

May 22, 2012

Ms. Elizabeth A. Rolando, Chief Clerk
Illinois Commerce Commission
527 East Capitol Avenue
Springfield, Illinois 62701

RE: ICC Docket No. 12-0298; Petition for Statutory Approval of Smart Grid
Advanced Metering Infrastructure Deployment Plan pursuant to Section 16-108.6
of the Public Utilities Act.

Dear Ms. Rolando:

On April 23, 2012, Commonwealth Edison Company (“ComEd”) filed with the Illinois Commerce Commission (“Commission”) a Petition for Statutory Approval of Smart Grid Advanced Metering Infrastructure Deployment Plan pursuant to Section 16-108.6 of the Public Utilities Act. ComEd submitted rebuttal testimony in this docket on May 17, 2012. The rebuttal testimony of Andrew L. Trump, ComEd Ex. 12.0, contained inadvertent errors listed below. Revised testimony, ComEd Ex. 12.0 REV, is attached to this Errata filing. The revisions are as follows:

- Change Document Header Throughout, insert “REV” after “ComEd Ex. 12.0”
- Page 3, Line 66, replace “net present value (“NPV”)” with “discounted”
- Page 6, Line 134, change “calculations” to “calculation results”
- Page 6, Line 135, insert “ComEd Ex. 12.01 presents the data itself. ComEd Ex. 12.03, also attached, presents (at page 2) the resulting discounted or net present value calculation results of using this data.”
- Page 10, Line 218, change “12.02” to “12.03, page 1”
- Page 10, Line 225, change “1.3” to “1.1”
- Page 11, Line 236, change “rows 28, 103 and 51” to “rows 28, 44 and 51”

- The changes to this document are reflected in the redlined version of ComEd Ex 12.0 REV served on all parties and attached hereto for reference.

A copy of this letter and enclosures are also being sent to Mr. Gene Beyer (Bureau Chief, Bureau of Public Utilities), Mr. Harry L. Stoller (Director, Energy Division), and Ms. Joy Nicdao-Cuyugan (Director, Financial Analysis Division) of the Commission's Staff.

Sincerely,



E. Glenn Rippie
Counsel for Commonwealth Edison Company

EGR

STATE OF ILLINOIS
ILLINOIS COMMERCE COMMISSION

COMMONWEALTH EDISON COMPANY	:	
	:	
Petition for Statutory Approval of a Smart Grid	:	No. 12-0298
Advanced Metering Infrastructure Deployment	:	
Plan pursuant to Section 16-108.6 of the Public	:	
Utilities Act	:	

Rebuttal Testimony of

ANDREW L. TRUMP

Director Utility Practice and Executive Consultant,
Black & Veatch Corporation

On behalf of
Commonwealth Edison Company

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1 **I. Introduction**

2 **A. Witness Identification**

3 **Q. What is your name and business address?**

4 A. My name is Andrew L. Trump. My business address is 832 Media Line Road, Newtown
5 Square, Pennsylvania 19073.

6 **Q. Are you the same Andrew L. Trump who has previously submitted testimony on
7 behalf of Commonwealth Edison Company (“ComEd” or the “Company”) in this
8 Docket?**

9 A. Yes, my direct testimony is ComEd Exhibit (“Ex.”) 6.0 REV.

10 **B. Summary of Rebuttal Testimony**

11 **Q. What is the purpose of your rebuttal testimony?**

12 A. The purpose of my rebuttal testimony is to respond to certain assertions, positions, and
13 recommendations related to ComEd’s Advanced Metering Infrastructure (“AMI”)
14 Deployment Plan (“AMI Plan”) contained in the direct testimony of AARP/Attorney
15 General (“AARP/AG”) witness Ms. Barbara Alexander, Attorney General (“AG”)
16 witness Mr. J. Richard Hornby, and City of Chicago (“City”) witness Ms. Karen
17 Weigert.

18 **Q. What are your principal conclusions?**

19 A. In Section II of my rebuttal testimony, I address Mr. Hornby’s assertions that 1) the AMI
20 Plan is only marginally cost-beneficial to customers, and 2) the cost-beneficial results
21 hinge primarily on the Company’s projections of value from additional revenues and
22 avoided power costs. I conclude based on the model’s results and using Mr. Hornby’s
23 range of discount rates and evaluation periods, regardless of their reasonableness, that he

24 sponsor's results in a benefit to cost ratio of 1.0 or greater which satisfies the Act.
25 Secondly, while more than half the value of benefits is derived from additional revenues
26 and avoided power costs, the foundational basis for those projections reflect significant
27 insight gained in the AMI Pilot and analysis of Company actual data. Further, it would
28 be unreasonable to dismiss the value of unaccounted for energy ("UFE"), consumption
29 on inactive meter ("CIM"), and bad debt benefits as it is my understanding that these
30 benefits will automatically flow to customers.

31 In Section III, I address Mr. Hornby's assertion the 20-year evaluation period is
32 inappropriate and used in the Black & Veatch assessment to artificially increase benefits.
33 I conclude that use of a 20-year evaluation period is reasonable and proper for conducting
34 a cost-benefit analysis based on guidance from the Illinois Statewide Smart Grid
35 Collaborative ("ISSGC"), the useful life of the AMI system, recent decisions in other
36 states, and the purposes for which the analysis is being conducted. I also conclude that
37 the 20-year cost-benefit analysis is conservative because after the AMI system is fully
38 deployed at 10 years, the cost/benefit Assessment and model does not forecast any
39 incremental material improvements that could be expected in operational efficiency, or
40 system enhancements involving added functionality over the remaining 10 years, either
41 of which would increase additional benefit value beyond that estimated.

42 In Section IV. I address Mr. Hornby's assertion that customers will see higher
43 monthly bills during the first five years of the plan and will not receive cumulative net
44 positive benefits from the AMI Plan for the first ten years. Costs will exceed benefits in
45 the initial years of the deployment as shown in Table A-4 of ComEd Ex. 6.02 REV;
46 however, the model makes no forecast of rate impacts as those will be decided in future

47 formula rate proceedings. I noted that the majority of the calculated benefits will
48 automatically flow to customers in a timely manner through the formula rates and
49 automatic adjustment mechanisms.

