BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Application of Rocky Mountain Power for Authority To Increase Its Retail Electric Utility Service Rates in Utah and for Approval of Its Proposed Electric Service Schedules and Electric Service Regulations	)))))	Docket No. 13-035-184 DPU Exhibit 2.0 DIR-COS

REDACTED

SUBJECT TO PUBLIC SERVICE COMMISSION OF UTAH RULE 746-100-16

Artie Powell, PhD

Pre-Filed Direct Testimony

Cost of Service

Division of Public Utilities

May 1, 2014

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1   **P R E L I M I N A R I E S**

2   **Q:**   **WOULD YOU STATE YOUR NAME, BUSINESS ADDRESS, AND POSITION FOR THE RECORD?**

3   A: My name is Artie Powell; I am the energy section manager within the Division of

4   Public Utilities; my business address is 160 East 300 South, Salt Lake City, Utah.

5   **Q:**   **WOULD YOU SUMMARIZE YOUR EDUCATION AND EXPERIENCE?**

6   A: I hold a doctorate degree in economics from Texas A&M University. Prior to

7   joining the Division, I taught courses in economics, regression analysis, and

8   statistics both for undergraduate and graduate students. I joined the Division in

9   1996 and have since attended several professional courses or conferences

10 dealing with a variety of regulatory issues including, the NARUC Annual

11 Regulatory Studies Program (1995) and IPU Advanced Regulatory Studies

12 Program (2005). Since joining the Division, I have testified or presented

13 information on a variety of topics including, electric industry restructuring,

14 incentive-based regulation, revenue decoupling, energy conservation, evaluation

15 of alternative generation projects, and the cost of capital.

16 **Q:**   **ARE YOU TESTIFYING ON BEHALF OF THE DIVISION?**

17 A: Yes.

18 **S U M M A R Y   O F   D I V I S I O N ' S   C O S   C A S E**

19 **G U I D I N G   P R I N C I P L E S**

20 **Q.**   **WHAT ARE THE DIVISION'S RATE DESIGN OBJECTIVES?**

21 A: Based on statutes enacted by the Utah Legislature, the Division's cost of service

22 and rate design objectives are for rates to be stable, simple, understandable, and

23 acceptable to the public; to be economically efficient; to promote fair

24 apportionment of costs among individual customers within each customer class

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25   with no undue discrimination; and to protect against wasteful use of utility

26   services. (See Utah Code Annotated § 54-4a-6)

27   Consistent with these statutorily defined objectives, the Division has developed a

28   set of guiding principles. These principles are:

29   1. Cost Causation—Rates and charges should reflect cost causation.
30   Customers who cause costs should pay for those costs.
31   2. Simplicity— Rates should be as simple as possible in design and easy
32   to understand and administer. Customers are more likely to accept
33   and understand relatively simple rates. Tariff descriptions should be
34   clear, unambiguous, and understandable by the public.
35   3. Correct Price Signals—Rates based on costs can incent customers to
36   make appropriate decisions about energy use including energy
37   conservation. While some customer classes are better able to
38   understand complicated rates than others, a complicated rate that is
39   not understood may not provide clear or correct price signals.
40   4. Rate Structures—Three part rates with customer, energy, and
41   demand components will more fairly apportion the costs among
42   individual customers than one or two part rates. However, a demand
43   component for the residential class is normally not recommended
44   since the added cost of demand meters usually outweighs the benefit
45   of better cost apportionment.
46   5. Gradualism—Gradual changes in rates help to promote rate stability
47   and to minimize impacts on individual customers.
48   6. Marginal and Embedded Costs—Regulated rates must be designed to
49   recover the embedded revenue requirement of a rate schedule.

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50   Marginal and average unit embedded costs should be reviewed and

51   taken into account when setting prices.

52   7. Customer Charges—Costs that generally increase with the number of

53   customers, but are not caused by each customer should be excluded

54   from the customer charge and should instead be included within the

55   commodity portion of rates. (See Commission Order in Docket No.

56   82-057-15)

57   In this case, the Division has relied on these principles, which sometimes act in

58   tension with one another, in formulating its cost of service and rate design

59   proposals.

