

Docket No. 05-057-T01
DPU Exh. No. 6.0 SSR (DGH-A)
Daniel G. Hansen
September 26, 2007

-BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH-

In the Matter of the Joint Application) Docket No. 05-057-T01
of Questar Gas Company, the Division of)
Public Utilities, and Utah Clean Energy for)
the Approval of the Conservation Enabling)
Tariff Adjustment Option and Accounting)
Orders)

SUPPLEMENTAL SURREBUTTAL TESTIMONY OF

DANIEL G. HANSEN

OF

CHRISTENSEN ASSOCIATES ENERGY CONSULTING, LLC

September 26, 2007

1 **I. Introduction**

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

3 A. My name is Daniel G. Hansen. I am a Vice President at Laurits R.
4 Christensen Associates, Inc. My business address is Suite 700, 4610 University
5 Avenue, Madison, Wisconsin, 53705.

6 **Q. Have you testified in this proceeding before?**

7 A. Yes. On behalf of the Utah Division of Public Utilities (DPU), I filed
8 testimony on June 1, 2007 with an accompanying report on natural gas decoupling
9 mechanisms used in the United States (the “Hansen Report”); I filed rebuttal
10 testimony on August 8, 2007; and I filed surrebuttal testimony on August 31, 2007.
11 My educational and business background may be found in Exhibit 6.2 of the June 1,
12 2007 testimony.

13 **Q. What is the purpose of your testimony?**

14 A. As permitted by the Commission at the hearing on this matter, on behalf of the
15 DPU, I am responding to the surrebuttal testimony of Dr. David Dismukes, witness
16 for Utah Committee of Consumer Services filed on August 31, 2007.

17 **Q. How is your testimony organized?**

18 A. The remainder of my testimony is organized as follows:

- 19 • Section II: Discussion of a study by the American Gas Association (AGA);
- 20 • Section III: Discussion of Dr. Dismukes’s criticisms of the analysis conducted in
21 Section 5.2 of the Hansen Report; and
- 22 • Section IV: Discussion of the statistical models presented by Dr. Dismukes.

23 **Q. What are the conclusions of your testimony?**

24 A. Dr. Dismukes has not provided any new information that demonstrates
25 statistically significant price response on the part of Questar Gas Company's (Questar
26 Gas's or the Company's) GS-1 customers. I therefore continue to conclude that the
27 shifting of commodity price risk from the Company to its ratepayers under the
28 Conservation Enabling Tariff (CET) is not a significant issue.

29 **II. Discussion of a Study by the American Gas Association**

30 **Q. Dr. Dismukes has asserted that the findings of Section 5.2 of the Hansen Report**
31 **are inconsistent with the results in a recent study by the AGA. Do you agree**
32 **with this conclusion?**

33 A. No. The AGA study presented residential natural gas customer price elasticity
34 estimates at the census division level. Dr. Dismukes cites results from the national
35 level and for the Mountain Census Region. For the Mountain Census Region, the
36 estimated short-run elasticity value is -0.07 and the long-run elasticity is -0.10.
37 (Dismukes, August 31, 2007, p. 11.) However, a study conducted by RAND that was
38 cited by Dr. Dismukes presented price elasticity estimates at both the regional and
39 state level. As I indicated in my surrebuttal testimony, the RAND study found
40 statistically significant price elasticity values for the Mountain Census Region, but
41 not for Utah. (Hansen, August 31, 2007, p. 16.)

42 The RAND study therefore demonstrates that findings for the Mountain
43 Census Region as a whole do not necessarily apply to the state of Utah. Because the
44 AGA study provides results for only the Mountain Census Region, it does not provide
45 any additional information on the price responsiveness of Questar Gas's GS-1
46 customers.

47 **III. Dr. Dismukes's Criticisms of the Analysis Conducted in**
48 **Section 5.2 of the Hansen Report**

49 **Q. Dr. Dismukes identified "two significant problems" (Dismukes, August 31, 2007,**
50 **p. 12) in your demand analyses. Can you please describe them?**

51 A. Yes. Dr. Dismukes asserted that my analysis "includes different income
52 variables which can result in some significant biases in the resulting parameter
53 estimates (i.e., the price elasticity of demand)" (Id., p. 12); and that the models use
54 "data that mismatches different classes of prices and usage." (Id., p. 12.)