50 In Section V, I address the assertion of City witness Ms. Weigert that some
51 customers will experience cost impacts *before* having the benefits associated with smart
52 meters. I conclude that the nature of the AMI benefits described in the model –
53 operational efficiencies, reductions in the amount of CIM, UFE and bad debt – is such
54 that all ComEd customers will share in these benefits regardless of whether their home or
55 business has a smart meter.

56 In Section VI, I address Mr. Hornby's assertion that it would be necessary to
57 adjust the 3.087% discount rate upward by the assumed level of inflation assumed in the
58 projections of costs and benefits. I conclude the 3.087% is a nominal rate that embeds
59 future inflation expectations. Adjusting 3.087% upward to account for inflation would
60 therefore double count the impact of inflation and be inappropriate.

61 In Section VII, I address Mr. Hornby's assertion that the AMI Plan cost benefit
62 model results are based on numerous projections, all of which are subject to uncertainty.
63 I agree any forecast will have some degree of uncertainty, but conclude the cost/benefit
64 assessment was constructed using conservative assumptions. I list 11 principal
65 assumptions I conclude are conservative. These create a greater degree of confidence
66 that the Base Case [discounted](#)~~net present value~~ (“NPV”) result of 1.9 benefit to cost ratio
67 is a reasonable result and suggests actual results should well exceed the 1.0 benefit to cost
68 ratio threshold.

69 **II. ComEd's Cost-Benefit Analysis**

70 **Q. AARP/AG witness Ms. Barbara Alexander describes ComEd's cost-benefit analysis**
71 **as follows:**

72 **ComEd is proposing to deploy AMI over a 10-year period at a cost of**
73 **\$2 billion that reflects the capital and operating costs of installing the**
74 **AMI system. While costs are calculated over a 10-year period,**
75 **ComEd's analysis calculates benefits over a 20-year period. The**
76 **Company projects that the operational benefits and enhanced delivery**
77 **service revenues over a 20-year period will total \$2.306 billion, that**
78 **other benefits relating to energy revenues will total \$2.307 billion and**
79 **that customers will experience \$2.607 billion benefits that are in**
80 **excess of costs. Over a 10-year period, ComEd calculates a net present**
81 **value of \$1.271 billion. These costs and benefits do not include the**
82 **costs and projected benefits associated with the implementation of a**
83 **Peak Time Rebate program that, according to the Company, will**
84 **enhance customer benefits even further. These costs include a**
85 **proposed budget for a consumer education and outreach effort that**
86 **totals \$27.7 million.**

87 **AARP/AG Ex. 3.0, 6:132-7:144. Are these statements accurate?**

88 **A. No, the quoted portion of Ms. Alexander's testimony contains a number of**
89 **misstatements:**

90 **➤ The model does not calculate costs over a 10-year period versus benefits over a**
91 **20-year period. Costs are included for the full 20-year study period. The \$2**
92 **billion in costs cited by Ms. Alexander's testimony occur over a 20-year period.**
93 **The costs incurred during the ten year meter deployment period is \$1.3 billion.**
94 **As indicated in Mr. Hornby's testimony on behalf of the AG, ComEd advised all**
95 **parties of a minor correction to the model resulting from a data entry error that**
96 **inadvertently omitted Project Management Office costs for a portion of the study**
97 **period. See Hornby Direct, AG Ex. 3.0, 4:20-21. Ms. Alexander refers to several**
98 **numbers that reflect the uncorrected costs. As corrected, operational benefits**

99 exceed operational costs by \$2.585 billion (instead of \$2.607 billion) and the NPV
100 of benefits over costs is \$1.251 billion (instead of \$1.271 billion). *See* AG Ex. 3.0
101 (Hornby Direct), 5:8-9; ComEd Ex. 6.0 REV, 5:100-01; ComEd Ex. 6.02 REV,
102 pp. 1-3, 1-4.

103 ➤ As indicated in ComEd Ex. 6.2 REV, the \$1.251 billion NPV of the costs and
104 benefit streams of ComEd's AMI Plan was computed "over the 20 year evaluation
105 term" rather than a 10-year period as stated by Ms. Alexander. ComEd Ex. 6.02
106 REV, p. 1-3.

107 ➤ If Ms. Alexander intended to indicate that the budget for customer education and
108 outreach is reflected in the analysis of benefits associated with the implementation
109 of a Peak Time Rebate program rather than the Black & Veatch cost-benefit
110 analysis, she is mistaken.

111 **Q. In AG witness Mr. Richard Hornby's direct testimony he purports to summarize**
112 **the results of ComEd's assessment of the projected benefits and costs of its AMI**
113 **Plan and calculates a benefit to cost ratio of 2.3 using figures from Table 1-2 in**
114 **ComEd Ex. 6.02 REV. AG Ex. 3.0, 4:16-5:9. This is further shown as the first**
115 **column in the column chart appearing on AG Ex. 3.2, page 2. Is this a fair**
116 **summary of ComEd's assessment?**

117 A. No. While the specific numbers provided by Mr. Hornby are accurate, he provides an
118 incomplete summary of ComEd's assessment from a benefit to cost ratio perspective.
119 ComEd Ex. 6.02 REV presents several benefit-to-cost views as results. First, the
120 undiscounted benefit-to-cost ratio is correctly reported at 2.3 (\$4,613 million ÷ \$2,028

121 million). Second, the discounted benefit to cost ratio result of 1.9 is used in ComEd's
122 Assessment on page 6-3 of ComEd Ex. 6.02 REV:

123 "Using values discounted to the present (2012) yields benefits of
124 \$3,080 million and costs of \$1,568 million, for a benefit-to-cost
125 ratio of 1.9."

126 **Q. Does Mr. Hornby reference this discounted result in his testimony?**

127 A. This result does not appear in Mr. Hornby's narrative testimony. This result, however,
128 does appear in AG Ex 3.3 under the "NPV at 3.087%" scenario for Base Case – 20 Year
129 Time Horizon.

