

ARIZONA CORPORATION COMMISSION

IN THE MATTER

**of the
Application of Arizona Public Service Company for a
Hearing to Determine the Fair Value of the Utility Property of the Company
for Ratemaking Purposes, to Fix a Just and Reasonable
Rate of Return Thereon, to Approve Rate Schedules Designed to Develop
Such Return, and to Amend Decision No. 67744**

Docket No. E-01345A-05-0816

**Direct Testimony of
J. Richard Hornby**

**On behalf of
The Residential Utility Consumer Office**

August 18, 2006

1 **Q. Please state your name, position and business address.**

2 A. My name is J. Richard Hornby. I am a Senior Consultant at Synapse Energy
3 Economics, Inc, 22 Pearl Street, Cambridge, MA 02139.

4 **Q. On whose behalf are you testifying in this case?**

5 A. I am testifying on behalf of the Residential Utility Consumer Office (“RUCO”).

6 **Q. Please describe Synapse Energy Economics.**

7 A. Synapse Energy Economics ("Synapse") is a research and consulting firm
8 specializing in energy and environmental issues, including electric generation,
9 transmission and distribution system reliability, market power, electricity market
10 prices, stranded costs, efficiency, renewable energy, environmental quality, and
11 nuclear power.

12 **Q. Please summarize your work experience and educational background.**

13 A. I am a consultant specializing in planning, market structure, ratemaking and gas
14 supply/fuel procurement in the electric and gas industries. Over the past twenty
15 years I have has presented expert testimony and provided litigation support on
16 these issues in approximately 100 proceedings in over thirty jurisdictions in the
17 United States and Canada. Over this period my clients have included staff of
18 public utility commissions, state energy offices, consumer advocate offices and
19 marketers.

20 Prior to joining Synapse in 2006, I was a Principal with CRA International,
21 formerly Tabors Caramanis & Associates. From 1986 to 1998 I worked with the
22 Tellus Institute (formerly Energy Systems Research Group); initially as Manager
23 of the Natural Gas Program and subsequently as Director of their Energy Group.
24 Prior to 1986 I was Assistant Deputy Minister of Energy for the Province of Nova
25 Scotia.

26 I have a Master of Science in Energy Technology and Policy from the
27 Massachusetts Institute of Technology and a Bachelor of Industrial Engineering

1 from the Technical University of Nova Scotia, now merged with Dalhousie
2 University.

3 A copy of my current resume is attached as Exhibit JRH-1.

4 **Q. Mr. Hornby, have you previously testified before the Arizona Corporation**
5 **Commission?**

6 A. Yes. I have testified in Dockets Nos.. E-1032-93-111; U-1551-91-069; U-1240-
7 90-051; U-1551-89-102 and 103 as well as U-1345-87-069.

8 **Q. What is the purpose of your testimony.**

9 A. Synapse was retained by RUCO to analyze the generation and associated costs
10 included in APS base rate application.

11 **Q. What data sources did you rely upon to prepare your testimony?**

12 A. My primary sources of data were the Company's filing and its responses to
13 information requests.

14 **Q. Please summarize your findings.**

15 A. My findings are that:

- 16 • the primary purpose of APS' hedging program is to stabilize the prices that it
17 pays for its natural gas and purchased power,
- 18 • it is inappropriate and misleading to measure either the performance or
19 benefits of the APS hedging program in terms of its savings relative to market
20 prices for natural gas and purchased power at the time of delivery,
- 21 • stabilization of natural gas and purchased power prices, in and of itself, is not
22 a major benefit to APS ratepayers,
- 23 • the detailed design of the APS hedging program does not appear to be based
24 upon quantitative studies or analyses, and
- 25 • APS has not presented a corresponding explicit strategy to minimize its
26 natural gas and purchased power costs.

1 Q. **Please summarize your recommendations.**

2 A. I recommend that the Arizona Corporation Commission:

- 3 • require APS to measure the performance of the hedging program in terms of
4 the stability of APS natural gas and purchased power prices,
- 5 • require APS to develop a strategy to minimize its natural gas and purchased
6 power costs, in the context of minimizing its overall costs, and place as much
7 emphasis on that strategy as on its hedging program,
- 8 • reject APS' proposal to exclude 10% of the gains and losses under the
9 hedging program from the determination of the Base Fuel Recovery Amount
10 and the 90/10 sharing of fuel and purchased power costs under the PSA, and
- 11 • require APS to limit the membership of any committees responsible for the
12 hedging strategy applicable to its regulated operations to employees of its
13 regulated operations.

14 Q. **Please begin by summarizing the problem that APS is facing with respect to**
15 **natural gas and purchased power prices.**

16 A. APS is facing two problems with respect to natural gas and purchased power
17 prices. First, the levels of those prices have more than doubled between 2002 and
18 2005. Second, natural gas and purchased power prices are quite volatile. Mr.
19 Ewen describes these problems on pages 14 to 20 of his prefiled Direct
20 Testimony, and in his Attachments PME-8 through PME-14.

21 Q **Is the APS hedging program designed to minimize the level of prices APS**
22 **pays for natural gas and purchased power?**

23 A. No. None of the APS witnesses has stated that the hedging program is
24 specifically designed to minimize the level of prices APS pays for natural gas and
25 purchased power. On the contrary, APS indicates in the June 12 Hedge Plan that
26 its cost minimization opportunities are limited (RUCO 8.2, attachment
27 APS08164). In addition, the consultant commissioned by APS to assess its
28 hedging program explicitly states that cost minimization is not a goal of the

1 hedging plan in his report dated October 13, 2005 (RUCO 8.2 C, attachment
2 APS08175).

3 **Q. Is the APS hedging program designed to minimize the volatility of the prices**
4 **APS pays for natural gas and purchased power?**

5 A. Yes. The primary purpose of the hedging program is to stabilize the price that
6 APS pays for its natural gas and purchased power. Mr. Robinson states that the
7 program "...protects the Company and its customers from dramatic price swings
8 in the commodity markets" (Direct Testimony page 19 line 17). APS' June 12,
9 2005 Hedge Plan and July 2005 Hedge Policy (RUCO 8.2, attachment
10 APS08165) both identify price stability as the primary goal. In addition, the
11 consultant commissioned by APS to assess its hedging program states in his
12 report that price stability is the goal.

13 **Q. Please summarize how APS achieves price stability though its hedging**
14 **program.**

15 A. Mr. Robinson describes APS hedging program in general terms in his pre-filed
16 Direct Testimony, on pages 17 and 18. In response to discovery APS provided
17 further, confidential, details of the program (RUCO 8.2) and the non-confidential
18 testimony of Mr. Thomas Carlson dated September 30, 2005 from Docket No. E-
19 01345A-05-0526 (RUCO 13.1).