60   **D ι ν ι s ι o n ' s   W ι τ n e s s e s**

61   **Q:**   **PLEASE IDENTIFY THE DIVISION'S WITNESS FOR THIS PORTION OF THE DOCKET.**

62   A: The Division has three witnesses providing testimony at this time.

63   Ms. Lee Smith is an independent contractor working with La Capra Associates.

64   She reviews and analyzes the cost allocation and rate design presented by the

65   Company and has developed a cost allocation study, used by Mr. Stan Faryniarz,

66   reflecting the Division's revenue requirements as a basis for determining class

67   revenue requirements.

68   Mr. Stan Faryniarz also works with La Capra Associates. He reviews and analyzes

69   the Company's rate design. Based upon the cost allocation studies done by Ms.

70   Smith, he determines a rate spread and rate designs. The Division's rate

71   objectives and class revenue requirements provide the basis for his design

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72   recommendations. He also discusses the Company's proposed net metering

73   charge.

74   Dr. Artie Powell, as the manager of the energy section, I am the policy witness

75   for the Division and present testimony on the Division's guiding principles.   I also

76   address modeling questions not resolved in previous dockets, namely, the

77   relationship among cash working capital, interest expense, and income taxes.

78   Along with Mr. Faryniarz, I present testimony on the Company's proposed net

79   metering charge. I also analyze the Company's stress factor study.

80   **C ASH W ORKING C APITAL , I NTEREST E XPENSE , AND I NCOME**
81   **T AXES**

82   **Q:**   **IN YOUR SUMMARY, YOU INDICATED THAT YOU WOULD ADDRESS CERTAIN MODELING**

83   **QUESTIONS THAT WERE NOT RESOLVED IN PREVIOUS DOCKETS. WOULD YOU EXPLAIN THE**

84   **NATURE OF THOSE QUESTIONS?**

85   **A:**   On May 10, 2012, as part of the Docket No. 11-035-200 rate case, the

86   Commission issued an action request to the Division directing the Division to

87   investigate several cost of service issues related to the Company's treatment of

88   certain items in the Company's filed case. On May 17, 2012, the Commission

89   issued a Revised Action Request (Revised Action Request) to the Division

90   wherein the Commission clarified several of those questions. The Revised Action

91   Request was issued under that docket with a due date of June 25, 2012; the

92   deadline for direct testimony on cost of service issues was scheduled as part of

93   that docket for June 22, 2012. Given the proximity of the two due dates, the

94   Division incorporated its response to the Revised Action Request as part of its

95   COS direct testimony.

96   According to the Revised Action Request, in the preparation of its integrated

97   revenue requirement and class cost of service model, the Commission identified

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98   what it perceived as inconsistent treatment of several items between the

99   Company's inter-jurisdictional and class cost of service models or studies. As

100   specified in the Revised Action Request, these items included, "1) [the]

101   relationships among cash working capital, interest expense, and income taxes; 2)

102   the determination of state income taxes; and 3) use of the income to revenue

103   multiplier."

104   The Commission held a technical conference on June 4, 2012. Prior to the

105   technical conference, the Commission made its model available as part of the

106   prior docket. At the technical conference, Commission staff explained the

107   nature of the perceived inconsistencies, potential impacts or implications for the

108   apportionment of costs to the classes, and their location using the Commission

109   Model. Parties attending the technical conference were given an opportunity to

110   ask clarifying questions.

111 **Q:** **WHAT SPECIFIC QUESTIONS DID THE COMMISSION ASK THE DIVISION TO ADDRESS WITH RESPECT**

112   **TO THE RELATIONSHIP AMONG CASH WORKING CAPITAL, INTEREST EXPENSE, AND INCOME TAXES?**

113 A: The Commission directed the Division to investigate the apparent differences in

114   the way these three variables are treated in the Company's JAM model and the

115   Company's class cost of service model, the need for these differences, and the

116   advantages or disadvantages of eliminating these differences with respect to the

117   fair statement of the class cost of service. Specifically, the Commission asked

118   whether "a direct calculation of cash working capital, interest expense, and

119   income taxes by rate schedule, without assumptions or imputation, [would] be

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120   easier to implement or model, and result in a fair statement of the cost of

121   service by rate schedule?"[1]

122   **Q:** **DOES THE DIVISION BELIEVE THAT IN THE PREVIOUS DOCKET THE THREE VARIABLES WERE**

123   **TREATED INCONSISTENTLY BETWEEN THE TWO COMPANY MODELS?**

124   A: Yes, in the prior docket they were. Notes provided by the Commission at the

125   June 4, 2011 technical conference describe these inconsistencies. For

126   convenience, I have attached these notes to this testimony as DPU Exhibit 2.1

127   DIR-COS.

128   **Q:** **DOES THE COMPANY ADDRESS THESE ISSUES IN THIS CASE?**

129   A: The Company's witness, Ms. Steward, indicates that the Company has modified

130   its COS model to treat the three items—the relationship among cash working

131   capital, interest expense, and income taxes; state income taxes; and the income

132   to revenue multiplier—in a manner consistent with the treatment in the

133   jurisdictional allocation model (JAM).[2] However, the Division was unable to

134   verify this claim.