130 **Q. Does this result appear in the spreadsheet model?**

131 A. No. This result is based on performing a net present value computation on Excel rows
132 11-12 and 14-19 on the "Results" tab of the spreadsheet model. The calculation was
133 performed for purposes of ComEd Ex. 6.02, but was not explicitly structured in the
134 model. The calculations results, using cost and benefit data from the model, are
135 presented in ComEd Ex. 12.01, attached. [ComEd Ex. 12.01 presents the data itself.](#)
136 [ComEd Ex. 12.03, also attached, presents \(at page 2\) the resulting discounted or net](#)
137 [present value calculation results of using this data.](#)

138 **Q. Why is the omission in Mr. Hornby's narrative testimony of a reference to the**
139 **Assessment's discounted result of 1.9 important?**

140 A. It is important for several reasons. First, when Mr. Hornby compares the undiscounted
141 result of 2.3 to discounted results he has prepared for illustration purposes, and fails to
142 reference the Assessment's 1.9 discounted benefit-to-cost ratio result, this leads to an

143 “apples to oranges” comparison of results throughout his testimony. See e.g., AG Ex.
144 3.0, 13:8-15; AG Ex. 3.3. This apples to oranges comparison exaggerates the claims of
145 the degree of difference represented in the illustrations of various benefit to cost ratio
146 results for the different discount rates he has studied.

147 Second, Mr. Hornby’s testimony claims that the Assessment’s 2.3 benefit-to-cost
148 ratio is based on application of a discount rate, when in fact it is not. Mr. Hornby testifies
149 that “[t]he benefit to cost ratio of the Base Case drops from 2.3 under *the Company’s*
150 *discount rate* to 1.5 with an 8.16% and 1.4 with a 10.05% discount rate.” AG Ex. 3.0,
151 13:11-13 (emphasis added). This statement is incorrect. Using the Company’s cost-
152 benefit ratio based on application of a discount rate, the change in the ratio based on use
153 of different discount rates is more moderate, changing from 1.9 (instead of 2.3) to 1.5
154 based on use of an 8.16% discount rate.

155 **Q. Why did you choose to include the results of the benefit to cost ratio using**
156 **undiscounted values (i.e., the 2.3 result)?**

157 **A.** It is very important that a complex evaluation of benefits and costs does not obscure the
158 foundation of the analysis, which is the nature, scope and magnitude of benefits and
159 costs. As illustrated by the AG’s testimony, changing assumptions about discount rates
160 and evaluation time periods alters the numerical benefit to cost and the net present value
161 results. However, underlying all of the AG’s illustrations is a consistent reliance on the
162 gross nominal dollar benefits and costs. That remains unchanged. In fact, in the case of
163 the Assessment, the nominal dollar benefits exceed the nominal dollar costs by a factor of
164 227% -- and this fact never changes no matter what discount rate is applied. It is useful

165 for stakeholders to be exposed to this underlying foundation before the important
166 dynamics associated with discount rates and evaluation time periods are introduced.

167 **Q. Is this the only reason?**

168 A. No. As indicated by Mr. Hornby (AG Ex. 3.0, 11:6), the ISSGC¹ recommendations
169 included guidance that the utility should be required to present multiple views, or
170 perspectives, as part of the cost-benefit analysis to be filed with the regulatory
171 commission. The ISSGC Report states that “The ICC and others should have the benefit
172 of these different perspectives when weighing the merits of smart grid investments.”
173 ISSGC Report at p. 236.

174 **Q. Does ComEd’s Assessment make additional benefit-to-cost claims?**

175 A. Yes, the Assessment provides a *third* view of the relationship of benefit-to-cost, in the
176 form of an overall NPV result for the Assessment. The Assessment refers to this as the
177 “Net Impact to Customers” or “NPV” view. *See* ComEd Ex. 6.02 REV, p. 1-4, Table 1-2
178 and p. 6-4, Table 6.1. “The NPV view takes into account depreciation of capital
179 investment, accelerated recovery of retired meters, income taxes, and return on
180 investment.” *Id.* at p. 6-4, fn. 38. These are the core components of determining utility
181 revenue requirements. The NPV is \$1.251 billion, which is the present value, over a 20-
182 year evaluation period, of the difference between the benefits and costs of ComEd’s AMI
183 Plan. This result uses the Assessment discount rate of 3.087 percent. This result means
184 that discounted benefits exceed discounted costs by \$1.251 billion over the 20-year

¹ Illinois Statewide Smart Grid Collaborative: Collaborative Report, September 30, 2010, compiled by
Enernex Corporation (available at <http://www.icc.illinois.gov/downloads/public/en/ISSGC%20Collaborative%20Report.pdf> (“ISSGC Report”).

185 evaluation period. This result is validated as a core model result by reference throughout
186 Mr. Hornby's testimony, and it is shown on Mr. Hornby's Exhibits worksheets.

187 **Q. Why is this third result important?**

188 A. It is important for several reasons. First, as stated earlier, the ISSGC recommended that
189 multiple perspectives be provided of the results. Second, this net impact to customers
190 view takes into account costs that are typically included in the determination of utility
191 revenue requirements. These costs include depreciation, taxes, the accelerated
192 depreciation recovery of certain assets, and a return for the providers of equity capital to
193 enable the capital investment.

194 **Q. Are some of these costs excluded in the Assessment's discounted benefit-to-cost ratio
195 result of 1.9?**

196 A. Yes. This net impact to customers view adds in additional costs such as tax and equity
197 returns. It also considers the depreciation treatment of capital expenses, something that
198 the other views do not. The other views treat capital expense in a "lump sum" fashion,
199 but this is not how ComEd customers will be exposed to capital costs. Capital costs are
200 systematically reflected in the model through yearly depreciation treatment.
201 Accordingly, the net impact to customers view is the most complete view of all costs and
202 benefits associated with the AMI system and operation.

203 **Q. Why did ComEd not express the net impact to customers view in terms of a benefit-
204 to-cost ratio result?**

205 A. While this view is the most sophisticated of the three views, it is also more difficult to
206 explain as it involves considerations around depreciation of assets, taxes, and utility

207 returns. To develop a benefit-to-cost ratio requires parsing the *embedded* costs and
208 benefits that make up the *net change in operational expenses* (row 12, Table A-4,
209 attached to ComEd Ex. 6.02 REV). Additionally, it means that instead of treating the
210 capital expense in a “lumpy” fashion (e.g., introduced into the calculations in the year
211 that the expense is incurred) the capital is treated through depreciation mechanisms, as
212 detailed in the model. The Assessment expressed the present value results on the overall
213 *net* difference of benefits and costs, as shown on Row 12 of Table A-4, attached to
214 ComEd Ex. 6.02 REV, taking into account these methods.