55 **Q. Do you agree with his first criticism regarding the inclusion of income variables?**

56 A. No. Section 5.2 of the Hansen Report includes two tables of results, shown on
57 pages 22 and 23 of the Report. Ten different models are presented in the two tables,
58 and only two of the ten models include an income variable. Therefore, even if one
59 accepts Dr. Dismukes's argument that the inclusion of an income variable biases the
60 results, eight models were presented in Section 5.2 that circumvent this problem by
61 not including an income variable at all. This is the solution that Dr. Dismukes
62 adopted in his own analyses.

63 **Q. Do you agree with his second criticism regarding the mismatch of price and**
64 **usage data?**

65 A. He is correct that I used price data that were calculated only for residential
66 customers and that the use per customer data that I used includes information for both
67 residential and commercial customers. However, this is not likely to be a significant
68 problem because residential and commercial GS-1 customers face the same tariff
69 rates. The only difference is that commercial customers, because of their higher

70 average usage levels, are more likely to pay the second (lower) block price (for usage
71 over 45 decatherms). Alternatively, the majority of residential customers are likely to
72 only pay the higher first block price (for the first 45 decatherms). Because rate
73 changes that are applied to one pricing block are likely to be applied to the other
74 block as well, the residential and commercial prices should move together over time.

75 In any case, the following section that discusses Dr. Dismukes's models
76 presents results that contain "matched" data, which should eliminate concern over this
77 potential problem.

78 **IV. Discussion of the Statistical Models Presented by Dr. Dismukes**

79 **Q. Dr. Dismukes presents the results of two statistical models that he believes**
80 **correct for the problems he alleged in the Hansen Report. Can you please**
81 **describe the first model that he presents?**

82 A. Yes. This analysis uses data collected by the Energy Information
83 Administration (EIA) through its form EIA-176. The survey form is attached as DPU
84 Exhibit 6.1 SSR.

85 Of interest to this study, the EIA-176 database contains annual revenues,
86 sales, and the number of customers by customer class and utility for the years 1997
87 through 2005. Dr. Dismukes obtained residential data for Questar Gas from this
88 database and conducted a statistical analysis of use per customer as a function of the
89 current price, the previous year's price, weather conditions, and a time trend. Prior to
90 estimation, the natural log of each variable (except the time trend) is taken, so that the
91 resulting coefficient estimates may be interpreted as elasticities (i.e., the percentage

92 change in use per customer divided by the percentage change of the variable in
93 question, such as price).

94 **Q. Did Dr. Dismukes obtain all of the information needed for this analysis from the**
95 **EIA-176 database?**

96 A. No, two pieces of information must have been obtained from another source.
97 The EIA-176 database provides data on nominal prices (i.e., not adjusted for
98 inflation). As Dr. Dismukes wrote on page 15 of his surrebuttal testimony, his model
99 included *real* prices (for both the lagged and current price variables). While it is
100 appropriate to include real prices in the statistical model, the data and method that Dr.
101 Dismukes used to adjust prices for inflation has not been provided.

102 Second, Dr. Dismukes includes a variable in his analysis that is simply labeled
103 in his dataset (shown in NAT_GAS_DEMAND_DATA.xls, provided in response to
104 the Division of Public Utilities 5th Set of Data Requests to CCS – Dr. David
105 Dismukes dated September 4, 2007) as “lnHdd” and described in his model output
106 presented in Exhibit SR CCS-1.2 as “Ln Weather.” As can be seen in DPU Exhibit
107 6.1 SSR, Form EIA-176 does not collect weather information, and weather
108 information is not available in the EIA-176 database provided by the EIA.

