

- 1997 *Gas Demand Forecasting System*
Client: *A Leading Gas Marketing and Trading Company, Texas.*

Developed a system for gas nominations for a leading gas marketing company that operated in 23 local distribution company service areas. The system made week-ahead and month-ahead forecasts using advanced forecasting methods. Its objective was to improve the marketing company's profitability by minimizing penalties associated with forecasting errors.

- 1996-1997 *Sustaining Energy Efficiency Services in a Restructured Market*
Client: *Southern California Edison.*

Helped in the development of a regulatory strategy for implementing energy efficiency strategies in a restructured marketplace. Identified the various players that are likely to operate in a competitive market, such as third-party energy service companies (ESCOS) and utility affiliates. Assessed their objectives, strengths, and weaknesses and recommended a strategy for the client's adoption. This strategy allowed the client to participate in the new market place, contribute to public policy objectives, and not lose market share to new entrants. This strategy has been embraced by a coalition of several organizations involved in the California PUC's working group on public purpose programs.

- 1996-1997 *Organizational Assessments of Capability for Energy Efficiency*
Client: *U.S. Agency for International Development, Cairo, Egypt.*

Conducted in-depth interviews with senior executives of several energy organizations, including utilities, government agencies, and ministries to determine their goals and capabilities for implementing programs to improve energy end-use efficiency in Egypt. The interviews probed the likely future role of these organizations in a privatized energy market, and were designed to help develop U.S. AID's future funding agenda.

- 1996-1997 *Enhancing Profitability Through Energy Efficiency Services*
Client: *Jamaica Public Service Company.*

Developed a plan for enhancing utility profitability by providing financial incentives to the client utility, and presented it for review and discussion to the

AHMAD FARUQUI
Principal

11

utility's senior management and Jamaica's new Office of Utility Regulation. Developed regulatory procedures and legislative language to support the implementation of the plan. Conducted training sessions for the staff of the utility and the regulatory body.

- 1994-1996 *Competitive Energy and Environmental Technologies*
Clients: Consortium of clients, led by Southern California Edison, Included the Los Angeles Department of Water and Power and the California Energy Commission.

Developed a new approach to segmenting the market for electrotechnologies, relying on factors such as type of industry, type of process and end-use application, and size of product. Developed a user-friendly system for assessing the competitiveness of a wide range of electric and gas-fired technologies in more than 100 four-digit SIC code manufacturing industries and 20 commercial businesses. The system includes a database on more than 200 end-use technologies, and a model of customer decision making.

- 1992 *Market Infrastructure of Energy Efficient Technologies*
Client: EPRI

Reviewed the market infrastructure of five key end-use technologies, and identified ways in which the infrastructure could be improved to increase the penetration of these technologies. Data was obtained through telephone interviews with equipment manufacturers, engineering firms, contractors, and end-use customers.

SELECTED PUBLICATIONS

Books

- *Electricity Pricing in Transition.* Co-editor with Kelly Eakin. Kluwer Academic Publishing, 2002.
- *Pricing in Competitive Electricity Markets.* Co-editor with Kelly Eakin. Kluwer Academic Publishing, 2000.

AHMAD FARUQUI**Principal**

12

-
- *Customer Choice: Finding Value in Retail Electricity Markets*. Co-editor with J. Robert Malko. Public Utilities Inc. Vienna, Virginia: 1999.
 - *The Changing Structure of American Industry and Energy Use Patterns*. Co-editor with John Broehl. Battelle Press, 1987.