215 **Q. What would the benefit-to-cost ratio result be using the benefits and costs**
216 **corresponding to the \$1.251 billion NPV result reported in Table A-4 attached to**
217 **ComEd Ex. 6.02 REV?**

218 A. The benefit-to-cost ratio result embedded in the \$1.251 billion NPV is 1.7 assuming a 20-
219 year evaluation period and a discount rate of 3.087%. The calculation of this benefit-to-
220 cost ratio is shown in ComEd Ex. 12.032, [page 1](#).

221 **Q. Are there other reasons why this benefit-to-cost ratio is important?**

222 A. Yes. By taking into account depreciation effects, tax effects, and the other items shown
223 on Rows 12-17 of Table A-4, attached to ComEd Ex. 6.02 REV, the overall sensitivity of
224 the model changes with changes to costs and benefits. For example, when using this
225 third benefit-to-cost ratio, and applying the door knock sensitivity with a discount factor
226 of 10.05% per the illustration provided by AG witness Mr. Hornby (AG Ex. 3.0), the
227 resulting benefit-to-cost ratio is 1.13. This compares with Mr. Hornby’s result of 1.0.
228 *See* ComEd Ex. 12.03.

229 Q. **Can you summarize your view of the benefit-to-cost ratios and their relationship to**
230 **the Assessment and your testimony?**

231 A. Yes. To help explain our resulting views, we have prepared Figure 1, below. The simple
232 benefit-to-cost ratio is 2.3. This is labeled View A. It is described in the report and
233 shown in the spreadsheet model. The benefit-to-cost ratio that uses *discounted* dollars is
234 1.9. This is labeled View B on Figure 1. It is described in ComEd Ex. 6.02 REV, and in
235 ComEd Ex. 12.03, using dollar amounts on Excel rows 11-12 and 14-19 on the “Results”
236 tab of the spreadsheet model. The benefit-to-cost ratio embedded in the net customer
237 impact NPV result is 1.7. This is labeled View C on Figure 1. It is described in ComEd
238 Ex. 12.03 attached, using dollar amounts on Excel rows 28, ~~44~~¹⁰³ and 51 on the
239 “Results” tab of the spreadsheet. Additionally, when performing a sensitivity using this
240 net impact to customers benefit to cost ratio, and when using the AG witness Mr.
241 Hornby’s 10.05% discount rate and door knock assumption, the resulting benefit-to-cost
242 ratio is 1.1. This is labeled View E on Figure 1. This compares with AG witness Mr.
243 Hornby’s estimate of 1.0. The 1.1 result is 10% higher than AG witness Mr. Hornby’s
244 estimate. This means that using these assumptions, on a present value basis, the benefits
245 exceed costs by 10%. For the sake of completeness we also show View D on Figure 1.
246 This shows the resulting benefit to cost ratio (1.4) assuming a 15 year evaluation period
247 with an assumed discount factor of 3.087%, and assuming this third method.

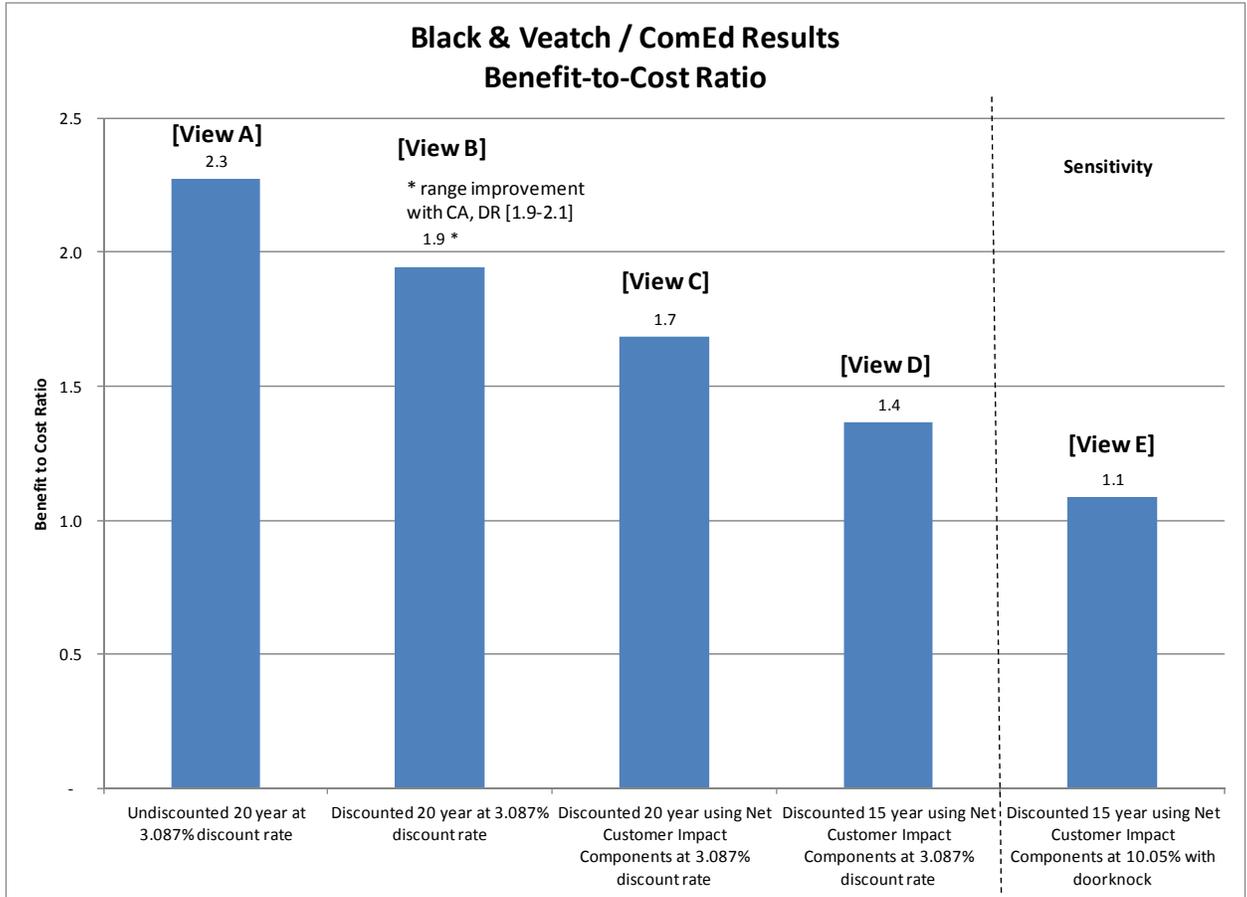


Figure 1

248
249

250 Q. Do you take additional exceptions to AG witness Mr. Hornby's testimony (AG Ex.
251 3.0) regarding the range of benefit-to-cost results?