109 **Q. Was the weather data used by Dr. Dismukes in his first analysis provided by**
110 **Questar Gas?**

111 A. No. Questar Gas has provided heating degree information on at least two
112 occasions during this proceeding, including in the Excel file “CCS 7.01a Attach.xls”
113 from which Dr. Dismukes claims to have obtained data for his second analysis; and in
114 Exhibit 1.7 to Mr. McKay’s August 14, 2006 surrebuttal testimony (in “Sur Test

115 McKay Ex 1-7 8-15.xls”). As DPU Exhibit 6.2 SSR shows, the weather data used by
116 Dr. Dismukes in his first analysis does not match the data provided by Questar Gas.
117 Dr. Dismukes has not provided a source for this new weather information, nor did he
118 describe the use of an alternative weather measure in his testimony.

119 **Q. Is it possible that Dr. Dismukes obtained a better weather measure than the one**
120 **provided by Questar Gas?**

121 A. If he believes that he has found a better weather measure, he has not provided
122 any support for this belief. In addition, Dr. Dismukes used the weather data provided
123 by Questar Gas in his second analysis, which would appear to indicate that he has
124 some confidence in the accuracy and appropriateness of the Company’s data.

125 **Q. Are the results of Dr. Dismukes’s analysis affected by the use of this new**
126 **weather data?**

127 A. Yes. His findings, as shown in Exhibit SR CCS-1.2, indicate statistically
128 significant short-run price response, with an estimated short-run price elasticity of
129 -0.22. However, if the model is re-estimated using the weather data provided by
130 Questar Gas, the price elasticity estimates are not statistically significantly different
131 from zero. These results are shown in DPU Exhibit 6.3 SSR. Note that the p-values
132 (shown in the “Pr > | t |” column) are higher than 0.4 for the coefficients on both the
133 current and lagged price variables. P-values less than 0.05 or 0.10 are traditionally
134 considered to indicate statistical significance of the estimated coefficient, so the
135 estimates of price response from this model are not particularly close to being
136 statistically significant.

137 **Q. How should the difference in results be interpreted?**

138 A. There are two possibilities. First, Dr. Dismukes may have inadvertently used
139 the wrong weather data, in which case there is no reason to believe that the results
140 that he presents are better than the results presented in DPU Exhibit 6.3 SSR (that use
141 Questar Gas's weather data). Second, Dr. Dismukes may believe that he has found a
142 superior weather measure for use in his model (despite the fact that he uses the
143 Company's weather data in his second model). In this case, the fact that a reasonable
144 alternative weather measure (i.e., the Company's) produces results that are not
145 consistent with his results indicates that the finding of statistically significant price
146 response is not robust.

147 On pages A.1.3 to A.1.4 of his Rebuttal Testimony Appendix 1, Dr. Dismukes
148 describes "robustness" as a factor to consider when "determining the appropriateness
149 of a particular model." He describes "robustness" as "ensuring that models are not
150 overly dependent upon unique specifications or time periods under consideration."
151 (Id., page A.1.4.) In this case, obtaining a statistically significant price elasticity
152 estimate depends upon using a very specific (though not described by Dr. Dismukes)
153 weather variable, indicating that the finding is not robust.

154 **Q. Can you please describe the second demand model presented by Dr. Dismukes?**

155 A. Yes. This model uses monthly data that Questar Gas used in its 2007
156 Integrated Resource Plan (IRP) to examine the relationship between GS-1 use per
157 customer and explanatory factors including price, weather, and a time trend. Dr.
158 Dismukes finds a statistically significant short-run price elasticity of -0.37.

159 **Q. Are there any problems with the data used by Dr. Dismukes in this model?**

160 A. Yes. First, in his “Response to Post-Hearing Data Request”, Dr. Dismukes
161 writes that “usage per customer data comes [from] column AC of the file CCS 7.01a
162 Attach.xls.” In fact, column AC of the aforementioned spreadsheet contains
163 temperature-adjusted usage per customer data for GS-1 commercial customers.
164 However, he claimed in his surrebuttal testimony to have examined “consistent
165 information at the rate class (GS-1) level rather than the customer class (residential,
166 commercial) level.” (Dismukes, August 31, 2007, p. 16.) The data provided by Dr.
167 Dismukes in response to the Division of Public Utilities 5th Set of Data Requests to
168 CCS – Dr. David Dismukes dated September 4, 2007 (attached as DPU Exhibit 6.4
169 SSR) indicate that he has, in fact analyzed total GS-1 use per customer, unadjusted
170 for weather. This value is calculated by using the following data and methods from
171 CCS 7.01a Attach.xls:

$$172 \quad \text{GS-1 Use Per Customer} = (\text{Column B} + \text{Column Q}) / (\text{Column D} + \text{Column S}).$$