20 In summary, APS' current strategy is to hedge 85% of the purchased power and
21 natural gas it will require in a calendar year prior to the start of that calendar year.
22 It accomplishes this goal by entering into a portfolio of contracts over a three year
23 time horizon in advance of the calendar year using a "laddered" approach. Under
24 this approach APS enters into contracts for a set percentage, e.g. portion A, of its
25 projected requirements for the calendar year three years in advance, a set
26 percentage two years in advance, e.g., portion B, and a set percentage one year in
27 advance, e.g. portion C. Thus, prior to the start of the calendar year in which it
28 will actually require delivery of the natural gas and purchased power it has
29 covered a total of 85% of those requirements, i.e. (A% + B% +C%). APS uses a
30 variety of mechanisms, primarily financial natural gas futures contracts traded on

1 NYMEX and physical contracts for power and natural gas. The NYMEX futures
2 market is a source of public forward prices for each future month of delivery.

3 **Q. How does stabilizing the prices of natural gas and purchased power through**
4 **its hedging program benefit APS?**

5 A. Hedging 85% of its annual natural gas and power requirements several months in
6 advance of its fiscal year enables APS to prepare an accurate budget for those
7 costs in the fiscal year. An accurate budget of its natural gas and purchased
8 power costs benefits APS in terms of managing cash flow and meeting its
9 earnings targets.

10 **Q. Has APS presented any evidence demonstrating that stabilization of natural**
11 **gas and purchased power prices, in and of itself, is of major benefit to**
12 **ratepayers?**

13 A. No. In the absence of any evidence to the contrary it is reasonable to conclude that
14 the commodity price stability that APS achieves through its hedging program is of
15 only modest benefit to ratepayers. This conclusion is based primarily on the fact
16 that ratepayers do not feel the impact of fluctuations in natural gas and purchased
17 power spot prices from day to day or month to month in anywhere near the same
18 way as APS. As a buyer, APS is directly exposed to those fluctuations and sees
19 their full impact immediately. In contrast, APS ratepayers only see the impacts of
20 fluctuations when their cumulative impact is of a magnitude sufficient for APS to
21 request either an adjustment in the PSA or a request for a change in base rates.

22 **Q You mentioned earlier that the APS hedging program is not designed to**
23 **minimize the level of prices APS pays for natural gas and purchased power.**
24 **Please reconcile that statement with the fact that Mr. Wheeler and Mr. Ewen**
25 **highlight the savings that APS achieved in 2005, and was projecting to**
26 **achieve in 2006, through its hedging program.**

27 A. The “savings” to which Mr. Wheeler and Mr. Ewen refer are calculated by
28 comparing the costs of the quantities of natural gas and purchased power APS has
29 covered with hedges to the market prices, either estimated or actual, for those

1 volumes at the time of delivery. My review indicates that those savings are a
2 fortuitous side effect of the operation of the APS hedging program rather than the
3 outcome of a deliberate strategy by APS to minimize the prices it pays for those
4 commodities.

5 **Q. Should the performance, or benefits, of the APS hedging program be**
6 **measured in terms of savings relative to actual spot prices?**

7 A. No. Since the hedging program is not designed to achieve those savings it is
8 inappropriate and misleading to measure either its performance or benefits against
9 such savings. As noted earlier, the goal of the hedging program is to stabilize the
10 price that APS pays for natural gas and purchased power. Its performance should
11 be measured against that goal.

12 **Q. What is the problem with highlighting the savings that APS has achieved**
13 **through its hedging program, or measuring its performance against that**
14 **benchmark?**

15 A. There are several problems associated with using actual prices as a benchmark.
16 First, by implying that its hedging program is beneficial because of projected
17 savings relative to actual prices APS is exposing itself to the possibility of a
18 disallowance if actual prices in a future period prove to be substantially less than
19 the prices under its hedging plan. For example, Mr. Ewen initially estimated that
20 the value of APS' hedges in 2006 would be over \$205 million, of which it
21 proposed to credit 90% or \$185 million to native and off-system load (Direct
22 Testimony, Exhibit PME_WP4). However, a few months later, Mr. Ewen
23 reduced his estimate of that value to approximately \$ 7.5 million, as shown in
24 Exhibit__(JRH-2). This dramatic reduction was due to a decline in market
25 expectations for 2006 natural gas and purchased power prices between November
26 30, 2005 and February 28, 2006.

27 Second, this benchmark represents ex post results. That type of benchmark is
28 routinely criticized as inappropriate if applied in prudence reviews. A more
29 appropriate approach is to assess the design of the program in light of the facts

1 and analyses available to APS management at the time they approved the
2 execution of the various contracts.

3 Finally, using spot gas prices as a benchmark implies that it would have been
4 prudent for APS to follow a strategy of acquiring 100% of its natural gas and
5 purchased power requirements at spot prices. It is questionable whether such a
6 strategy would be considered prudent under current gas and power market
7 conditions given APS' obligation as a regulated utility to provide reliable service
8 at reasonable rates.

9 **Q. Please comment on the APS strategy for acquiring natural gas and**
10 **purchased power.**

11 A. My primary concern is that the APS strategy for acquiring natural gas and
12 purchased power seems to consist solely of its hedging program. There is no
13 corresponding explicit cost minimization strategy. In order to provide reliable
14 service at reasonable cost APS should have a comprehensive strategy that seeks to
15 minimize its natural gas and purchased power costs, in the context of minimizing
16 its overall costs, as well as to minimize the volatility of those commodity prices.
17 For example, Southwest Gas indicates that its policy is to acquire a "best cost
18 portfolio" considering reliability, price, flexibility and protection from short-term
19 volatility (Southwest Gas presentation, ACC Natural Gas forum, September 8,
20 2005). Similarly, in Arkansas gas utilities are required to develop a portfolio
21 consisting of "...an appropriate combination of different types of gas purchase
22 contracts and/or financial hedging instruments that are designed to yield the
23 optimum balance of reliability, reduced volatility and reasonable price."¹

24 **Q. Has APS provided the quantitative studies or analyses upon which it based**
25 **the details of its hedging program.**

26 A. No. APS did not provide any such studies or analyses in response to our
27 discovery (RUCO 13-2 c).

1 In general, APS' strategy of hedging a portion of its requirements in advance by
2 entering into a portfolio of contracts tied to futures prices is consistent with the
3 general approach being used by gas utilities in Arizona and elsewhere. APS'
4 decision to hedge 85 % of its requirements starting three years in advance is a
5 more aggressive strategy than that of Arizona gas utilities. They are hedging
6 approximately 60% of their requirements starting 18 months to a year in advance.
7 The APS strategy is supported by the review conducted by its independent
8 consultant. In addition there are several states in which 100% of the supply for
9 default service is covered by contracts for purchased power (e.g., New Jersey,
10 Maine, Illinois, Maryland, District of Columbia and Delaware). Nevertheless, I
11 expected that APS would provide quantitative analyses to support the details of its
12 program, in particular the specific portions hedged in each of the three years in
13 advance and the total hedge percentage of 85%.

14 Acquiring futures over a three year period prior to delivery has appeal because
15 one is locking in a price. Moreover, futures prices from any particular point in
16 time tend to be either flat or declining the farther out the delivery date. This
17 characteristic is illustrated in Exhibit ___(JRH-3), which plots the annual
18 averages of futures prices for 2005 through 2008 drawn from four past periods
19 (April 01/March 02; April 02/March 03; April 03/March 04; April 04/March 05).
20 Page one plots annual average futures prices for natural gas at Henry Hub and
21 Page two plots annual average futures prices for on-peak power at Palo Verde.

