

STATE OF ILLINOIS
ILLINOIS COMMERCE COMMISSION

ILLINOIS COMMERCE COMMISSION)

On Its Own Motion,)

vs.)

COMMONWEALTH EDISON COMPANY,)

Investigation of Rate Design Pursuant)
to Section 9-250 of the Public Utilities)
Act.)

Docket No. 08-0532

Direct Testimony and Exhibits of

David L. Stowe

On behalf of

Illinois Industrial Energy Consumers

Project 9061
May 22, 2009



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BEFORE THE
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Direct Testimony of David L. Stowe

1 Introduction

2 Q PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

3 A My name is David L. Stowe. My business address is 16690 Swingley Ridge Road,
4 Suite 140, Chesterfield, MO 63017.

5 Q WHAT IS YOUR OCCUPATION?

6 A I am a consultant in the field of public utility regulation with Brubaker & Associates,
7 Inc. ("BAI"), energy, economic and regulatory consultants.

8 Q PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

9 A This information is included in Appendix A to my testimony.

10 **Q ON WHOSE BEHALF ARE YOU APPEARING IN THIS PROCEEDING?**

11 A I am appearing on behalf of the Illinois Industrial Energy Consumers (“IIEC”). IIEC is
12 an ad hoc group of industrial customers eligible to take power and energy or delivery
13 service from Commonwealth Edison Company (“ComEd” or “Company”).

14 **Q PLEASE EXPLAIN THE PURPOSE OF YOUR TESTIMONY.**

15 A The purpose of my testimony is to discuss ComEd’s analysis of its distribution system
16 to determine the costs of serving its primary and secondary customers. Throughout
17 my testimony I will refer to such analyses of primary and secondary systems as “P/S
18 analyses.” Customers that take service at primary or secondary voltages will be
19 referred to as “primary customers” or “secondary customers,” respectively.

20 The fact that I did not address an issue should not be interpreted as tacit
21 approval of any position taken by ComEd.

22 **Q PLEASE SUMMARIZE YOUR FINDINGS AND CONCLUSIONS.**

23 A ComEd’s P/S analysis overstates the costs incurred to distribute electricity to
24 customers that take service at primary voltage levels. This overstatement is the result
25 of errors in the way ComEd assigned costs to customers that receive electric service
26 at primary voltage levels. I have proposed modifications to the primary and
27 secondary analysis to correct some of the deficiencies found in ComEd’s study.

28 **Q HAS COMED PERFORMED A P/S ANALYSIS PRIOR TO THE ONE REQUIRED IN**
29 **THIS CASE?**

30 A No. ComEd stated in response to data request IIEC 3.03 that it has not previously
31 performed a P/S analysis. Furthermore, Mr. Alongi states in his testimony that:

32 ... over the many years that ComEd has been filing ECOSs with the
33 Commission, ComEd has not recorded on its books gross plant in a
34 manner that distinguishes between the costs of primary and secondary
35 facilities. (ComEd Exhibit 1.0 at 15).

36 **Q ARE P/S ANALYSES PERFORMED AS A MATTER OF COURSE BY OTHER**
37 **UTILITIES IN ILLINOIS AND IN OTHER MIDWESTERN STATES?**

38 A Yes. I have compiled the results of P/S analyses performed by 11 other electric
39 companies that operate in Illinois and the Midwest, and will discuss these results later
40 in my testimony.

41 **Q DID COMED STUDY THE P/S ANALYSES OF OTHER ELECTRIC COMPANIES**
42 **TO GUIDE ITS OWN P/S ANALYSIS EFFORTS?**

43 A Generally, no. In response to data request IIEC 3.04, ComEd states:

44 ComEd is aware of and has briefly reviewed some of the
45 primary/secondary analyses performed for the Ameren Utilities.
46 ComEd has not reviewed any other primary/secondary analyses for
47 any other utility for the purposes of performing its primary/secondary
48 analyses.

49 **Q WHY ARE P/S ANALYSES IMPORTANT TO THE COST OF SERVICE PROCESS?**

50 A Electric customers receive their electric service at diverse voltage levels and
51 consequently, cause the Company to incur different costs in providing them with
52 service. A properly conducted P/S analysis allows the cost analyst to better
53 recognize and identify the cost of the distribution system components that operate at
54 specific voltage levels, and to determine more accurately the customer classes those
55 costs were incurred to serve. This essential capability addresses the central issue of
56 *cost causation*, and allows for a more refined and equitable allocation of revenue
57 responsibility.