252 A. Yes. Mr. Hornby's evaluation does not consider the additional contribution to the
253 benefit-to-cost result of the demand response-related benefits and costs. These are
254 described in Chapters 8 and 9 of ComEd Ex. 6.02 REV. These impacts result in
255 additional net benefit, expressed on a NPV basis, over 20 years, of between \$13 and \$292
256 million.

257 Q. Related to the two benefit-to-cost results you have described that use discounted
258 dollars, how would the demand response values impact the resulting ratio results?

259 A. There are four scenarios described for the demand response values, leading to a range of
260 resulting benefit-to-cost ratio results. When including the demand response results, the
261 1.9 Assessment result ranges from 1.9 to 2.1 depending on the scenario for demand
262 response. Similarly, when including the demand response result, the 1.7 benefit to cost
263 ratio tied to the net customer impact result ranges from 1.7 to 1.8 depending on the
264 demand response scenario. To see the impact of including the demand response
265 valuation, View B on Figure 1 shows the additional positive range of impact to the
266 benefit to cost ratio when including the demand response valuation results. The benefit-
267 to-cost ratio is improved as much as 10%.

268 Q. **In AG witness Mr. Hornby's direct testimony (AG Ex. 3, 3:9-23), he summarizes**
269 **two principal conclusions: 1) the AMI Plan is only marginally cost-beneficial to**
270 **customers, and 2) the cost-beneficial results hinge primarily on the Company's**
271 **projections of value from additional revenues and avoided power costs. Are these**
272 **correct characterizations of your analysis?**

273 A. No. With respect to the claim that the AMI Plan is marginally cost-beneficial based on
274 my analysis presented in ComEd Ex. 6.02 REV, the NPV of the AMI Plan is a positive
275 \$1.251 billion, and the benefit to cost ratio is 2.3 based on gross nominal benefits and
276 costs, and 1.9 on a NPV discounted benefits and costs basis. Mr. Hornby tests my
277 analysis over a wide range of sensitivities to reach his conclusion, but for the 15- and 20-
278 year scenarios still demonstrates a benefit to cost ratio of 1.0 or greater as shown in
279 Figure 1 of Mr. Hornby's direct testimony, which satisfies the standard required by the
280 Act. Mr. Hornby demonstrates in Figure 1 on page 8 of AG Ex. 3.0 that under all
281 alternative discount rates and sensitivities he offered on Figure 1, reasonableness

282 notwithstanding, the benefit to cost ratio is 1.0 or greater, thus satisfying the requirements
283 of the Act in any possible scenario presented. Mr. Hornby's direct testimony therefore
284 supports the reasonableness of the AMI Plan as cost-beneficial.

285 With respect to Mr. Hornby's second claim, that the results hinge primarily on the
286 forecast value of additional revenues and avoided power costs associated with primarily
287 unaccounted for energy ("UFE"), consumption on inactive meters ("CIM") and bad debt,
288 I disagree. On page 5, lines 1-9 of AG Ex. 3.0, Mr. Hornby lists UFE, CIM and bad debt
289 as the largest sources of projected benefits. These three sources comprise nominally 62
290 percent of the benefits. Operational efficiencies and cost reductions comprise the
291 remaining 38 percent, which is a significant portion of the benefits. In recognizing the
292 value of the benefits, my analysis carefully considered the quantities of the activities or
293 energy avoided and then applied a unit cost (or revenue) to those quantities to determine
294 value.

295 In the case of UFE, CIM, bad debt and certain operational efficiencies, the
296 quantities of those benefits are derived from analysis of Company actual data gained in
297 the AMI Pilot. In assigning unit revenue or cost to those quantities, certain operational
298 avoided costs are based on ComEd actual costs and experience to currently perform
299 activities that will be eliminated with AMI. In assigning avoided energy costs to UFE
300 and CIM we have relied on conservative projections of future energy costs as I discuss
301 later in my testimony. While more than half the value of benefits is derived from
302 additional revenues and avoided power costs, the foundational basis for those projections
303 reflect significant insight gained in the AMI Pilot and analysis of Company actual data.
304 Further, it would be unreasonable to dismiss the value of UFE, CIM and bad debt

305 benefits as it is my understanding that these benefits will automatically flow to customers
306 through adjustment mechanisms as discussed in the testimony of ComEd witness Mr.
307 Louis Harris (ComEd Ex. 7.0).

308 **Q. AG witness Mr. Hornby (AG Ex. 3.0, 5:10-17) lists three criticisms that he contends**
309 **call into question the reasonableness of your benefit to cost ratio and NPV analyses**
310 **of the AMI Plan. How do you respond to the first criticism that the Base Case does**
311 **not reflect currently effective customer notification requirements?**

312 A. I cannot speak to the current requirements. My understanding is that ComEd witness Mr.
313 Louis Harris (ComEd Ex. 7.0) addresses this issue. However, in terms of analyzing the
314 costs and benefits of AMI deployment, I can state that only the customer notification
315 requirements in effect at the time AMI deployment occurs would have any potential
316 impact on the costs and benefits of AMI deployment. I excluded customer notification
317 for a non-payment disconnect from the Base Case based on directions from ComEd.
318 Putting aside any issues related to current requirements, this was appropriate in my
319 opinion to identify the benefits related to the availability of remote disconnection
320 functionality enabled by AMI meters. Further, we also conducted a sensitivity analysis to
321 assess the impact on the cost-benefit analysis of a customer notification requirement.
322 That analysis shows ComEd's AMI Plan remains cost-beneficial (\$1.031 billion NPV)
323 even with a customer notification of remote disconnect requirement. ComEd Ex. 6.02
324 REV, p. 10-3.