173 Second, there are issues with respect to the price variable used by Dr.
174 Dismukes. In his “Response to Post-Hearing Data Request”, Dr. Dismukes identifies
175 the source of the price data as column L of “CCS 7.04 Attach.xls.” A comparison of
176 the data contained in column L of this spreadsheet to the data included in the file
177 provided by Dr. Dismukes (DPU Exhibit 6.4 SSR) again shows that he has likely
178 converted nominal prices to real prices, but he has not provided any description of the
179 data or methods used to do so. DPU Exhibit 6.5 SSR shows a graph of the price data
180 provided by Dr. Dismukes (exponentiated so that it is no longer expressed in log
181 form) and the data contained in column L of the Company’s spreadsheet. Of note,
182 while the majority of the data provided by Dr. Dismukes appear to be simply the raw

183 data adjusted for inflation, the first two data points are unadjusted for inflation. It
184 appears from his output that these observations were included in Dr. Dismukes's
185 analysis (based on the number of observations reported).

186 Dr. Dismukes stated in his testimony that "the price variable that was
187 provided by the Company, while not clearly defined, appears to be based on a moving
188 average process." (Dismukes, August 31, 2007, p. 16.) He then corrects for this
189 moving average process, but he has not provided any documentation or description of
190 the methods used to do so. However, this adjustment is not necessary, as the raw data
191 (i.e., not transformed into a moving average) are publicly available on the Utah Public
192 Service Commission's (Utah PSC) web site. Specifically, on the "Natural Gas Utility
193 Information" page of the Utah PSC's web site, there is a link to a "History of Electric
194 and Natural Gas Rates." Clicking on this link
195 (<http://www.psc.state.ut.us/HistoryOfRates.pdf>) leads to typical bill information
196 dating back to January 1992. I have confirmed with Questar Gas that the information
197 contained in the column labeled "115 Dth/year Residential Annual Bill" contains the
198 raw data used to create the moving-average variable used by Dr. Dismukes. Because
199 the data on the Utah PSC web site is the information that Dr. Dismukes's adjustment
200 process is attempting to reproduce, it is more appropriate to eliminate the unnecessary
201 adjustment step and simply use the available "raw" price data that requires no
202 adjustment.

203 **Q. Have you re-estimated Dr. Dismukes's model using the unadjusted price data?**

204 A. Yes. I estimated models using data from 1992 through 2006. The GDP
205 deflator that I use to convert nominal prices to real prices uses data from the Bureau

206 of Economic Analysis, found at the link: <http://www.bea.gov/national/xls/gdplev.xls>.
207 The GDP deflator is calculated as “GDP in billions of current dollars” divided by
208 “GDP in billions of chained 2000 dollars” taken from the spreadsheet found at this
209 link. Real prices are calculated as the nominal prices provided by Questar Gas
210 divided by the GDP deflator.

211 I estimated six different models to account for the possible interpretations of
212 Dr. Dismukes’s testimony and description of data sources. First, I estimated models
213 both with and without a 12-month lagged price variable. Dr. Dismukes wrote that “a
214 longer lag structure was not included since the price variable that was provided by the
215 Company, while not clearly defined, appears to be based on a moving average
216 process.” (Dismukes, August 31, 2007, p. 16.) Because the prices that I am using are
217 not based on a moving average process, I assume that Dr. Dismukes would prefer to
218 include the 12-month lag variable. However, I have provided results excluding this
219 variable in case I have misinterpreted his testimony.