135   **Q:** **WOULD YOU EXPLAIN THE RELATIONSHIP BETWEEN THE THREE VARIABLES?**

136   A: The three variables form a system of three equations that yields a closed form

137   solution. That is, cash working capital (CWC) is a function of, among other

138   things,[3] income taxes; interest expense is a function of CWC; and income taxes

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[1] "Revised Action Request," May 17, 2011, Docket No. 11-035-200.

[2] "Direct Testimony of Joelle R. Steward: Cost of Service," Docket No. 13-035-184, p. 4.

[3] For example, CWC is a function of O&M expense. However, since O&M is an exogenous variable—a variable whose value is determined outside the instant system of equations—its value is treated as a constant or known value in the relationships among CWC, interest expense, and income taxes.

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139   are a function of interest expense.[4] Given this relationship, it is possible to solve

140   the system of equations to arrive at a solution that is consistent with the initial

141   relationship but avoids any circularity, or the need for iterations or imputations

142   in the solution. In other words, although the variables are dependent on one

143   another, the solution makes it possible to calculate a value for each variable

144   independent of the calculation of the other two and yet preserve the underlying

145   relationship. Perhaps a simple example would be useful.

146   Suppose we have two unknown variables, X and Y, and two equations that define

147   their relationship where a, b, c, and d are known parameters (values):

$$Y \ = \ a \ + \ b * X$$

$$\text{(1)}$$

$$X \ = \ c \ + \ d * Y$$

148   To solve the system we can substitute the value of Y into the expression for X,

149   and solve for X. The resulting solution for X can be substituted into the first

150   expression for Y to yield the solution for Y. The final expressions yield formulas

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[4] This relationship was discussed at the June 4, 2012, technical conference. See DPU Exhibit 2.1 DIR_COS.

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151   (or values) for X and Y in terms of the known parameters consistent with the

152   original relationship defined in Equation 1. That is,

$$Y = \frac{a + b * c}{1 - d * b}$$

(2)

$$X = \frac{c + d * a}{1 - d * b}$$

153   Although more complicated, the relationships among CWC, interest expense,

154   and income taxes can be solved in a similar fashion so that their values for a

155   given level of revenues can be calculated directly. This is in essence what the

156   Company has done for this case in both the JAM and class cost of service models.

157 **Q:** **DOES THE DIVISION HAVE A RECOMMENDATION REGARDING THE COMPANY'S MODELING**

158   **CHANGE TO TREAT THESE VARIABLES AND THE OTHER ISSUES IN A CONSISTENT MANNER?**

159 A: Yes. In general, the Division believes the Company's two models should treat

160   consistently the issues raised at the June 4, 2011 technical conference.

161   Specifically, the class cost of service study should treat consistently the

162   determination of CWC, interest expense, and income taxes for each schedule as

163   is done for each jurisdiction in the JAM. Additionally, the class cost of service

164   should apply the income to revenue multiplier in a consistent manner. The

165   Division believes that consistent treatment more fairly apportions the Utah

166   revenue requirement to the various schedules and customers.

167   The Division, however, was unable prior to filing this testimony to verify that the

168   modeling changes employed by the Company do indeed address consistently

169   these issues. Therefore, the Division recommends that the Company be directed

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170   to file a mathematical white paper similar to that contained in DPU 2.1 DIR-COS

171   with its next general rate case explaining its modeling treatment of these issues.

172   **NET METERING SURCHARGE**

173   **Q: THE COMPANY IS PROPOSING $4.25 SURCHARGE FOR NET METERING CUSTOMERS IN THIS CASE.**

174   **WHAT IS THE DIVISION'S POSITION ON THIS ISSUE?**

175   A: Mr. Stan Faryniarz and I address the Company's net metering surcharge. In

176   general, the Division is supportive of the concept and, given two caveats,

177   recommends approval. I first discuss why the Division is in general support of

178   the charge and then near the end of this section discuss the Division's two

179   caveats.