325 **Q. Could you address the second criticism that the discount rate used is too low?**

326 A. I was directed by ComEd to use a discount rate of 3.087% which in my opinion is
327 reasonable for the purpose of the cost benefit study. ComEd witness Mr. Scott Vogt
328 (ComEd Ex. 13.0) addresses the determination and appropriateness of the discount rate.

329 **Q. Does AG witness Mr. Hornby appropriately compare his benefit to cost ratio to the**
330 **benefit to cost ratios that ComEd reports in your direct testimony and ComEd Ex.**
331 **6.02 REV?**

332 A. No. Mr. Hornby inappropriately compares benefit to cost ratios throughout his direct
333 testimony (AG Ex. 3.0) by omitting reference to the NPV discounted benefit to cost ratio
334 of 1.9 that is presented on page 6-3 of ComEd Ex. 6.02 REV. Moreover, the intrinsic
335 benefit to cost ratio of the net customer impact NPV computation is not referenced in Mr.
336 Hornby's testimony. By intrinsic I refer to the underlying comparison of benefits and
337 costs embedded in the NPV calculation of *net customer impacts* as shown on Table A-4
338 of ComEd Ex. 6.02 REV.²

339 **III. Criticism of the 20 Year Study Period**

340 **Q. Please address the third criticism by AG witness Mr. Hornby that the time period**
341 **used to calculate the benefit to cost ratios is too long.**

342 A. It was determined that 20 years would be a reasonable evaluation time period for costs
343 and benefits, and that lead to the evaluation period of 2012 – 2031. I consider this to be
344 reasonable based on a number of factors. First, I take into account ISSGC Report
345 guidance, which emphasizes “extended” time periods in several instances in the report
346 but doesn't prescribe any specific evaluation time period. Instead, the report places

² Include footnote that explains the source and location of how this benefit to cost ratio is determined from values on Table A-4.

347 emphasis on present value techniques as a way to deal with potential differences in time

348 periods amongst plans under evaluation:

349 Smart grid applications can be expected to require upfront capital
350 investment and ongoing operational expenses. Benefits may occur
351 gradually and over extended periods of time. Therefore, cost-benefit
352 analyses in support of smart grid investments should convert future
353 expected streams of costs and benefits into a present value amount using
354 an appropriate discount rate.

355 ISSGC Report, p. 29.

356 I also took into account the ISSGC guidance regarding useful life of AMI assets,
357 and ComEd's expectations of useful life:

358 The length of time over which a cost benefit analysis is calculated should
359 reflect the projected useful life of the smart grid investment or system.
360 "Useful life" means the continuous period of time when the components
361 and systems of the investment operate correctly and reliably to perform
362 their designed functions.

363 ISSGC Report, p. 239,

364 **Q. Is it your understanding that ComEd expects the useful life of the AMI system to be**
365 **at least 20 years?**

366 A. Yes. ComEd has indicated its expectation that the AMI system will have a useful life
367 greater than 20 years. This conclusion arose specifically around my questions as to
368 whether the cost benefit assessment should factor in replacement costs for meters starting
369 at year 16. ComEd, based on its experience operating its current meter fleet, is confident
370 and expects AMI meters to have useful lives greater than 15 years.

371 **Q. Were there additional considerations in assuming the 20-year evaluation time**
372 **period?**

373 A. Yes. In recent cases within Maryland before the Maryland Public Service Commission
374 (“PSC”), the PSC ordered that the subject utilities (Order 83571) use a 10-year *post-*
375 *deployment* time period. This ten-year post deployment time period is consistent with the
376 ComEd 20-year cost/benefit assessment evaluation period, since the deployment period
377 last ten years. Plus, it seemed illogical to evaluate a ten-year “build” or deployment
378 period over a short five-year post-deployment operations period. Furthermore, one
379 purpose of the cost benefit assessment was to determine the long term “steady state”
380 nature of costs and benefits once the system was installed.

381 **Q. Is the 20-year evaluation period consistent with ISSGC guidance in reference to**
382 **service life for depreciation purposes?**

383 A. I believe it is for very practical reasons. The ISSGC Report states: “Absent any
384 persuasive contrary evidence, the depreciable life of the investment for regulatory (non-
385 tax) purposes should match the useful life of the investment.” ISSGC Report, p. 239. So
386 it is true that according to ISSGC recommendations the useful life estimates should
387 match the depreciable life assumptions for the investment. In the case of the cost/benefit
388 Assessment, Black & Veatch has used a 15-year depreciation schedule for the meter
389 assets. Furthermore, we have included the depreciation as one of the net customer impact
390 cost elements to ensure a comprehensive treatment of customer costs. What is important
391 to note is that the meter asset depreciation recovery begins immediately after the meter’s
392 installation, as it becomes used and useful immediately. This means that meters deployed
393 in years 9 or 10, for example, will retain useful lives and service lives well past year 20 of
394 the evaluation period. Therefore, were we to use a shorter evaluation period than 20
395 years there would remain significant unrecovered cost associated with the meters. For

396 example, a 15-year evaluation period coupled with a ten year meter deployment results in
397 approximately \$236 million of unrecovered meter investment. This means that the *net*
398 *customer impact* NPV result will not include the recovery of 33% of the initial meter
399 investment cost. In contrast, by extending the evaluation period to 20 years, the cost
400 benefit assessment is able to recover as a cost approximately 93% of the initial meter
401 investment cost.³

402 **Q. Is a 20-year evaluation period referenced by the ISSGC Report?**

403 A. Yes, a 20-year evaluation period is referenced indirectly by the ISSGC Report. The
404 ISSGC report recommends several studies and reports, which it believes are “particularly
405 useful.” ISSGC Report, p. 227. One study listed is the McKinsey & Company
406 spreadsheet model for comparing costs and benefits of AMI “to assist in analyzing AMI
407 deployments.” This spreadsheet model is structured as a 20-year evaluation.