22 This Exhibit also illustrates a key question that arises both with respect to hedging
23 and cost minimization, i.e., what quantity to lock-in at each point in time in
24 advance of delivery. If the market for natural gas and purchased power is rising
25 consistently, as it has done over the past several years, a buyer may be tempted to
26 lock-in a large portion of requirements in advance at what the buyer considers is a
27 reasonable price. On the other hand, the buyer may be concerned that such a

¹ Arkansas Public Service Commission, Natural Gas Procurement Plan Rules, Docket 01-023-NOI, Order 5, April 19, 2002.

1 commitment may reduce his or her ability to take advantage of a future decrease
2 in prices due to change in market conditions.

3 **Q. Do you agree with the APS proposal to exclude 10 percent of its gains and**
4 **losses under the hedging program from the determination of the Base Fuel**
5 **Recovery Amount and from the operation of the 90/10 sharing of fuel and**
6 **purchased power costs under the PSA?**

7 A. No. Mr. Robinson presents this proposal in his Direct Testimony. He has
8 provided no rationale for this proposal other than to provide APS an additional
9 financial incentive to avoid losses under its hedging program. He has not
10 demonstrated that APS would operate the program any differently were his
11 proposal to be approved (RUCO 8. 29 c).

12 I disagree with this proposal. First, as noted earlier, it is not appropriate to
13 measure the performance of the hedging program in terms of its savings or losses
14 relative to actual spot prices. Second, APS has an obligation to provide reliable
15 service at reasonable rates. It has a responsibility to make decisions and take
16 actions to achieve that objective, including running a hedging program. By
17 making those decisions, and taking those actions, APS management is simply
18 doing its job,. Third, APS already has a financial incentive to control all its fuel
19 and purchased power costs in the form of the 90/10 sharing under the PSA.

20 **Q. Do you have comments on any other aspect of APS hedging program?**

21 A. Yes. APS long-term hedge strategy for gas and purchased power to serve its
22 native load is developed by two senior executives from its Marketing and Trading
23 group and one from its regulated operations. My understanding is that the
24 Marketing and Trading group is not part of APS regulated operations, but instead
25 participates for its own account as a marketer and trader in power and natural gas
26 markets. Based on that understanding I do not believe it is appropriate for anyone
27 from the Marketing and Trading Group to be involved with the development or
28 implementation of the hedging program applicable to APS regulated operations. I
29 recommend that APS review the relationship between its Marketing and Trading
30 personnel and its regulated personnel. Based on that review APS should consider

1 limiting the membership of the committees responsible for the hedging strategy
2 applicable to its regulated operations to employees of its regulated operations.

3 **Q. Does this complete your testimony at this time?**

4 **A. Yes.**

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. *Senior Consultant*, 2006 to present.

Analysis and expert testimony regarding planning, market structure, ratemaking and contracting issues in the electricity and natural gas industries.

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

Principal, 2004-2006.

Senior Consultant, 1998-2004.

Provided expert testimony and litigation support in several energy contract price arbitration proceedings, as well as in electric and gas utility ratemaking proceedings in Ontario, New York, Nova Scotia and New Jersey. Managed a major productivity improvement and planning project for two electric distribution companies within the Abu Dhabi Water and Electricity Authority. Analyzed a range of market structure and contracting issues in wholesale electricity markets.

Tellus Institute, Boston, MA.

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

Presented expert testimony on rates for unbundled retail services in restructured retail markets and analyzed the options for purchasing electricity and gas in those markets.

Manager of Natural Gas Program, 1986–1997.

Prepared testimony and reports on a range of gas industry issues including market structure, unbundled services, ratemaking, strategic planning, market analyses, and supply planning.

Nova Scotia Department of Mines and Energy, Halifax, Canada; 1981–1986

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

Member of a federal-provincial board responsible for regulating petroleum industry exploration and development activity offshore Nova Scotia.

Assistant Deputy Minister of Energy 1983–1986

Responsible for analysis and implementation of provincial energy policies and programs, as well as for Energy Division budget and staff. Directed preparation of comprehensive energy plan emphasizing energy efficiency and use of provincial energy resources. Senior technical advisor on provincial team responsible for negotiating and implementing a federal/provincial fiscal, regulatory, and legislative regime to govern offshore oil and gas. Directed analyses of proposals to develop and market natural gas, coal, and tidal power resources. Also served as Director of Energy Resources (1982-1983) and Assistant to the Deputy Minister (1981-1982).

Nova Scotia Research Foundation, Dartmouth, Canada, Consultant, 1978–1981
Edited Nova Scotia's first comprehensive energy plan. Administered government-funded industrial energy conservation program—audits, feasibility studies, and investment grants.

Canadian Keyes Fibre, Hantsport, Canada, Project Engineer, 1975–1977

Imperial Group Limited, Bristol, England, Management Consultant, 1973–1975

SELECTED TESTIMONY

Testimony before an arbitration panel in Toronto, Ontario, on behalf of a cogeneration plant regarding a dispute over a component of the price for steam under a 20-year contract. January 2006.

Testimony before an arbitration panel in Halifax, Nova Scotia, on behalf of Nova Scotia Power against Shell Canada regarding the determination of a new price under their ten year natural gas supply contract. October 2005.

State of New York, Public Service Commission, Case 00-M-0504, September 2002 and October 2002. Review of estimates of embedded costs of unbundled services (e.g., supply, distribution, metering, billing), and associated proposed rates, filed by Consolidated Edison of New York and New York State Electric and Gas respectively.

State of New Jersey Board of Public Utilities, BPU Docket GM00080564, April 2001. Analysis of the proposed transfer of gas supply and capacity contracts from Public Service Electric and Gas to an unregulated affiliate, and the full requirements supply contract associated with that transfer.

Nova Scotia Utility and Review Board, NSUARB-NG-SEMPRA-SEM-00-08, February 2001. Review of proposed distribution service tariff, including methodology for setting market-based rates, rates for large customers and default supply.

State of New Jersey Board of Public Utilities, BPU Docket EX99009676, March 2000. Analysis of the design and pricing of customer account services to be offered by utilities on an unbundled basis.

United States of America Bonneville Power Administration, BPA Docket WP-02, (TCA #391), November 1999. Functionalization of Communication Plant.

South Carolina Public Service Commission, 99-006-G, South Carolina Electric and Gas, October 1999. Reasonableness of purchased gas costs.

State of New Jersey Board of Public Utilities, BPU Dockets GO99030122–GO99030125, July 1999 and sur-rebuttal September 1999. Analysis of service unbundling policies and rates proposed in filings of Public Service Electric & Gas, South Jersey Gas, New Jersey Natural Gas, and Elizabethtown Gas.

Maine Public Utilities Commission, Docket 97-393, Northern Utilities Inc., September 1998 and rebuttal December 1998. Review of request for approval of rate redesign and partial unbundling proposal.

Pennsylvania Public Utility Commission, R-00984281, A-12250F0008, Peoples Natural Gas, May 1998. Analysis of the reasonableness of 1998 1307(f) filing and proposal to transfer production assets to affiliate.

State of New Jersey, Board of Public Utilities, BPU E09707 0465, OAL PUC-7309-97, BPU E09707 0464, OAL PUC-7310-97, January 1998 with Supplemental and Sur-rebuttal March 1998. Analysis of rate unbundling filing of Rockland Electric Company.