180   **Q: WOULD YOU EXPLAIN THE REASONS WHY THE DIVISION IS GENERALLY SUPPORTIVE OF THE**

181   **COMPANY'S PROPOSAL?**

182   A: The Division views the net metering charge as a cost causation issue. The

183   principle of cost causation indicates that those customers causing the costs, in

184   this case all customers using the infrastructure, should pay for those costs. Net

185   metering customers, while decreasing their energy consumption taken from the

186   Company, still utilize the infrastructure put in place to deliver energy when

187   needed.

188   **Q: WOULD YOU PLEASE ELABORATE?**

189   A: At a high level, the Company's costs are divided into two categories, namely

190   fixed and variable costs. In this respect, rates serve at least two purposes.[5] First,

191   rates are generally designed to allow the Company a reasonable opportunity to

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[5] In "Principles of Public Utility Rates, James C. Bonbright refers to four purposes that utility rates serve.
For a full discussion of these purposes see Bonbright, pages 42-65.

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192   recover its cost of providing services to its customers. Second, rates and their

193   design can help promote efficient use of resources and consumption.

194   In the first instance, if rates persistently promote the under collection of the

195   Company's costs, the Company may in the long-run experience difficulty in

196   attracting capital. In the second instance, rates designed incorrectly are less

197   likely to provide proper price signals to all customers and thus fail to promote

198   efficient utilization of scarce resources.

199   According to the Company, under the current rate design, which was adopted to

200   help promote conservation, the intent is to collect a large proportion of its fixed

201   costs through the volumetric rates. (See RMP Exhibit_(JRS-8)) Given the

202   inverted block rate and the relatively small customer charge, the increased

203   penetration of net metering customers and future penetration by these

204   customers (and even increased conservation from other customers) will make it

205   more difficult for the Company to recover those fixed costs.

206   Increased penetration of net metering customers will also shift costs to other

207   customers. Since these are fixed costs, this shift is not only unfair to those other

208   customers but also it possibly could create a downward incentive spiral of

209   increasing volumetric rates, and difficulty collecting fixed costs and attracting

210   capital.

211   Allocating costs and designing rates to reflect a net metering charge is an

212   equitable way of resolving these issues.

213   **Q:**   **SOME MIGHT ARGUE THAT THE IMPOSING A NET METERING CHARGE PENALIZES NET METERING**

214   **CUSTOMERS. HOW WOULD YOU RESPOND?**

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215 A: The Division does not believe that the charge is a penalty on net metering

216   customers. In fact, the Division's view is just the opposite. Net metering

217   customers are primarily providing energy for their own consumption and

218   (incrementally) to the Company. In exchange, net metering customers are

219   compensated at the full retail rate either through a reduction in consumption or

220   through credits. However, these net metering customers still use the

221   distribution and transmission infrastructure and that makes this a cost causative

222   issue. All customers, including net metering customers, using infrastructure

223   should pay for that usage.

224   Again, referring to the Company's exhibit, JRS-8, the Company's proposal for the

225   net metering charge includes retail and distribution costs totaling approximately

226       $25 per customer per month. Given the Company's proposed $8.00 customer

227   charge, this leaves $16.72 in fixed costs, which volumetric rates are designed to

228   recover. However, at the projected billing determinants for net metering

229   customers, the Company anticipates collecting only $12.46 from each of these

230   customers. Thus, without the net metering charge, assuming the customer

231   charge is not substantially increased the remaining $4.25 potentially goes

232   uncollected or is collected through higher volumetric rates from all residential

233   customers.

234 Q: IN YOUR OPINION, DOES THE ADOPTION OF THE NET METERING CHARGE CONSTITUTE

235   DISCRIMINATION?

236 A: From an economic perspective, I do not believe it would. According to economic

237   theory, price discrimination is "the practice of making different customers pay

238   different prices for the same good."[6] For example, if I take my minor son to the

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[6] Michael L. Katz and Harvey S. Rosen, (1991), "*Microeconomics*," Irwin, Boston, Massachusetts, p. 469.

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239   movie we pay different ticket prices but see the same movie and sit in virtually

240   identical seats. Thus, movie ticket prices for children verses adults illustrates the

241   principle of price discrimination. The net metering charge is not about charging

242   different customers different "prices" but rather about ensuring that all

243   customers pay the same price.