408 **Q. Is the 20-year evaluation period used in the Black & Veatch assessment used to**
409 **artificially increase benefits?**

410 A. No. In fact, once the AMI system is fully deployed at 10 years, the cost/benefit
411 Assessment and model does not forecast any incremental material improvements that
412 could be expected in operational efficiency, or system enhancements involving added
413 functionality over the remaining 10 years, either of which would increase additional
414 benefit value beyond that estimated. Rather, AMI-centric benefits and costs largely trend
415 during the 10 year post deployment period based on meter population growth and
416 inflationary effects.

³ Footnote – to be developed citing the specific source and location of information from spreadsheet model.

417 **Q. Does the 20-year evaluation period used in the Black & Veatch assessment**
418 **understate costs because it does not include the replacement costs for meters at the**
419 **conclusion of their useful service lives for depreciation purposes?**

420 A. No. It is correct that the model does not include costs for replacing the newly installed
421 AMI-meters in the “to-be” scenario, but it also does not include costs for replacing
422 existing meters in the “as is” scenario. Black & Veatch considered this approach
423 accurate, reasonable, and balanced because it would not be appropriate to assume that the
424 new AMI meters need replacing beginning in year 16 (at the end of the service life for
425 depreciation purposes for the meters installed during year 1) but that the existing ComEd
426 meters last forever. This would be illogical.

427 **IV. Balance of Benefits and Costs In the First Ten Years**

428 **Q. AG witness Mr. Hornby states that customers will see higher monthly bills during**
429 **the first five years of the plan and will not receive cumulative net positive benefits**
430 **from the AMI Plan for the first ten years. AG Ex. 3.0, 9:15-19. Do you agree with**
431 **these statements?**

432 A. No. This is a misinterpretation of both certain data in the evaluation model and the
433 purpose of the model. First, costs will exceed benefits in the initial years as shown in
434 Table A-4 of ComEd Ex. 6.02 REV. The AMI Plan, however, makes no forecast of rate
435 impacts as those will be decided in future formula rate proceedings. Several of the
436 calculated benefits (UFE, CIM and Bad Debt) will automatically flow to customers in a
437 timely manner through the formula rates and automatic adjustment mechanisms.

438 Q. **Is the criticism valid, however, that the early years are disproportionately burdened**
439 **with costs, and the benefits are delayed, thus putting customers in the position for**
440 **paying for the system for ten years without getting sufficient benefit?**

441 A. No. First, the ISSGC Report specifically recommends using present value methods to
442 ensure proper assessment of these imbalances in time of costs and benefits:

443 Smart grid applications can be expected to require upfront capital
444 investment and ongoing operational expenses. Benefits may occur
445 gradually and over extended periods of time. Therefore, cost-benefit
446 analyses in support of smart grid investments should convert future
447 expected streams of costs and benefits into a present value amount using
448 an appropriate discount rate.

449 ISSGC Report, p. 29. Second, it is useful to consider that the model forecasts nominal
450 dollar benefits during the first ten years, at \$1.236 billion, compared to the \$1.385 billion
451 nominal deployment, operations, and maintenance costs of the AMI system, to appreciate
452 the fact that the AMI system drives substantial near-term value nearly equal to cost over
453 the first ten years. Third, applying Mr. Hornby's implied standard – that projects must
454 show net positive benefit earlier than year 10 – would mean that many capital intensive
455 and long-lived energy projects – such as central power stations I worked to license --
456 might never be considered cost-beneficial. Such a view is unreasonable.

457 V. **Apportionment of Benefits and Costs Due to Deployment Sequencing**

458 Q. **Is the nature of the cost and benefit estimates such that some customers will**
459 **experience cost impacts before having the benefits associated with smart meters?**

460 A. The nature of the AMI benefits described in ComEd Ex. 6.02 REV – operational
461 efficiencies, reductions in the amount of CIM, UFE and bad debt – is such that all
462 ComEd customers will share in these benefits regardless of whether their home or
463 business has a smart meter. For example, if ComEd reduces operational costs, or

464 improves (lowers) bad debt, customers share in these benefits regardless of location of
465 smart meter installation status.

466 **Q. Does this conclusion apply to customers wanting to participate in new rate**
467 **programs, such as a peak-time rebate (“ PTR”) program?**

468 A. No, this conclusion applies to the AMI-centric benefits, as listed on Table 4-3 of ComEd
469 Ex. 6.02 REV. But it is important to note that ComEd’s AMI Plan is cost-beneficial
470 relying solely on such operational benefits.

471 **VI. The Relationship of 3.087% and Inflation**

472 **Q. AG witness Mr. Hornby contends that it would be necessary to adjust the 3.087%**
473 **discount rate upward by the assumed level of inflation assumed in the projections of**
474 **costs and benefits. AG Ex. 3.0, 12:11-17. Do you agree?**

475 A. No. The costs and benefits are expressed on a nominal dollars basis, not a real dollar
476 basis. The 3.087% is also a nominal rate that embeds future inflation expectations.
477 Adjusting 3.087% upward to account for inflation would therefore double count the
478 impact of inflation and be inappropriate. The Office of Management and Budget
479 (“OMB”), for example, cites as guidance a nominal 20 year Treasury rate at 3.5% and a
480 corresponding real rate for the same Treasury at 1.7%. See OMB, Circular A-94
481 http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c.

482 **VII. Uncertainty**

483 **Q. AG witness Mr. Hornby contends that the AMI Plan assessment NPV result of the**
484 **Base Case is based on numerous projections, all of which are subject to uncertainty.**
485 **AG Ex. 3.0, 15:7-8. Do you agree?**

486 A. All forecasts inherently have some degree of uncertainty, but I disagree with the absolute
487 nature of Mr. Hornby's statement. ComEd's projections have varying degrees of
488 uncertainty. For example, ComEd has excellent visibility into likely AMI RF Network
489 deployment costs because it has the benefit of a contract with its communication system
490 provider, and experience deploying and operating its extensive, 128,000 meter Pilot
491 system. Second, its discussions with meter suppliers have been extensive, allowing it to
492 develop price assumptions for its meter supply that are highly reasonable and
493 conservatively high given that there is no assumed change in meter pricing over ten
494 years. Moreover, its meter installation price estimate is likewise conservatively high
495 based on my experience. It should be noted that the meter and installation costs comprise
496 over \$700 million of the nominally \$1.385 billion estimated deployment cost of the
497 system.