58 **Q PLEASE EXPLAIN WHAT YOU MEAN.**

59 A The principle of cost causation emphasizes the importance of having the rates
60 charged to a particular customer class that are designed to recover only those costs
61 that the utility incurred to serve that customer class. Properly conducted P/S
62 analyses allow cost analysts to distinguish the costs of serving customers at
63 secondary voltage levels (i.e., secondary customers), from those incurred to serve
64 customers at primary voltage levels (i.e., primary customers).

65 To illustrate, primary customers receive their electricity prior to its
66 transformation and, therefore, are often characterized as taking their service
67 “upstream” of the secondary system. Consequently, these customers do not use any
68 part of the distribution system that operates at secondary voltages. Secondary
69 customers use all of the secondary system and parts of the primary system. The
70 challenge at hand is to properly classify facilities as part of the primary or secondary
71 system, and then to determine the proper allocation of the costs of primary system
72 facilities between primary and secondary customers.¹

73 Based on data provided by ComEd in its responses to data requests
74 IIEC 2.01, IIEC 3.01, AG 2.00, PL 3.16, CTA 1.03, and CTA 2.01 (provided as IIEC
75 Exhibit 2.1), the Company’s distribution system can effectively be described as being
76 composed of three separate distribution sub-systems; (1) a secondary distribution
77 sub-system that distributes electricity *exclusively* to secondary customers, (2) a
78 primary distribution sub-system that distributes electricity *exclusively* to primary
79 customers, and (3) a general distribution sub-system that serves both primary and
80 secondary customers. I describe the elements of each of these sub-systems later in
81 my testimony. Customers served by a particular distribution sub-system cause costs

¹ Allocation of secondary facilities between primary and secondary customers is not necessary, since primary customers do not use the secondary system.

82 of that sub-system to be incurred. Customers that do not receive any benefit
83 whatsoever from any portion of a particular distribution sub-system, do not cause any
84 of that sub-system's costs to be incurred, and they should not be allocated any of its
85 costs.

86 **Q HOW DOES ONE DETERMINE THE CUSTOMER CLASSES THAT ARE**
87 **APPROPRIATELY ASSIGNED PRIMARY OR SECONDARY COSTS?**

88 A In general, the proper way to determine the customer classes that are appropriately
89 assigned primary or secondary costs is to perform a thorough analysis of the
90 customers in each class to determine if they take service at primary or secondary
91 voltages. Electric companies usually have many sources of data to use as the basis
92 of this customer analysis. These sources of data include the company's Customer
93 Information System ("CIS"), billing data, Automated Mapping/Facilities Management
94 ("AM/FM") and Geographic Information Systems ("GIS"), distribution loss studies, or
95 system operation records.

96 In Illinois Commerce Commission ("Commission" or "ICC") Docket No.
97 07-0566, I dedicated a section of my direct testimony to this issue. My methods and
98 conclusions described in that testimony (excerpted and provided as IIEC Exhibit 2.2)
99 were based on data provided by ComEd in a document titled 2006 ComEd
100 Distribution System Loss Factors ("the 2006 loss study"). Briefly, the 2006 loss study
101 analyzes the loss of electrical power across key components of ComEd's distribution
102 system. As a direct result of this analysis, the 2006 loss study shows the portion of
103 each customer class's load that passes through distribution components such as
104 substations, line transformers, and secondary system wires. I used these data to

105 determine if ComEd's customers received service at secondary voltages (i.e.,
106 secondary customers) or at primary voltages (i.e., primary customers).

107 It is important to realize that electric companies that perform P/S analyses
108 also differentiate, by voltage level, the customer classes in their ECOS studies. They
109 do this because the ECOS studies that are unable to differentiate the customer
110 classes by voltage levels, are also unable to make full use of the valuable data
111 provided by the P/S analyses.

112 My colleague, Mr. Robert Stephens, discusses this issue in more depth in his
113 direct testimony, IIEC Exhibit 1.0.

114 **Q HOW DOES COMED DETERMINE THE CUSTOMER CLASSES THAT ARE**
115 **APPROPRIATELY ASSIGNED PRIMARY OR SECONDARY COSTS?**

116 A Mr. Alongi describes the process ComEd uses to determine which customers take
117 service from the secondary system. (ComEd Exhibit 1.0 at 20-22). Unfortunately,
118 ComEd's process fails to properly assign primary and secondary costs to those
119 customers.