244   Given the Company's proposal, after the customer charge, the Company needs

245   to collect on average approximately $16.72 in fixed costs from each customer.

246   However, the Company will only collect approximately $12.46 from net metering

247   customers. The remaining amount would be either uncollected or forced on

248   other customers through higher volumetric rates. The net metering charge,

249        $4.25 in the Company's scenario, equalizes on average the amount all customers

250   pay. Again, from an economic perspective the net metering charge does not

251   constitute price discrimination.

252 **Q:**   **DOES THE NET METERING CHARGE AS PROPOSED BY THE COMPANY IGNORE POTENTIAL BENEFITS**

253   **THAT NET METERING CUSTOMERS BRING TO THE SYSTEM?**

254 A: Not really. The net metering charge is about collecting costs not about

255   compensating for benefits. If the Commission concludes that too much cost is

256   being collected through volumetric rates, thus, making it difficult for recovery or

257   sending incorrect price signals, it should adjust those rates and any fixed charges

258   accordingly. Similarly, if there are uncaptured benefits from the net metering

259   program or its customers, then, in the Division's view, the Commission should

260   review and adjust the compensation side of the equation. Under the current net

261   metering tariff, net metering customers are compensated at the retail rate for

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262   their production either as a reduction through reduced consumption on their

263   current bill or incrementally as a credit on future bills.[7]

264   Failing to distinguish the separate concepts of collection and compensation, will

265   not likely lead to a program or tariff that is in the public interest.

266 **Q.**   **AT THE BEGINNING OF THIS SECTION, YOU NOTED THAT THE DIVISION HAD TWO CAVEATS TO ITS**

267   **GENERAL SUPPORT OF THE PROPOSED NET METERING CHARGE. PLEASE DISCUSS.**

268 A.   First, the Division notes from the Company's testimony, in particular Exhibit

269   RMP_JRS-8, that there is an inverse relationship—though not necessarily one-to-

270   one—between the customer charge and the net metering charge. While the

271   Division is recommending a customer charge lower than the $8 proposed by the

272   Company, the Division is not proposing to increase the net metering charge

273   above the $4.25 per month at this time. Division witness Mr. Faryniarz discusses

274   this issue further in his direct testimony.

275   Second, on April 16, 2014, in response to SB 208, passed by the Utah Legislature

276   and signed by the Governor, the Commission issued a notice inviting parties to

277   comment on the costs and benefits of the net metering program. The Division

278   has made no attempt in this period to quantify the costs or benefits of the net

279   metering program. However, we do discuss herein what we believe is the

280   proper separation of cost recovery between net metering customers and

281   customers who do not net meter and compensation to net metering customers.

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[7] Under SB 208, unused credits will be given to the Company's low income energy assistance program

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282   Additionally, as discussed in Mr. Faryniarz's direct testimony, we recommend

283   that the Commission open a docket to explore issues raised by SB 208.

284   **Q:**   **GIVEN CURRENT CIRCUMSTANCES, DOES THE DIVISION BELIEVE THAT CONTINUATION OF THE**

285   **COMPANY'S CURRENT RATE DESIGN (WHICH DOES NOT TAKE INTO ACCOUNT A NET METERING**

286   **CHARGE) IS IN THE PUBLIC INTEREST?**

287   A.   No.

288   **Q:**   **PLEASE ELABORATE.**

289   A.   In the Division's opinion, the currently effective rate design (which does not

290   include a separate recognition of the net metering program) should be

291   reexamined in this case because it was put into place prior to the rapid explosion

292   of net metering customers and prior to enactment of Senate Bill 208.

293   **S T R E S S F A C T O R S T U D Y**

294   **O V E R V I E W**

295   **Q:**   **WOULD YOU SUMMARIZE THE INFORMATION INCLUDED IN THE COMPANY'S STRESS FACTOR**

296   **STURDY?**

297   A: As agreed in settlement of the last general rate case, Docket No. 11-035-200, on

298   November 1, 2013, the Company filed an update to its stress factor study. The

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299   sturdy includes six items described in the Stress Factor Study Plan, attached to
300   this testimony as DPU Exhibit 2.2 DIR-COS. The six items include,

301   1. Monthly Firm Peak Demands;

302   2. Probability of Contribution to Peak (1);

303   3. Probability of Contribution to Peak (2);

304   4. Monthly Reserve Margins;

305   5. Cost of Peak Resources; and

306   6. Loss of Load Probability.