Technical Reports

- *Demand-Side Bidding in Wholesale Electricity Markets*. With Robert Earle. Australian Energy Market Commission, 2008.
<http://www.aemc.gov.au/electricity.php?r=20071025.174223>
- *Assessment of Achievable Potential for Energy Efficiency and Demand Response in the U.S. (2010-2030)*. With Ingrid Rohmund, Greg Wikler, Omar Siddiqui, and Rick Tempchin. American Council for an Energy-Efficient Economy, 2008.
- *Quantifying the Benefits of Dynamic Pricing in the Mass Market*. With Lisa Wood. Edison Electric Institute, January 2008.
- California Energy Commission. *2007 Integrated Energy Policy Report*, CEC-100-2007-008-CMF.
- *Applications of Dynamic Pricing in Developing and Emerging Economies*. Prepared for The World Bank, Washington, DC. May 2005.
- *Preventing Electrical Shocks: What Ontario—And Other Provinces—Should Learn About Smart Metering*. With Stephen S. George. C. D. Howe Institute Commentary, No. 210, April 2005.
- *Primer on Demand-Side Management*. Prepared for The World Bank, Washington, DC. March 21, 2005.

AHMAD FARUQUI**Principal**

13

-
- *Electricity Pricing: Lessons from the Front.* With Dan Violette. White Paper based on the May 2003 AESP/EPRI Pricing Conference, Chicago, Illinois, EPRI Technical Update 1002223, December 2003.
 - *Electric Technologies for Gas Compression.* Electric Power Research Institute, 1997.
 - *Electrotechnologies for Multifamily Housing.* With Omar Siddiqui. EPRI TR-106442, Volumes 1 and 2. Electric Power Research Institute, September 1996.
 - *Opportunities for Energy Efficiency in the Texas Industrial Sector.* Texas Sustainable Energy Development Council. With J. W. Zarnikau et al. June 1995.
 - *Principles and Practice of Demand-Side Management.* With John H. Chamberlin. EPRI TR-102556. Palo Alto: Electric Power Research Institute, August 1993.
 - *EPRI Urban Initiative: 1992 Workshop Proceedings (Part I).* The EPRI Community Initiative. With G.A. Wikler and R.H. Manson. TR-102394. Palo Alto: Electric Power Research Institute, May 1993.
 - *Practical Applications of Forecasting Under Uncertainty.* With K.P. Seiden and C.A. Sabo. TR-102394. Palo Alto: Electric Power Research Institute, December 1992.
 - *Improving the Marketing Infrastructure of Efficient Technologies: A Case Study Approach.* With S.S. Shaffer. EPRI TR- 10 1 454. Palo Alto: Electric Power Research Institute, December 1992.
 - *Customer Response to Rate Options.* With J. H. Chamberlin, S.S. Shaffer, K.P. Seiden, and S.A. Blanc. CU-7131. Palo Alto: Electric Power Research Institute (EPRI), January 1991.

Articles and Chapters

- "Smart Meters and Smart Pricing: A Survey of the Experimental Evidence," with Sanem Sergici, *Metering International*, Issue 2 2009, pp 68-69.

AHMAD FARUQUI**Principal****14**

-
- "Smart Grid Strategy: Quantifying Benefits," with Peter Fox-Penner and Ryan Hledik, *Public Utilities Fortnightly*, July 2009 32-37.
 - "The Power of Dynamic Pricing," with Ryan Hledik and John Tsoukalis, *The Electricity Journal*, April 2009, pp. 42-56.
 - "Transitioning to Dynamic Pricing," with Ryan Hledik, *Public Utilities Fortnightly*, March 2009, pp. 26-33.
 - "Ethanol 2.0," with Robert Earle, *Regulation*, Winter 2009.
<http://www.cato.org/pubs/regulation/regv31n4/v31n4-noted.pdf>
 - "Inclining Toward Efficiency," *Public Utilities Fortnightly*, August 2008, pp. 22-27.
http://www.fortnightly.com/exclusive.cfm?o_id=94
 - "California: Mandating Demand Response," with Jackalyne Pfannenstiel, *Public Utilities Fortnightly*, January 2008, pp. 48-53.
 - "Avoiding Load Shedding by Smart Metering and Pricing," with Robert Earle, *Metering International*, Issue 1 2008, pp. 76-77.
 - "The Power of 5 Percent," with Ryan Hledik, Sam Newell, and Hannes Pfeifenberger, *The Electricity Journal*, October 2007, pp. 68-77.
 - "Pricing Programs: Time-of-Use and Real Time," *Encyclopedia of Energy Engineering and Technology*, September 2007, pp. 1175-1183.
 - "Breaking Out of the Bubble: Using demand response to mitigate rate shocks," *Public Utilities Fortnightly*, March 2007, pp. 46-48 and pp. 50-51.
 - "From Smart Metering to Smart Pricing," *Metering International*, Issue 1, 2007.