120 **Q PLEASE EXPLAIN WHAT YOU MEAN.**

121 A Mr. Alongi's testimony describes data (provided in ComEd Exhibit 1.6) that show the
122 "Estimated Percent of Customers That Do Not Receive Service from the Secondary
123 Distribution System." ComEd Exhibit 1.6 indicates the number of customers in each
124 class that ComEd identifies as "non-secondary" customers. In testimony, Mr. Alongi
125 differentiates between secondary and "non-secondary" customers in the customer
126 classes with peak demand values less than 400 kW, which includes the following:

127 1. Single Family Residential without Space Heat,

- 128 2. Single Family Residential with Space Heat,
129 3. Multi Family Residential without Space Heat,
130 4. Multi Family Residential with Space Heat,
131 5. Watt-hour Only,
132 6. Small Load Delivery Class 0-100 kW,
133 7. Medium Load Delivery Class 101-400 kW, and
134 8. Lighting.

135 I used the data in ComEd Exhibit 1.6 to develop Table 1 to show the numbers and the
136 percentages of non-secondary customers in each class.

<u>Line</u>	<u>Delivery Service Class</u>	<u>Number of "Non-Secondary" Customers</u> (1)	<u>Percent of Total "Non-Secondary" Customers</u> (2)
1	Single Family without Space Heat	50,702	45.9%
2	Single Family with Space Heat	6,547	5.9%
3	Watt-hour Delivery Class	5,223	4.7%
4	Small Load Delivery Class 0-100 kW	32,807	29.7%
5	Medium Load Delivery Class 101-400 kW	<u>15,122</u>	<u>13.7%</u>
	Totals	110,401	100.0%

137 Table 1 shows that the majority of ComEd's "non-secondary" customers are
138 residential customers (i.e., Single Family with, and without, Space Heat). This is
139 surprising since Table 1 shows only the customers ComEd defines as "non-
140 secondary," and all ComEd's *residential* customers take service at secondary voltage
141 levels. In addition, the 2006 loss study discussed in IIEC Exhibit 2.2² shows that
142 100% of the electricity delivered to every class on Table 1, except the Medium Load

² IIEC Exhibit 2.2, page 6 of 7, Table 5.

143 class, is delivered at secondary voltages. The 2006 loss study further shows that
144 85% of the Medium Load class also receives its electricity at secondary voltages.
145 Therefore, nearly all of the ComEd defined “non-secondary” customers are served at
146 secondary voltage levels.

147 ComEd’s uses the results of its P/S analysis to assign costs to secondary and
148 “non-secondary” customers. However, since the customers ComEd defines as
149 “non-secondary” are clearly secondary customers. ComEd only assigns costs
150 between one type of secondary customer and another. ComEd’s attempt to assign
151 costs fails to properly assign them to secondary and primary customers.

152 **The Secondary Distribution Sub-System**

153 **Q PLEASE DESCRIBE THE “SECONDARY DISTRIBUTION SUB-SYSTEM.”**

154 **A** The secondary distribution sub-system is used to distribute electricity exclusively to
155 secondary customers. This sub-system is composed of multi-phase primary feeder
156 circuits, single-phase primary lateral circuits, as well as the network of conductors and
157 cables that operate at secondary voltage levels. This sub-system serves many of the
158 small communities and subdivisions located within ComEd’s service territory.
159 Secondary distribution sub-system circuits travel through the streets, alleys, and
160 backyard easements of residential neighborhoods, and along the roads and highways
161 of rural counties, serving secondary customers via pole- and pad-mounted
162 transformers. It is important to note that the secondary distribution sub-system
163 includes some facilities that may be energized at primary voltage levels, but which are
164 used exclusively to serve secondary customers.

165 **Q** **WHAT DISTINGUISHES THE SECONDARY DISTRIBUTION SUB-SYSTEM FROM**
166 **THE OTHER TWO DISTRIBUTION SUB-SYSTEMS?**

167 A As noted in my prior answer, the characteristic that distinguishes the secondary
168 distribution sub-system from the other two is that it consists of primary and secondary
169 voltage circuits that serve *only* secondary customers. This critical distinction clarifies
170 that the components of this sub-system are installed for the sole benefit of secondary
171 customers even though some of the components carry power at primary voltages. A
172 properly conducted P/S analysis must recognize this fact.