220 I have also estimated models for all GS-1 customers as well as by customer
221 class (i.e., separately for GS-1 residential and commercial customers). Dr. Dismukes
222 wrote that “the purpose of this approach was to develop an alternative model using
223 consistent information at the rate class (GS-1) level rather than the customer class
224 (residential, commercial) level.” (Id., p. 16.) However, he has also criticized my
225 models for using “mismatched” data. Because a possible interpretation of this
226 criticism is that prices based on typical residential customer bills should only be
227 matched to residential use per customer data, I have also included models that use
228 residential use per customer as the dependent variable. Residential use per customer

229 is calculated by dividing the data in column B (residential decatherms) by the data in
230 column D (the number of residential customers) of “CCS 7.01a Attach.xls.”

231 Finally, Dr. Dismukes apparently mistakenly identified commercial use per
232 customer data as the source of the data used in his models. However, in order to
233 cover the chance that he intended to analyze this information, I have estimated
234 models using commercial use per customer as the dependent variable. Commercial
235 use per customer is calculated by dividing the data in column Q (commercial
236 decatherms) by the data in column S (the number of commercial customers) of “CCS
237 7.01a Attach.xls.”

238 **Q. What models specifications and estimation methods did you use?**

239 A. Aside from the omission of the moving average correction, which is no longer
240 necessary because of the use of publicly available data that are not in the form of a
241 moving average, I have used the same specification and estimation methods used by
242 Dr. Dismukes. Specifically, I estimated the models using Ordinary Least Squares
243 (OLS) and taken the natural log of the use per customer, price, and weather variables.

244 **Q. What are the results from these statistical models?**

245 A. DPU Exhibit 6.6 SSR shows the estimated coefficients and the associated
246 statistical significance for each of the six models that I analyzed. The results show no
247 statistically significant price response in any of the models. For example, the second
248 model shown in the exhibit analyzed residential use per customer against “matched”
249 residential price data (addressing Dr. Dismukes’s second criticism of the models from
250 Section 5.2 of the Hansen Report), did not include any income variables (addressing
251 Dr. Dismukes’s first criticism of the models from Section 5.2 of the Hansen Report),

252 and included a lagged price variable in an attempt to discover long-run price
253 response. While this model found a statistically significant effect of weather on
254 residential use per customer, the price coefficients were not statistically significant.

255 **Q. How would you summarize the various statistical models that have been**
256 **presented?**

257 A. In his surrebuttal testimony, Dr. Dismukes raised two specific criticisms of the
258 models contained in Section 5.2 of the Hansen Report and presented the results of
259 two of his own models. Dr. Dismukes's two models show large and statistically
260 significant price response on the part of GS-1 customers. However, the results of his
261 first model depend upon the use of weather data that do not match the weather data
262 provided by Questar Gas. Dr. Dismukes has not provided the source of this new
263 weather data, nor has he explained why he chose to use the new weather data in his
264 first model, but not in his second. If the weather data provided by Questar Gas is
265 used in place of the weather data provided by Dr. Dismukes, the price elasticity
266 estimates are no longer statistically significant.

267 Dr. Dismukes's second model uses moving-average price data that were
268 created by Questar Gas to compare to moving-average consumption data. However,
269 the raw data upon which the moving-average price data were based are publicly
270 available from the Utah PSC web site. This allows me to re-estimate his models
271 using the correct price data, as opposed to performing a correction in an attempt to
272 approximate the correct price data as Dr. Dismukes did. The results indicate no
273 statistically significant price response for GS-1 customers. These results address all
274 of the concerns that Dr. Dismukes has raised: the models do not include an income

275 variable; the models use “matched” price and usage data; and the statistical model
276 and estimation method correspond to the methods used by Dr. Dismukes.

277 **Q. What is your conclusion based on the analyses presented in your testimony?**

278 A. I continue to conclude that GS-1 use per customer does not change
279 significantly as prices change, and therefore that the shifting of commodity price risk
280 from Questar Gas to its ratepayers is not likely to occur under the CET. This finding
281 has been observed in my initial analyses contained in the Hansen Report, in the
282 Company’s IRP (which found a relatively small price elasticity of -0.06 with no test
283 of statistical significance), in a study by RAND cited by Dr. Dismukes, and in the
284 results presented in this testimony. I continue to recommend that the CET remain in
285 use for the duration of the approved pilot program period.

286 **Q. Does this conclude your testimony?**

287 A. Yes.