State of New Jersey, Board of Public Utilities, BPU EO9707 0459, OAL PUC- 7308-97, BPU E09707 0458, OAL PUC-7307-97, November 1997. Analysis of rate unbundling filing of Jersey Central Power & Light Company d/b/a GPU Energy.

Pennsylvania Public Utility Commission, R-00963858, Equitable Gas Company, June 1997 with rebuttal and sur-rebuttal July 1997. Analysis of the reasonableness of rate structure proposals.

Pennsylvania Public Utility Commission, R-00973896 and A-0012250F-0007, (Tellus 97-065) Peoples Natural Gas Company, May 1997. Review of 1997 1307(f) filing, proposal to transfer producing assets to CNG Producing Company, and proposed Migration Rider.

South Carolina Public Service Commission, 97-009-G, South Carolina Pipeline Corporation, April 1997. Reasonableness of proposal to acquire an additional 75,700 Mcf/day of capacity from Transco.

Federal Energy Regulatory Commission, RP95-197-001, RP97-71-000, March 1997. Review of proposed rolled-in ratemaking for Leidy Line incremental facilities.

Arkansas Public Service Commission 95-401-U, Arkla, September 1996. Review of proposed gas purchasing and transportation plan.

Maine Public Utilities Commission, 95-480, 95-481, April 1996, proposed Precedent Agreement between Northern Utilities, Inc. and Granite State Gas Transmission, Inc. for LNG Storage Service (95-480); and PNGTS for Transportation Service (95-481).

Rhode Island Public Utilities Commission, 2025, November 1995, Settlement Agreement reached between ProvGas and the Division of Public Utilities and Carriers.

Pennsylvania Public Utility Commission, R-953406, October 1995, application of T.W. Phillips Gas and Oil Co. for increase in rates and changes in rate and tariff design.

Illinois Commerce Commission, 95-0219, August 1995, application of Northern Illinois Gas Company for increase in rates and changes in rate and tariff design.

Pennsylvania Public Utility Commission, R-953316, May 1995, purchased gas costs and gas procurement of Columbia Gas of Pennsylvania with Supplemental Direct Testimony and Sur-Rebuttal Testimony.

Pennsylvania Public Utility Commission R-943252, (Tellus 95-039), May 1995, application of Peoples Natural Gas Company for increase in rates and changes in rate and tariff design.

South Carolina Public Service Commission, 94-007-G, (Tellus 95-038), April 1995, reasonableness of 1994 purchased gas costs of South Carolina Pipeline Corporation.

Pennsylvania Public Utility Commission R-943207, (Tellus 95-014), March 1995, 1995 Purchased Gas Adjustment filing of National Fuel Gas Distribution Corp.

Pennsylvania Public Utility Commission, R-00943063, (Tellus 94-271), December 1994, design of FERC Order 636 transition cost tariff of UGI Utilities, Inc.

South Carolina Public Service Commission, 94-008-G, (Tellus 94-173), October 1994, 1994 Purchased Gas Adjustment of South Carolina Electric and Gas Co.

Oklahoma Corporation Commission, PUD 920, 001342, (Tellus 93-250) September 1994, reasonableness of gas supply strategy of Public Service of Oklahoma, including payments to Transok, Inc. for transportation and agency services and rate mechanism for cost recovery. November 1994 Rebuttal testimony in above docket.

Pennsylvania Public Utility Commission, R-943078, (Tellus 94-155), September 1994, Market Sensitive Sales Service proposed by Pennsylvania Gas and Water Company (PG&W).

Massachusetts Department of Public Utilities, D.P.U. 93-141-A, (Tellus 94-184), September 1994, response to questions regarding policies on interruptible transportation and capacity release in DPU IT/CAPACITY RELEASE SCOPE document dated June 16, 1994. October 1994 Comments in above docket.

Hawaii Public Utilities Commission, 7259, (Tellus 94-020), August 1994, HELCO'S proposed DSM programs for competitive energy end-use markets and its multi-attribute analysis.

Pennsylvania Public Utility Commission, R-00943066, (Tellus 94-135), July 1994, 1994 Purchased Gas Adjustment of Pennsylvania Gas and Water Company. August 1994 Sur-rebuttal testimony in above docket.

Pennsylvania Public Utility Commission, R-942993, R-942993 C0001-C0004, (Tellus 94-110), May 1994, proposal of Pennsylvania Gas and Water Company for recovery of FERC Order 636 transition costs. May 1994 Rebuttal testimony in above docket.

Pennsylvania Public Utility Commission, R-943001, (Tellus 94-018), May 1994, application of Columbia Gas of Pennsylvania for an increase in rates and changes in rate design, specifically Negotiated Sales Service.

Pennsylvania Public Utility Commission, R-943029, (Tellus 94-093), May 1994, 1994 Purchased Gas Adjustment of Columbia Gas of Pennsylvania.

Pennsylvania Public Utility Commission, R-932866, R-932915, (Tellus 93-243), 1994, Direct and rebuttal testimony on application of Peoples Natural Gas Company for increase in rates and changes in rate design. March 1994 Rebuttal testimony in above docket.

Kansas Corporation Commission, 180,056-U, (Tellus 92-105), February 1994, Oral Testimony on IRP Rules for gas utilities.

Arizona Corporation Commission, E-1032-93-111, (Tellus 93-099), December 1993, application of Citizens Utility Company, Arizona Gas Division, for an increase in rates, and changes in rate design. January 1994 Sur-rebuttal testimony in above docket.

Hawaii Public Utilities Commission, 7257 (Tellus 93-144B5), December 1993, proposed DSM programs for end-use markets, specifically HECO's residential sector water heating program.

Hawaii Public Utilities Commission, 7261 (Tellus 93-171), September 1993, GASCO IRP. December 1993 Rebuttal testimony in above docket.

Pennsylvania Public Utility Commission, R-932655, R-932655 C001, R-932655 C002, (Tellus93-149), September 1993, balancing service charge proposed by PG&W.

Pennsylvania Public Utility Commission, R-932676, (Tellus 93-092), July 1993, 1993 Purchased Gas Adjustment filing of Pennsylvania Gas and Water Company. July 1993 Rebuttal Testimony in above docket.

Public Utilities Commission of Rhode Island, 2025, (Tellus 93-018), April 1993, Providence Gas Company Integrated Resource Plan.

Pennsylvania Public Utility Commission, I-900009, C-913669, (Tellus 91-074), March 1993, Equitable's charges for transportation service and cost allocation methods in general.

Arkansas Public Service Commission, 92-178-U, (Tellus 92-014), August 1992, Stipulation and Agreement concerning gas cost and purchasing practices issues in Dockets No.91-093-U (Arkla Energy Resources) and No. 92-032-U (Arkansas Louisiana Gas).

Colorado Public Utilities Commission, 91R-642EG, (Tellus 91-203), August 1992, Draft, proposed gas integrated resource planning (IRP) rule.

Pennsylvania Public Utility Commission, R-00922324, (Tellus 92-117), July 1992, 1992 Purchased Gas Adjustment filing of PG&W. July 1992 Supplemental Testimony in above docket.