307 **Q:** **WHAT IS THE INTENT OR PURPOSE OF THE STUDY?**

308 A: Currently, the system capacity factor uses the coincident peaks from all 12
309   months—a 12CP allocator. The intent of the study is to support or justify a
310   particular definition of demand, either 12CP or some other lesser configuration
311   of the months.

312 **Q:** **WHAT CONCLUSIONS IF ANY HAVE REACHED FROM ANALYZING THE DATA FROM THE STUDY?**

313 A: In general, the study does not support moving away from or abandoning the
314   current 12CP.

315 **Q:** **WOULD YOU EXPLAIN YOUR ANALYSIS AND RESULTS?**

316 A: The study provides four sets of data for the monthly firm peak demands. Each of
317   these data sets have an historical period—2008 through 2012—with actual data,

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318   and a forecasted period, 2013 through 2022, and 2027. DPU Exhibit 2.2DIR-COS

319   provides more details for each of the four data sets provided in the study plan.

320   To analyze the Company's monthly peak load data, I employed several common

321   statistical methodologies including, summary statistics, F-tests (analysis of

322   variance or ANOVA), simple Student t-tests, and Tukey's honestly significant

323   differences (HSD) procedure. I have provided an explanation for each of these

324   statistical methods in DPU Exhibit 2.3 DIR-COS. Detailed results for each data set

325   for each method are in DPU Work Papers 2.1 DIR-COS to 2.4 DIR-COS.

326   S T A T I S T I C A L   R E S U L T S

327   **Data Set 1.1-A: Stress Factor Study 1.1.A Total Firm Load, No Curtailment**

328   Referring to this first data set, for the historical years, 2008-2012, the summary

329   statistics indicate that on average, July has the greatest peak, while May has the

330   greatest relative volatility as measured by the Coefficient of Variation (CV). All of

331   the monthly averages, except for April, are within 75% of the average July peak;

332   April's average is approximately 74.6% of July's average.

333   Note for 2009, the Peak in December is actually greater than the peak in June.

334   This result illustrates why volatility in the monthly peaks may be important for

335   system planning and reliability. The volatility in May—the month with the

336   largest volatility—is almost 7 times that in August, the month with the smallest

337   volatility; and May's volatility is 2.6 times larger than the volatility in July.

338   **Pairwise Comparison of the Monthly Means**

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339   The F-test that the monthly means are statistically all the same indicates that at

340   least one of the means is different. To explore which of the means are different,

341   I used Tukey's HSD procedure.

342   The pattern of "failing to reject" the Null hypothesis that the monthly means are

343   the same using the HSD-Test is summarized in *Table 1*. As can be seen, no single

344   month stands out as being statistically significantly different from all other

345   months. For example, the hypothesis test reveals that July's peak is not different

346   from that of June and August; August is not different from June and July; June is

347   not different from July, August, or September; etc.

348   **Table 1: 1.1.A Total Firm Peak Load, No Curtailment, Historical Data (2008 – 2012)**

	Month	**Not Different From**
	Pattern of Failing to Reject, HSD Test	
1	July	Jun, Aug
2	August	Jun, Jul
3	June	Jul, Aug, Sep
4	September	Jan, Feb, Nov, Dec
5	December	Jan, Feb, Jun, Sep, Nov
6	January	Feb, Mar, May, Sep, Nov, Dec
7	February	Jan, Mar, May, Sep, Oct, Nov, Dec
8	November	Jan, Feb, Mar, May, Sep, Oct
9	May	Jan, Feb, Mar, Apr, Oct, Nov
10	March	Jan, Feb, Apr, May, Oct, Nov
11	October	Feb, Mar, Apr, May, Nov
12	April	Mar, May, Oct

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350   Additionally, no group of months can be isolated from the remaining months.

351   That is, no group of months are statistically different from the remaining

352   months.