AHMAD FARUQUI**Principal**

15

-
- "Demand Response and the Role of Regional Transmission Operators," with Robert Earle, *2006 Demand Response Application Service*, Electric Power Research Institute, 2006.
 - "2050: A Pricing Odyssey," *The Electricity Journal*, October, 2006.
 - "Demand Response and Advanced Metering," *Regulation*, Spring 2006. 29:1 24-27. <http://www.cato.org/pubs/regulation/regv29n1/v29n1-3.pdf>
 - "Reforming electricity pricing in the Middle East," with Robert Earle and Anees Azzouni, *Middle East Economic Survey (MEES)*, December 5, 2005.
 - "Controlling the thirst for demand," with Robert Earle and Anees Azzouni, *Middle East Economic Digest (MEED)*, December 2, 2005.
 - "California pricing experiment yields new insights on customer behavior," with Stephen S. George, *Electric Light & Power*, May/June 2005.
 - "Quantifying Customer Response to Dynamic Pricing," with Stephen S. George, *Electricity Journal*, May 2005.
 - "Dynamic pricing for the mass market: California experiment," with Stephen S. George, *Public Utilities Fortnightly*, July 1, 2003, pp. 33-35.
 - "Toward post-modern pricing," Guest Editorial, *The Electricity Journal*, July 2003.
 - "Demise of PSE's TOU program imparts lessons," with Stephen S. George. *Electric Light & Power*, January 2003, pp.1 and 15.
 - "2003 Manifesto on the California Electricity Crisis," with William D. Bandt, Tom Campbell, Carl Danner, Harold Demsetz, Paul R. Kleindorfer, Robert Z. Lawrence, David Levine, Phil McLeod, Robert Michaels, Shmuel S. Oren, Jim Ratliff, John G. Riley, Richard Rumelt, Vernon L. Smith, Pablo Spiller, James Sweeney, David Teece,

AHMAD FARUQUI
Principal

16

Philip Verleger, Mitch Wilk, and Oliver Williamson. May 2003. Posted on the AEI-Brookings Joint Center web site, at

<http://www.aei-brookings.org/publications/abstract.php?pid=341>.

- "Reforming pricing in retail markets," with Stephen S. George. *Electric Perspectives*, September/October 2002, pp. 20-21.
- "Pricing reform in developing countries," *Power Economics*, September 2002, pp. 13-15.
- "The barriers to real-time pricing: separating fact from fiction," with Melanie Mauldin, *Public Utilities Fortnightly*, July 15, 2002, pp. 30-40.
- "The value of dynamic pricing," with Stephen S. George, *The Electricity Journal*, July 2002, pp. 45-55.
- "The long view of demand-side management programs," with Gregory A. Wikler and Ingrid Bran, in *Markets, Pricing and Deregulation of Utilities*, Michael A. Crew and Joseph C. Schuh, editors, Kluwer Academic Publishers, 2002, pp. 53-68.
- "Time to get serious about time-of-use rates," with Stephen S. George, *Electric Light & Power*, February 2002, Volume 80, Number 2, pp. 1-8.
- "Getting out of the dark: Market based pricing can prevent future crises," with Hung-po Chao, Vic Niemeyer, Jeremy Platt and Karl Stahlkopf, *Regulation*, Fall 2001, pp. 58-62. <http://www.cato.org/pubs/regulation/regv24n3/specialreport2.pdf>
- "Analyzing California's power crisis," with Hung-po Chao, Vic Niemeyer, Jeremy Platt and Karl Stahlkopf, *The Energy Journal*, Vol. 22, No. 4, pp. 29-52.
- "Hedging Exposure to Volatile Retail Electricity Prices," with Bruce Chapman, Dan Hansen and Chris Holmes, *The Electricity Journal*, June 2001, pp. 33-38.