Pennsylvania Public Utility Commission, R-922180, (Tellus 92-039), May 1992, application of Peoples Natural Gas Company for an increase in rates and accompanying changes, in rate design. June 1992 Rebuttal Testimony in above docket. June 1992 Sur-rebuttal Testimony in above docket

Michigan Public Commission, U-10030, (Tellus 91-120), April 1992, 1992 Gas Cost Recovery Plan submitted Service by Consumers Power Company, specifically the role of demand-side management as a resource in five-year forecast and supply plan.

Pennsylvania Public Utility Commission, R-912140, (Tellus 92-038), March 1992, review of 1992 Purchased Gas Adjustment of T.W. Phillips.

Federal Energy Regulatory Commission, RP91-161-000 et al., RP91-160-000 et al., (Tellus 91-175), February 1992, review of cost allocation and rate design issues in rate case application of Columbia Gas Transmission and Columbia Gulf Transmission (on behalf of PA OCA).

Arkansas Public Service Commission, 91-093-U, (Tellus 92-014), February 1992, establishment of a base cost of gas for Arkla Energy Resources (AER), modification of Purchased Gas Adjustment (PGA). June 1992 Sur-rebuttal Testimony in above docket.

New Hampshire Public Utilities Commission, DR90-183, (Tellus 91-164), January 1992, role of embedded cost-of-service studies, level of customer charges, seasonal differential in commodity rates; and class revenue requirements (Energy North Natural Gas, Inc.).

Arizona Corporation Commission, U-1551-89-102 & U-1551-89-103, U-1551-91-069, (Tellus 90-203) September 1991, Gas Procurement Practices and Purchased Gas Costs (January 1986 – November 1990) of Southwest Gas Corporation. December 1991. Rebuttal Testimony in above docket.

Maryland Public Service Commission, 8339, (Tellus 91-79), July 1991, cost allocation and rate design issues in rate case application of Baltimore Gas and Electric Company.

Public Utilities Commission of Rhode Island, 1727, (Tellus 90-135), June 1991, review of gas procurement practices of Bristol and Warren Gas Company. Sept. 1991, (Tellus 91-165), Supplemental Direct Testimony in above docket.

New Mexico Public Service Commission, 2367, (Tellus 91-030), June 1991, analysis of gas transportation policies proposed by Gas Company of New Mexico.

Pennsylvania Office of Consumer Advocate, R-911889, (Tellus 91-025), March 1991, review of gas supply strategy and purchasing practices of T.W. Phillips.

Michigan Public Service Commission, U-9752, (Tellus 90-099), March 1991, review of 1991 Gas Cost Recovery Plan submitted by Michigan Gas Company to Michigan PSC.

Arkansas Public Service Commission, 90-036-U, (Tellus 90-041), August 1990, reasonableness of certain gas supply contracts, of Arkla, Inc. and its various subsidiary companies including the Arkla-Arkoma transactions. September 1990. Prepared Rebuttal Testimony.

Arizona Corporation Commission, U-1240-90-051, (Tellus 90-059), August 1990, application of Southern Union Gas Company for a change in tariffs.

Public Utility Commission of Utah, 89-057-15, (Tellus 89-242), July 1990, Cost Allocation and Rate Design, Mountain Fuel Supply. August 1990 Rebuttal and Sur-rebuttal Testimony.

Pennsylvania Public Utility Commission, R-901595, (Tellus 90-043), June 1990, application of Equitable Gas Company for changes to its tariffs.

West Virginia Public Service Commission, 90-196-E-GI, 90-197-E-GI, (Tellus 90-025), May 1990, expanded Net Energy Cost, coal supply strategy and contracting practices, APS.

Pennsylvania Public Utility Commission, R-891572, (Tellus 90-08B), March 1990, Purchased Gas Costs and Gas Procurement, T.W. Phillips Gas and Oil Co.

Public Utilities Commission of Colorado, 89R-702G, (Tellus 89-30A), January 1990, policies and rules for gas transportation service offered by public utilities regulated by the Commission. January 1990, (Tellus 89-30B), Supplemental Testimony

Arizona Corporation Commission, U-1551-89-102 and U-1551-89-103, (ESRG 89-01), October 1989, Regulatory Oversight of Purchased Gas Costs.

Public Utilities Commission of Rhode Island, 1938, (ESRG 89-139), October 1989, Sales Forecast, Cost Allocation, Rate Design, Narragansett Electric Company.

Pennsylvania Public Utility Commission, R891293, (ESRG 89-92), July 1989, Purchased Gas Costs & Gas Procurement, Pennsylvania Gas and Water. July 1989 Rebuttal Testimony.

Pennsylvania Public Utility Commission, R891236, (ESRG 89-48), May 1989, Take-or-Pay Cost Recovery, Columbia Gas of Pennsylvania.

New Jersey Board of Public Utilities, GR 88070-877, (ESRG 88-150A), February 1989, Take-or-Pay Cost Recovery, Public Service Electric and Gas.

New Jersey Board of Public Utilities, GR 88080-913-Phase II (ESRG 88-150C), February 1989, Take-or-Pay Cost Recovery, South Jersey Gas Company.

New Jersey Board of Public Utilities, GR 88081-019-Phase II (ESRG 88-150D), February 1989, Take-or-Pay Cost Recovery, Elizabethtown Gas Company.

New Jersey Board of Public Utilities, 88080913, (ESRG 88-102), December 1988, Take-or-Pay Cost Recovery, Elizabethtown Gas Company.

Montana Public Service Commission, 87.7.33, 88.2.4, 88.5.10, 88.8.23, (ESRG 88-117), December 1988, Gas Procurement, Transportation Service, Gas Adjustment Clause, Montana-Dakota Utilities Company.

New Jersey Board of Public Utilities, GR 88081-019, (ESRG 88-103), November 1988, Take-or-Pay Cost Recovery, South Jersey Gas Company.

New Jersey Board of Public Utilities, GR 88070-877 (ESRG 88-89), October 1988, Take-or-Pay Cost Recovery, Public Service Electric and Gas.

Public Service Commission of District of Columbia, Formal Case 874, (ESRG 88-58), September 1988, Gas Acquisition, Gas Cost Allocation, Take-or-Pay Cost, Regulatory Oversight; District of Columbia Natural Gas.

Illinois Commerce Commission, 88-0103, (ESRG 88-68), July 1988, Take-or-Pay Cost Recovery.

Public Service Commission of West Virginia, 240-G, (ESRG 88-42), June 1988, Gas Transportation Rate Design.

Pennsylvania Public Utility Commission, R-880958, (ESRG 88-29), June 1988, Purchased Gas Adjustment, Pennsylvania Gas & Water Company.

Public Service Commission of Utah, 86-057-07, (ESRG 87-111), March 1988, Gas Transportation Rate Design; Mountain Fuel Supply.

South Carolina Public Service Commission, 83-126-G, 86-217-G, (ESRG 87-106), January 1988, Gas Supply and Rate Design, Piedmont Gas Company.

South Carolina Public Service Commission, 87-227-G, (ESRG 87-64), September 1987, Gas Supply and Rate Design, South Carolina Electric and Gas.