498 **Q. Mr. Hornby contends that there is uncertainty in the AMI Plan results due to**
499 **uncertainty over the meter life. AG Ex. 3.0, 15:16. This is supported by citing**
500 **Oklahoma Gas & Electric's experience in securing a five-year meter warranty from**
501 **its meter manufacturers. Do you agree with this logic?**

502 A. I do not. In my experience of supporting utility clients negotiate long term meter supply
503 contracts, I have found that meter manufacturers have offered to increase warranty
504 periods from traditional 12-18 months for mechanical meters to up to 60 months to win
505 the utility's business. This *increase* in the warranty coverage duration has been used to
506 improve the value of the supply contract. This willingness to increase warranty terms
507 reflects the confidence the meter manufacturers place in their products, not an expression
508 of concern over the life expectancy of their products.

509 **Q. If you agree with Mr. Hornby that there is some degree of uncertainty in the AMI**
510 **Plan assessment results, how should the results be interpreted?**

511 A. Because any forecast will have some degree of uncertainty, the cost/benefit assessment
512 was constructed using conservative assumptions. This helps create a greater degree of
513 confidence that the Base Case NPV result of 1.9 benefit to cost ratio is a reasonable result
514 and suggests actual results should well exceed the 1.0 benefit to cost ratio threshold.

515 **Q. Are there specific assumptions in the forecast that you consider to be conservative?**

516 A. Yes. The conservative assumptions in the forecast include:

517 (1) No price increase is assumed for the provision of meters over the
518 ten year deployment period.

519 (2) The Base Case results exclude consideration of the additional
520 value created through the PTR demand response plan element,
521 which could add several hundreds of millions of dollars.

522 (3) Incremental improvements in operational efficiencies are not
523 assumed in the Base Case steady state post deployment period.
524 Costs and benefits trend with system growth and general effects of
525 inflation.

526 (4) No other smart grid applications, using ISSGC terminology,
527 beyond the core AMI system, is assumed. In fact, whereas the
528 ISSGC Report identifies twenty eight (28) smart grid applications,

529 the cost/benefit assessment is based on the quantified AMI-related
530 benefits associated with four applications.⁴

531 (5) Approximately \$165 million in general price escalation is assumed
532 over 20 years for various IT systems.

533 (6) Over \$146 million of costs related to Outage Management System
534 (“OMS”) enhancements and operations expenses have been
535 included in the cost/benefit assessment without any corresponding
536 quantified benefit. ComEd plans on upgrades to its OMS, but to be
537 conservative has not assigned additional benefit value to it for
538 purposes of the AMI Plan assessment model.

539 (7) The discounting of cash flows begins during year 1, 2012. This
540 was done to ensure conservativeness and recognize that
541 expenditures would begin to occur mid-2012. (Model results
542 would be approximately 3% higher assuming the first period of
543 discounting is 2013).

544 (8) Several benefits delay any benefit recognition until 2014.
545 Additionally benefits include lag assumptions to ensure business
546 processes are in place to capture the benefits.

547 (9) The cost/benefit assessment does not assign any monetization to
548 the identified societal benefits (avoided emissions).

⁴ The AMI-centric applications are shown and explained in Table 3-1 of ComEd Ex. 6.02 REV.

549 (10) No offsetting consideration is assumed for sales taxes that are
550 included in the cost/benefit evaluation. These taxes represent a
551 customer cost, but they also represent a form of societal benefit as
552 they flow to the state.

553 (11) Mr. Hornby points out that there are additional opportunities to
554 introduce TOU rates and to optimize the Distribution Automation
555 communication system rollout.

556 (12) The assessment model includes an adjustment to the energy service
557 prices by reducing these prices for the impact of the rider covering
558 bad debt, which is current in rates. This reduces the energy service
559 price assumptions, making them more conservative.

560 (13) Inclusion of the costs for the ComEd Pilot, both capital and
561 operations and maintenance expenses, are conservatively high.

562 **Q. AG witness Mr. Hornby argues that the nature of future energy prices are**
563 **speculative, and by implication the benefits are sensitive to these speculative**
564 **assumptions. AG Ex. 3.0, 15:17-16:2. Do you agree that future energy prices are**
565 **speculative?**

566 A. The Assessment uses a specific forecast of energy prices, which it has developed for
567 years 2012-2015, a four-year period. An inflation factor of 2.5% was applied thereafter.
568 It is relevant to consider past trends to help gauge if assumptions about the future are
569 reasonable. The Energy Information Agency (“EIA”), part of the Department of Energy,
570 provides historical electricity price data. It reports that electricity prices for the United
571 States from 2001 to 2011 (a ten year period of change) trended from \$7.29 to \$9.99, a

572 change of 37%.⁵ This is equivalent to a rate of change of 3.2% per year, compounded.
573 This historical price change over a reasonably long period of ten years is higher than the
574 conservative 2.5% assumption used in the cost/benefit Assessment.

575 **Q. Mr. Hornby's testimony argues that the nature of future energy prices are**
576 **speculative, in part because energy prices are very sensitive to future natural gas**
577 **prices. AG Ex. 3.0, 15:23-16:1. Do you agree with this statement?**

578 A. I agree that energy prices are sensitive to future natural gas prices. Synapse reports
579 (reasonably) that there are many components that determine the wholesale price of energy
580 (natural gas prices, forecasted load growth, new additions and retirements, transmission
581 configuration, renewable portfolio standards requirements, and emission prices). See
582 Slide 4, Synapse Energy Economics, Presentation to the Efficiency Maine Trust,
583 September 7, 2011. Natural gas prices are one of several important determinants.

584 **VIII. Conclusion**

585 **Q. Does this conclude your direct testimony?**

586 A. Yes, it does.

⁵ Source: the electricity prices used here come from the Energy Information Agency, a department of the US Department of Energy. The datasource can be found at <http://www.eia.gov/cneaf/electricity/page/eia826.html>.