353   As expected, the results of the Student-t Test lead to different conclusions. The

354   Student-t Test indicates that Jul and August are statistically different from the

355   other months. In particular, the t-Test rejects the Null Hypotheses that July and

356   June, and August and June are the same. Tukey's HSD Test fails to reject these

357   hypotheses. In fact, 11 cases, or nearly 17%, of the 66 comparisons where the t-

358   Test rejects the Null Hypothesis, the HSD Test fails to reject the Null. See DPU

359   Work Papers 2.1 DIR-COS.

360   **Q: WOULD YOU SUMMARIZE YOUR CONCLUSIONS FROM THIS FIRST DATA SET?**

361   A: Given that no month or group of months can be statistically isolated from the

362   other months, I conclude that this data set does not support movement away

363   from the current use of a 12CP.

364   **Q: DID YOU ANALYZE THE *FORECASTED* DATA IN THIS FIRST DATA SET?**

365   A: Yes. I used the same techniques as previously described. The forecasted data,

366   even under the HSD Test, leads to somewhat different conclusions. **Table *2***

367   summarizes the rejection pattern. (The months are present from highest to

368   lowest: July has the highest average peak while April has the lowest average

369   peak).

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370 **Table 2: 1.1.A Total Firm Peak Load, No Curtailment, Forecasted Data (2013 – 2022)**

371

372   On a forecasted basis the HSD Test indicates that July and August are different

373   from the other months, but not from each other. In total, there are eight groups

374   of months, which appear to be different from the remaining months.   For

375   example, June is different from every other month; January and November are

376   the same but different from the other months; etc. This might suggest moving

377   away from the 12CP currently used. However, a comparison of the summary

378   statistics for the historical and forecasted data raises concerns.

379   **Table *3*** and **Table *4*** compare the average load and relatively volatility of the

380   historical and forecasted data. The forecasted loads appear reasonably

381   consistent with the historical loads. The forecasted average load in each month

382   is less than the historical average load with the largest difference, approximately

383   4%, in December's forecast.   The rankings of the average loads are also similar

384   between the historical and forecasted data. See **Table *5*** . Given the Company's

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385   use of normalized data in forecasts and projections of lower growth, the changes

386   between the actual and forecasted data appear reasonable.

387   **Table 3: Comparing Average Loads, 1.1.A Total Firm Peak Load, No Curtailment**

388

389   However, the relative volatility measured by the CV are noticeably different

390   between the historical and forecasted data. On a historical basis, May has the

391   greatest volatility but on a forecasted basis is ranked second; June, which was

392   ranked third historically, is ranked tenth in the forecasted data. Other months'

393   ranking vary in similar ways: January, April, May, August, September, and

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394   November exhibit similar rankings while the remaining six months are noticeably

395   different. See **Table *5***.

396   The change in the CV for each month also merits examination.[8] Except for

397   January, the CV for each month varies by more than 10% from the historical to

398   the forecasted data.   And while some months' CV increase others decrease. For

399   example, February's CV increases by almost 54% while June deceases by

400   approximately 58%; and May, which historically has the largest CV, decreases by

401   more than 61% in the forecasted data. See **Table *4***.

402   **Table 4: Comparing Volatility, 1.1.A Total Firm Peak Load, No Curtailment**

	Coefficient of Variation			
	Historical	**Forecasted**	**Difference**	**Percent**
Jan	2.42%	2.39%	-0.03%	-1.25%
Feb	1.61%	2.48%	0.87%	53.74%
Mar	1.73%	2.43%	0.70%	40.17%
Apr	3.32%	2.59%	-0.73%	-21.95%
May	7.37%	2.84%	-4.53%	-61.51%
Jun	4.42%	1.84%	-2.58%	-58.34%
Jul	2.83%	1.47%	-1.36%	-48.06%
Aug	1.12%	1.54%	0.42%	37.33%
Sep	2.38%	1.87%	-0.51%	-21.51%
Oct	3.50%	3.11%	-0.38%	-10.89%
Nov	5.81%	2.72%	-3.09%	-53.23%
Dec	3.93%	2.18%	-1.74%	-44.37%

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404

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[8] The concern is with using the forecasted data to determine the correct CP for the system capacity, SC, factor and is not meant as a criticism of the Company's forecast per se.