Arizona Corporation Commission, U-1345-87-069, (ESRG 87-48), September 1987, Fuel Adjustment Clause.

SELECTED RESEARCH AND CONSULTING, PUBLICATIONS, AND PRESENTATIONS

Research and analysis underlying testimony filed before the Ontario Energy Board by Mr. Ralph Luciani on behalf of Greater Toronto Airport Authority regarding rates for standby and distribution service to customers with load displacement generation, Docket No. RP-2005-0020, January 2006. CRA # DO8676-00.

Consulting services to Abu Dhabi Water and Electricity Authority on electric distribution system performance. Identify metrics for technical, economic and service quality performance, establish benchmarks, develop and help implement, a decision-making framework and a set of decision-support tools for identifying and evaluating measures to improve productivity. (2003–2004)

Litigation support, research and analysis underlying testimony filed by Dr. Richard Tabors and Dr. Assef Zobian on behalf of ProGas in two gas supply contract arbitration proceedings regarding the interpretation of, and arbitration proceedings regarding, the pricing provisions in their long-term gas supply contracts with Ocean States Power. (2000 –2004)

Review of Initial Report on Company-Specific Separate Proceedings and Generic Reevaluations; Published Natural Gas Price Data; and Enron Trading Strategies, August 2002. Co-author of report to Powerex Corporation, filed in FERC Docket A02-2.TCA # 592. (2002)

Consulting to the Nova Scotia Petroleum Directorate regarding interpretation of fiscal arrangements in the Canada-Nova Scotia Offshore Petroleum Resources Accord. TCA #781. (2002)

Research and analysis underlying testimony filed before the Federal Energy Regulatory Commission by Dr. Richard Tabors on behalf of Powerex Corporation and the Transaction Finality Group regarding the need for price mitigation in the Pacific Northwest, Docket Nos. EL01-10-000; EL01-10-001, October 2001. TCA # 592.

Research and analysis underlying testimony filed before the Michigan Public Service Commission by Dr. Richard Tabors regarding methodologies for calculating stranded costs and the market value of the generating units of DECo and of Consumers Energy Company based on sales of comparable units. Case No. U-12639, April 2001. TCA # 516.

Consulting to the Houston-Galveston Area Council on the formation of an electric aggregation for city and county governments. TCA #585. (2001)

Consulting to Staff of the Arkansas Public Service Commission regarding gas-purchasing practices of local gas utilities. TCA #582. (2001–2002)

Consulting to the South Carolina Department of Consumer Affairs on a range of gas utility ratemaking issues. TCA #548. (2001–2002)

Review of the cost-benefit analysis of RTO West, and the challenges to that analysis. TCA #646 (2001–2002).

Consulting to an independent power plant regarding the reasonableness of the rate it was being charged for utility standby service. TCA #518 (2000).

Consulting to an energy marketer regarding a strategy for energy service providers to replace utilities as providers of standard offer and default services. TCA #517. (2000)

Consulting to the Nova Scotia Petroleum Directorate on the tariff for gas distribution service and on policies to govern the licensing of retail gas suppliers. TCA #461. (2000)

Assistance to the National Association of State Utility Consumer Advocates (NASUCA) in reviewing, and preparing comments on, *Regulation of Short-Term Natural Gas Transportation Services* (FERC Docket RM98-10-000) and *Regulation of Interstate Natural Gas Transportation Services* (FERC Docket RM98-12-000). Tellus 98-014. Principal investigator, 1998.

Assistance to the Oklahoma Attorney General's Office re: Oklahoma Corporation Commission's Rulemaking Proceedings on Gas Unbundling in Oklahoma. OCC Case No. RM9700009. Tellus No. 97-105, 1997.

Assistance to the Province of Nova Scotia re: The Sable Offshore Energy Project and related pipeline projects. Assessment of U.S. market for Nova Scotia gas—demand, existing supply, proposed supply. Tellus 96-209, 1997.

Consulting to Massachusetts Division of Energy Resources re retail gas market restructuring, including proposals in Boston Gas rate case. Docket 96-50. Tellus 96-064 (1996–1998).

Consulting to Pennsylvania Office of Consumer Advocate. Gas Industry Restructuring in Pennsylvania. Tellus analyzed key issues raised by the proposed legislation for restructuring the gas industry in Pennsylvania. Tellus 95-323, 95-093, (1996–1998)

Consultant to Staff of the Georgia Public Service Commission as sub-contractor to Foster Associates. Atlanta Gas Light rate cases and rate unbundling filing. Tellus No. 97-099. (1997–1998)

Consultant to Consumers Gas and Nova Scotia Power Corporation regarding the preparation of an application for a gas distribution franchise in Nova Scotia. Tellus No. 97-209. (1997)

Consultant to Staff of the Colorado Public Service Commission regarding retail gas market restructuring. Tellus No. 97-150. (1997)

Consultant to Maine Office of Public Advocate regarding retail gas market restructuring. Docket No. 97-267. Tellus No. 97-132 (1997).

Consulting to So. Carolina Division of Consumer Advocate re: future structure and regulation of gas services in South Carolina. Docket No. 94-719-G. Tellus No. 96-025 and 95-120 (1995–1996).

Consulting to Pennsylvania Office of Consumer Advocate regarding pilot programs of retail choice for gas, Borough of Pleasant Hills, Allegheny County, et al. Docket No. P-00950980. Tellus 95-323. (1996–1997)

Comments of the Pennsylvania Office of Consumer Advocate on FERC's Notice of Proposed Rulemaking dated February 14, 1995, regarding Alternatives to Traditional Cost-of-Service Ratemaking for Natural Gas Pipelines. (FERC Docket no. RM95-6-000.) Tellus No. 95-092. Principal investigator, 1995

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Comments of Joint Consumer Advocates on Issues Raised by the FERC Notice of Public Conference dated October 28, 1993, specifically (1) rate and valuation treatment to be accorded the profits or losses associated with the sale or abandonment of gathering facilities, and (2) appropriate rate design for gathering and related production expenses. (FERC Docket No. RM94-4-000) Tellus No. 93-264. Principal investigator. (1993–1994)

A Framework for Future Regulation of Gas Services in Maryland. Recommendations of Staff of the Maryland Public Service Commission. Tellus Study No. 93-273. Principal investigator, 1994.

Projections of Fuel Prices in Vermont: Summer 1993. Technical Report 28 to Vermont Department of Public Service. Tellus Study No. 93-026. Principal investigator, 1993.

GASCO, Inc. Integrated Resource Plan Report. Volume 1 and 2. Before the Public Utilities Commission, State of Hawaii. Docket No. 7261. Project manager and principal investigator, 1993.

Position Paper on Gas Integrated Resource Planning, N.Y.P.S.C. Docket No. 93-G-0326. Assistance to Pace Energy Project et al. in developing comments on gas integrated resource planning. Tellus No. 93-163. Co-author, 1993.

Advertising Costs in Demand-Side Management Programs. A report to: The Corporation Commission Staff, Phoenix, Arizona. Tellus Study No. 93-103. Co-author, 1993.

Proposed Rules Governing Integrated Resource Planning for Electric and Natural Gas Utilities Regulated by the State of Kansas. In collaboration with Kansas Corporation Commission Staff. Tellus Study No. 92-105. Co-author, 1993.