AHMAD FARUQUI

Principal

17

-
- "California Syndrome," with Hung-po Chao, Vic Niemeyer, Jeremy Platt and Karl Stahlkopf, *Power Economics*, May 2001, Volume 5, Issue 5, pp. 24-27.
 - "The choice not to buy: energy savings and policy alternatives for demand response," with Steve Braithwait, *Public Utilities Fortnightly*, March 15, 2001.
 - "Tomorrow's Electric Distribution Companies," with K. P. Seiden, *Business Economics*, Vol. XXXVI, No. 1, January 2001, pp. 54-62.
 - "Bundling Value-Added and Commodity Services in Retail Electricity Markets," with Kelly Eakin, *Electricity Journal*, December 2000.
 - "Summer in San Diego," with Kelly Eakin, *Public Utilities Fortnightly*, September 15, 2000.
 - "Fighting Price Wars," *Harvard Business Review*, May-June 2000.
 - "When Will I See Profits?" *Public Utilities Fortnightly*, June 1, 2000.
 - "Mitigating Price Volatility by Connecting Retail and Wholesale Markets," with Doug Caves and Kelly Eakin, *Electricity Journal*, April 2000.
 - "The Brave New World of Customer Choice," with J. Robert Malko, appears in *Customer Choice: Finding Value in Retail Electricity Markets*, Public Utilities Report, 1999.
 - "What's in Our Future?," with J. Robert Malko, appears in *Customer Choice: Finding Value in Retail Electricity Markets*, Public Utilities Report, 1999.
 - "Creating Competitive Advantage by Strategic Listening," *Electricity Journal*, May 1997.
 - "Competitor Analysis," *Competitive Utility*, November 1996.

AHMAD FARUQUI**Principal**

18

-
- "Forecasting in a Competitive Environment: The Need for a New Paradigm," *Demand Forecasting for Electric Utilities*, Clark W. Gellings (ed.), 2nd edition, Fairmont Press, 1996.
 - "Defining Customer Solutions through Electrotechnologies: A Case Study of Texas Utilities Electric," with Dallas Frandsen et al. *ACEEE 1995 Summer Study on Energy Efficiency in Industry*. ACEEE: Washington, D.C., 1995.
 - "Opportunities for Energy Efficiency in the Texas Industrial Sector," *ACEEE 1995 Summer Proceedings*.
 - "Study on Energy Efficiency in Industry," with Jay W. Zamikau et al. *ACEEE*: Washington, D.C., 1995.
 - "Promotion of Energy Efficiency through Environmental Compliance: Lessons Learned from a Southern California Case Study," with Peter F. Kyricopoulos and Ishtiaq Chisti. *ACEEE 1995 Summer Study on Energy Efficiency in Industry*. ACEEE: Washington, D.C., 1995.
 - "ATLAS: A New Strategic Forecasting Tool," with John C. Parker et al. *Proceedings: Delivering Customer Value, 7th National Demand-Side Management Conference*. EPRI: Palo Alto, CA, June 1995.
 - "Emerging Technologies for the Industrial Sector," with Peter F. Kyricopoulos et al. *Proceedings: Delivering Customer Value, 7th National Demand-Side Management Conference*. EPRI: Palo Alto, CA, June 1995.
 - "Estimating the Revenue Enhancement Potential of Electrotechnologies: A Case Study of Texas Utilities Electric," with Clyde S. King et al. *Proceedings: Delivering Customer Value, 7th National Demand-Side Management Conference*. EPRI: Palo Alto, CA, June 1995.