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405   **Table 5: Comparison of Historical and Forecasted Data**

		Ranking Mean		Ranking CV	
		Historical	Forecasted	Historical	Forecasted
	Jan	6	6	8	7
	Feb	7	9	11	5
	Mar	10	10	10	6
	Apr	12	12	6	4
	May	9	8	1	2
	Jun	3	3	3	10
	Jul	1	1	7	12
	Aug	2	2	12	11
	Sep	4	4	9	9
	Oct	11	11	5	1
	Nov	8	7	2	3
	Dec	5	5	4	8

406

407   Given the difference in volatility patterns between the historical and forecasted

408   data, I am not confident that the forecasted data is that useful in determining

409   the stress on the system by month. For example, the historical data indicates

410   that May's peak load is quite volatile relative to the other months. On a

411   forecasted basis, May is much less volatile relative the other months and is no

412   longer the most volatile month. While one might expect the volatility patterns

413   to change in a forecast, the pronounced changes here do not appear to be

414   simply the result of (forecast) averaging.   Therefore, I do not recommend relying

415   on the forecasted data to support any particular demand definition or CP usage.

416   In summary, the historical monthly load data does not appear to support moving

417   away from the current use of all 12 months in the definition of the system

418   capacity factor. The forecasted data may support some movement. However,

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419 change in the relative volatility are pronounced and raise doubts about using the

420 forecasted data to determine demand allocators. Therefore, based on the

421 analysis of the first data set, I conclude that there is no justification for

422 abandoning the use of the 12CP in the system capacity factor.

423 **Data Set 1.1-B: Stress Factor Study 1.1.B Total Firm Load, With Curtailment**

424 Qualitatively, the results for the second data set are similar to those for the first

425 data set. On a historical basis the HSD Test indicates that no single month or no

426 group of months is significantly different from the remaining months; however,

427 the forecasted data tell a somewhat different story.

428 On a forecasted basis, the months can be classified into eight groups. July and

429 August are different from the remaining months. June and September are each

430 different from every other month. January, November and December form a

431 fourth group; February and May a fifth group; and March, April, and October

432 each forming a group. However, while the average loads, both in value and

433 ranking are similar between the historically and forecasted data, the CV is quite

434 different. As explained previously, the difference in the ranking and magnitude

435 of the CV or relative volatility raise doubts about the usefulness of this data in

436 determining an appropriate combination of monthly CPs.

437 Therefore, I reach the same conclusion as with the first data set, namely, data

438 set two does not support moving away from the 12CP.

439 **Data Set 1.2-A: Stress Factor Study, Retail Firm Load, No Curtailments**

440 Qualitatively, the results are similar to those previously presented. The volatility

441 difference between the historical and forecasted data is striking. May, which on

442 a historical basis had the largest volatility, ranked seventh on a forecasted basis

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443   with the CV decreasing by 59%. The volatility for October increased by almost

444   268% and changed rank from eleventh most volatile to having the largest

445   volatility.

446 **Q:**   **DO YOU HAVE ANY OBSERVATIONS ON THE OTHER ELEMENTS OF THE STRESS FACTOR STUDY?**

447 A: A few. In addition to the monthly peak load data, there five other elements in

448   the study. Items two and three, the Probability of Contribution to Peak (1) and

449   (2), measure respectively the hours in the month that exceed a percentage of

450   the annual peak or the number of MWh associated with the hours that exceed a

451   percentage of the peak load. All of these exhibit similar patterns.

452   The percentages of peak load provided in the stress factor study are 70%, 80%,

453   90%, 95%, and 99%. Every month has some hours that exceeds 70% of the

454   annual peak. Also, at 70% of the annual peak, January frequently has more

455   hours that exceed the threshold than do the other months of the year, including

456   July. However, as the percentage increases, the number of hours in January

457   exceeding the threshold declines rapidly. For example, in 2008, January has ▮

458   hours that exceed 70% of peak; ▮ hours at 80% peak; and zero hours at higher

459   percentages.

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460   **Table 6: Number of Hours Exceeding Percent of Peak**

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461

462   Not surprisingly, the number hours in each month declines as the percentage is

463   increases until at 99% only July and August persistently have hours exceeding the

464   designated level.

465   In summary, this data may provide some measure of system stress. At lower

466   percentages and thus thresholds, all months have hours exceeding the threshold

467   but the percentage level is arbitrary. As the percentage increases, the number of

468   months with hours exceeding the threshold declines until only the summer

469   months, specifically July and August have hours above the threshold. Given the

470   statistical result previously discussed and the arbitrary choice of the percentage

471   to define a threshold, I do not believe this data provides support for changing

472   the definition of the system capacity factor.

473   **Q: DOES THAT CONCLUDE YOUR DIRECT TESTIMONY?**

474   A: Yes.