Consultant to Pennsylvania Office of Consumer Advocate regarding FERC Order 636, Impact on Purchased Gas Costs, T.W. Phillips Gas and Oil Co. (Tellus No. 93-021), 1993

Consultant to Staff of the Maryland Public Service Commission. Review and critique of the DSM Plans of five Maryland natural gas utilities. Tellus Study No. 91-222. Project manager and principal investigator, 1992/3.

The Analysis of Residential Gas Heat Pumps as a DSM Measure from an Integrated Resource Planning Perspective. A report to: The American Gas Cooling Center, Arlington, VA. Tellus Study No. 91-265. Co-author, 1992.

Management Audit of Arkla, Inc. Regarding Its Compliance with the Least-Cost Purchasing Statute of the State of Arkansas. A report to: The Staff of the Arkansas Public Service Commission. Tellus Study No. 91-080. Principal investigator. 1992

Preliminary Study on Integrated Resource Planning for the Consumers' Gas Company, Ltd. A report to: Consumers Gas Company, Ltd. Tellus Study No. 91-001. Co-author, 1992.

Comments on Gas IRP Rule and Issues, on behalf of: Pennsylvania Office of Consumer Advocate. Docket No. L-00920066. Tellus Study No. 92-141. Author, 1992.

Draft Comments to the New Mexico Attorney General in the Matter of an Inquiry by the New Mexico Public Service Commission into Integrated Resource Planning, for Natural Gas Utilities. Case No. 2449. Tellus Study No. 91-077. Principal investigator, 1992.

Projections of Fuel Prices in Vermont. Submitted to: Vermont Department of Public Service. Tellus Study No. 92-043. Principal investigator, 1992.

Informal and Preliminary Responses to Generic Questions on Gas Utility Demand Side Management Cost Recovery Issues. Before the Pennsylvania Public Utility Commission, on behalf of: Office of Consumer Advocate. Tellus No. 91-252. Author, 1992.

Consultant to District of Columbia Office of People's Counsel. Analysis and critique of the least-cost integrated plan of District of Columbia Natural Gas. Tellus Study No. 90-149. Project manager and principal investigator, 1991/2.

America's Energy Choices: Investing in a Strong Economy and a Clean Environment In collaboration with the Union of Concerned Scientists, the American Council for an Energy Efficient Economy, the Natural Resources Defense Council, and the Alliance to Save Energy. Tellus Study No. 90-067. Co-author, 1991.

Assistance to Wisconsin Gas Company regarding appropriate avoided cost calculations. Tellus No. 89-145, 1990.

Environmental Impacts of Long Island's Energy Choices: The Environmental Benefits of Demand-Side Management. A report to: Long Island Power Authority. Tellus Study No. 90-028A. Co-author, 1990.

Review of Southern Connecticut Gas Company's Conservation Impact Model. Prepared for The Conservation Collaborative Group: Southern Connecticut Gas Company; Connecticut Department of Public Utility Control (DPUC); Prosecutorial Division, DPUC; Office of Policy and Management/Energy Division; Office of Consumer Counsel. Tellus Study No. 90-084. Co-author, 1990.

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Consultant to Pennsylvania Office of Consumer Advocate regarding cost allocation and rate design issues, T.W. Phillips Gas and Oil Co. (R-891566). (Tellus 90-008), 1990.

Evaluation of gas supply and non-utility generation regarding Vermont utilities, for the Vermont Public Service Board. Tellus No. 89-110B, 1989.

Consultant to MCAAA on incentive ratemaking issues, Michigan Consolidated Gas Company, U-9475. (ESRG 89-213), 1989

Consultant to Maryland People's Counsel regarding review of three aspects of the application of Frederick Gas Company, Inc., for an increase in rates. (Study No. 89-137), 1989

An Analysis of FERC Policy Statement Regarding Natural Gas Pipeline Rate Design. A report prepared for the Maryland People's Counsel. ESRG Study No. 89-104. Principal Investigator, 1989.

Consultant to Staff of the Wisconsin Public Service Commission, Calculation of Avoided Natural Gas Costs. ESRG Project No. 89-80, 1989.

Fuel Procurement Planning of Gas-Fired Cogeneration Projects Proposed for Massachusetts. A report prepared for the Massachusetts Office of Energy Resources. ESRG Study No. 88-65. Principal Author, 1988.

Consultant to Staff of Arkansas Public Service Commission, Natural Gas Purchasing Practices. ESRG Project No. 87-03, 1987.

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Towards an Energy Transition on Long Island: Issues and Directions for Planning. A report prepared for Nassau and Suffolk Counties. ESRG Study No. 87-05, 1987.

An Evaluation of Kentucky's Fuel Adjustment Clause for Electric Utilities. A report to the Kentucky Office of the Attorney General. ESRG Study No. 86-74. Principal author, 1986.

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Developing an RFP for a Municipal Aggregation. Presented at "Electric Deregulation: What's the Next Step for Municipalities", New Jersey State League of Municipalities, Iselin, New Jersey. May 5, 1999.

Feasibility of Small Customer Aggregation for the Delivery of Comprehensive Energy Services in a Competitive Utility Environment. An evaluation of the feasibility of alternative options for providing electricity and related services to residential customers in a competitive retail market. Project manager and principal author. Report prepared for the Department of Energy, Chicago Regional Office by Environmental Futures, Tellus Institute, and EUA Citizens Conservation. 1998.

Natural Gas Price Volatility: Implications for Consumers. Presented to National Association of State Utility Consumer Advocates, Boston, Massachusetts, November 11, 1997.

"Applying Performance-Based Ratemaking to Gas Utility Services," presented to: NASUCA 1996 Mid-Year Meeting, Chicago, Illinois. June 26, 1996.

"Unbundling: To be or not to be?" Fifth Annual DOE-NARUC Natural Gas Conference, Roundtable Moderator, 1996.

"New Approaches to Regulation of Gas Utilities: Unbundling and Performance-Based Ratemaking." A presentation to: National Association of Utility Consumer Advocates, Reno, Nevada. Co-author, 1994.

"Fuel Choice in Demand-Side Management: Creating a Level Playing Field for Gas and Electric DSM." A presentation to: New England Chapter—International Association for Energy Economics, MIT Faculty Club, 1994.

"Sensitivity Analysis of Avoided City-Gate Gas Costs." Presented at: NARUC/DOE Fifth National Conference of Integrated Resource Planning, Kalispell, MT, May 15-18. Co-author, 1994.

"Fuel Choice, Competition & DSM," *Energy Report*. Co-author, 1994.

"Fuel Choice in Demand-Side Management: Creating a Level Playing Field for Gas and Electric DSM." A presentation to: New England Chapter - International Association for Energy Economics, MIT Faculty Club, 1994.

"The Energy Policy Act of 1992 and Gas Integrated Resource Planning." Presented at: NARUC Workshop "Competition in the Energy Markets and its Impact on IRP", St. Louis, Missouri, May 25, 1993.

"Policy Issues Associated with Gas Integrated Resource Planning." Presented at: Natural Gas Seminar, Public Utilities Commission of the State of Colorado, Denver, Colorado, May 19, 1993.