AHMAD FARUQUI

Principal

19

-
- “Modeling Customer Technology Competition in the Industrial Sector,” *Proceedings of the 1995 Energy Efficiency and the Global Environment Conference*, Newport Beach, CA, February 1995.
 - “Clouds in the Future of DSM,” with G.A. Wikler and J.H. Chamberlin. *Electricity Journal*, July 1994.
 - “The Changing Role of Forecasting in Electric Utilities,” with C. Melendy and J. Bloom. *The Journal of Business Forecasting*, pp. 3-7, Winter 1993–94. Also appears as “IRP and Your Future Role as Forecaster.” *Proceedings of the 9th Annual Electric Utility Forecasting Symposium*. Electric Power Research Institute (EPRI). San Diego, CA, September 1993.
 - “Stalking the Industrial Sector: A Comparison of Cutting Edge Industrial Programs,” with P.F. Kyriopoulos. *Proceedings of the ACEEE 1994 Summer Study on Energy Efficiency in Buildings*. ACEEE: Washington, D.C., August 1994.
 - “Econometric and End-Use Models: Is it Either/Or or Both?” with K. Seiden and C. Melendy. *Proceedings of the 9th Annual Electric Utility Forecasting Symposium*. Electric Power Research Institute (EPRI). San Diego, CA, September 1993.
 - “Savings from Efficient Electricity Use: A United States Case Study,” with C.W. Gellings and S.S. Shaffer. *OPEC Review*, June 1993.
 - “The Trade-Off Between All-Ratepayer Benefits and Rate Impacts: An Exploratory Study,” *Proceedings of the 6th National DSM Conference*. With J.H. Chamberlin. Miami Beach, FL. March 1993.
 - “The Potential for Energy Efficiency in Electric End-Use Technologies,” with G.A. Wikler, K.P. Seiden, and C.W. Gellings. *IEEE Transactions on Power Systems*. Seattle, WA, July 1992.

AHMAD FARUQUI**Principal****20**

-
- “The Dynamics of New Construction Programs in the 90s: A Review of the North American Experience,” with G.A. Wikler. *Proceedings of the 1992 Conference on New Construction Programs for Demand-Side Management*, May 1992.
 - “Forecasting Commercial End-Use Consumption” (Chapter 7), “Industrial End-Use Forecasting” (Chapter 8), and “Review of Forecasting Software” (Appendix 2) in *Demand Forecasting in the Electric Utility Industry*. C.W. Gellings and P.E. Lilbum (eds.): The Fairmont Press, 1992.
 - “Innovative Methods for Conducting End-Use Marketing and Load Research for Commercial Customers: Reconciling the Reconciled,” with G.A. Wikler, T. Alereza, and S. Kidwell. *Proceedings of the Fifth National DSM Conference*. Boston, MA, September 1991.
 - “Potential Energy Savings from Efficient Electric Technologies,” with C.W. Gellings and K.P. Seiden. *Energy Policy*, pp. 217–230, April 1991.
 - “Demand Forecasting Methodologies: An overview for electric utilities,” with Thomas Kuczmowski and Peter Lilienthal, *Energy: The International Journal*, Volume 15, Issues 3-4, March-April 1990, pp. 285-296.
 - “The Residential Demand for Electricity by Time-of-Use: A survey of twelve experiments with peak load pricing,” with J. Robert Malko, *Energy: The International Journal*, Volume 8, Issue 10, October 1983, pp. 781-795.
 - “Time-of-Use Rates and the Modification of Electric Utility Load Shapes,” with J. Robert Malko, *Challenges for Public Utility Regulation in the 1980s*, edited by H.M. Trebing, Michigan State University Public Utilities Papers, 1981.
 - “Implementing Time-Of-Day Pricing of Electricity: Some Current Challenges and Activities,” with J. Robert Malko, *Issues in Public Utility Pricing and Regulation*, edited by M. A. Crew, Lexington Books, 1980.