"Sensitivity of Avoided City-Gate Gas Cost Estimates to Calculation Methods and Input Assumptions." A Working Paper presented at: Gas Integrated Resource Planning (IRP) Workshop, NARUC Gas IRP Subcommittee Meeting, NARUC Annual Conference, Los Angeles, CA, Co-author, November 15, 1992.

"Natural Gas Planning: An IRP Case Study." Presented at: The NARUC Conference on Integrated Resource Planning, Burlington, Vermont, Co-author, September 13-16, 1992.

"Major Sources of Controversy in Gas Least Cost Planning." Presented at: Washington Gas Least Cost Planning Conference, Washington, D.C., April 7-8, 1992.

"Calculating the Value of Avoided Gas Requirements: Methods and Results." Presented at: NARUC Third National Conference on Integrated Resource Planning, Santa Fe, NM, April 8-10, 1991.

"State Gas Issues in an Era of Open Access Transportation." A presentation to: National Association of State Utility Consumer Advocates, San Francisco, 1988.

"Setting Rates for Unbundled Services to Meet Competition," Proceedings of the Sixth NARUC Biennial Regulatory Information Conference, Columbus, Ohio, 1988.

"Offshore Gas and Oil: Progress and Prospects." A presentation to: Mining Society of Nova Scotia Annual Meeting, Ingonish, Nova Scotia, 1986.

Energy Plan 1985. Nova Scotia Department of Mines and Energy. Steering Committee Chairman, 1986.

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"The Canada-Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing." A presentation to: Canadian Bar Association Annual Meeting, Halifax, Nova Scotia, 1985.

Coal in Nova Scotia. Nova Scotia Department of Mines and Energy. Editor, 1985.

"Regulatory Approaches." A presentation to: Canadian Petroleum Association Offshore Operating Division Annual Workshop, Fairmont Hot Springs, British Columbia, 1985.

"Nova Scotia's Offshore Oil and Gas." A presentation to: Economic Council of Canada/University of Calgary Energy Conference, Calgary, Alberta, 1985.

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"The Future of Coal Utilization in Nova Scotia." A presentation to: Chemical Institute of Canada Annual Conference, Halifax, Nova Scotia, 1981.

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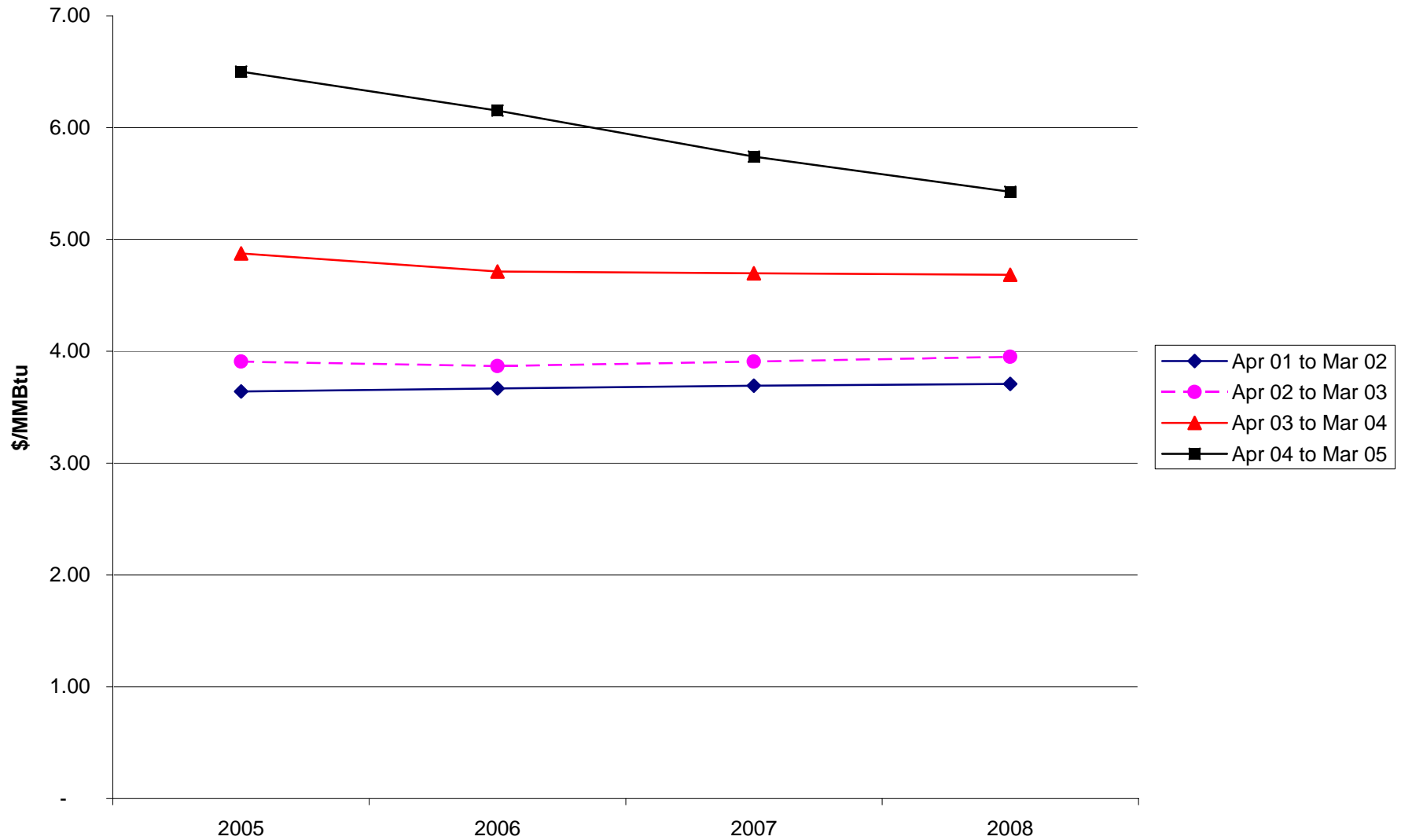
Energy, A Plan for Nova Scotia. A proposal from the Energy Planning Task Force 1979. Editor and Coordinator, 1979.

An Assessment of Government Policies to Promote Investments in Energy Conserving Technologies. Thesis, Massachusetts Institute of Technology. Author, 1978.

Arizona Public Service Company - Estimates of 2006 Hedge Value

Line	Description	Amount
1	Valued as of 11/30/05 (1)	
2	<i>\$(000)</i>	
3	2006 Hedge Value @ 90%	Total
4	Gas	\$163,425
5	Electric	21,589
6	Total	<u>185,014</u>
7	Valued as of 2/28/06 (2)	
8	<i>\$(000)</i>	
9	2006 Hedge Value @ 90%	Total
10	Gas	\$22,841
11	Electric	(15,317)
12	Total	<u>7,524</u>
13	Source 1	PME_WP3, page 1 of 7, and PME_WP4
14	Source 2	RUCO 8.8, APS10565 page 1 of 5

Average Annual Futures Prices for Natural Gas at Henry Hub from Different Points in the Past



Average Annual Futures Prices for On-peak Power at Palo Verde from Different Points in the Past