173 P/S analyses that purport to distinguish the costs of serving primary and
174 secondary customers, but associate those customer groups with only the cost of
175 components that operate at primary and secondary *voltage levels*, respectively, will
176 not provide accurate results.

177 To illustrate the distinction, I have prepared IIEC Exhibit 2.3 which shows a
178 schematic of a simplified distribution system, and which shows the secondary
179 distribution sub-system near the bottom half of the page.

180 **Q** **DOES COMED'S P/S ANALYSIS RECOGNIZE THE SECONDARY DISTRIBUTION**
181 **SUB-SYSTEM AS YOU HAVE DESCRIBED IT?**

182 A No. In general, what ComEd refers to as the "secondary system" consists only of the
183 network of conductors and cables that connect to the secondary side of a line
184 transformer, and extend from pole-to-pole or underground to the corner of the
185 customer's property.

186 The secondary distribution sub-system, as I have described it, contains all the
187 components included in ComEd's secondary system, and also includes poles, wires,
188 cables, and other components that comprise the single- and multi-phase primary

189 circuits that distribute electricity into sections of ComEd's distribution system where
190 no primary customers exist (i.e., serving secondary customers only).

191 **The Primary Distribution Sub-System**

192 **Q PLEASE DESCRIBE THE "PRIMARY DISTRIBUTION SUB-SYSTEM."**

193 A The primary distribution sub-system consists of relatively short lengths of electrical
194 circuit³ that operate at primary voltage levels, and provide service *exclusively* to
195 primary customers.

196 **Q WHAT DISTINGUISHES THE PRIMARY DISTRIBUTION SUB-SYSTEM FROM THE**
197 **OTHER TWO DISTRIBUTION SUB-SYSTEMS?**

198 A The characteristic that distinguishes the primary distribution sub-system from the
199 other two is that it consists of primary voltage circuits that serve *only* primary
200 customers. The primary distribution sub-system is illustrated in IIEC Exhibit 2.3 as
201 the short blue lines connecting the lines labeled "Three-phase Primary" to the
202 "Primary Customers."

203 **The General Distribution Sub-System**

204 **Q PLEASE DESCRIBE THE "GENERAL DISTRIBUTION SUB-SYSTEM."**

205 A The general distribution sub-system is the network of circuits and components that
206 serve as the backbone of ComEd's distribution system. The distinguishing
207 characteristic of the general distribution sub-system is that both primary and
208 secondary customers receive their electricity via this distribution sub-system.

³ These circuits can include poles, overhead or underground conductors, switching gear, and transformers.

209 Since the general distribution sub-system provides electricity to both primary
210 and secondary customers alike, it is reasonable that both types of customers should
211 contribute to the recovery of the costs incurred by the Company to install, operate,
212 and maintain it. The assignment of these costs to both primary and secondary
213 customers typically is non-controversial.

214 **Q HAS COMED PROVIDED TESTIMONY AND EXHIBITS EXPLAINING THE**
215 **RESULTS OF ITS P/S ANALYSIS?**

216 **A Yes. ComEd witness Mr. Lawrence Alongi provides testimony and exhibits describing**
217 **the Company's P/S analysis.**

218 **ComEd's P/S Analysis**

219 **Q PLEASE DESCRIBE COMED'S P/S ANALYSIS.**

220 **A In his direct testimony, ComEd witness Mr. Alongi states:**

221 Primary distribution facilities include the wire, cable, attachments,
222 portions of poles, and conduit used to distribute electricity at a primary
223 voltage (i.e., 4,000 Volts or higher phase-to-phase and less than
224 69,000 Volts phase-to-phase). Secondary distribution facilities include
225 the wire, cable, attachments, portions of poles, and conduit used to
226 distribute electricity at a secondary voltage (i.e., less than 4,000 Volts
227 phase-to-phase). (ComEd Exhibit 1.0 at 14-15).

228 Thus, in this context, ComEd defines "primary" and "secondary" in relation to
229 4,000 volts (4 kV) phase-to-phase. Circuit components energized at or above 4 kV
230 are defined as primary, and components energized below 4 kV are defined as
231 secondary.⁴ In ComEd's P/S analysis, line transformers, which in the majority of
232 cases serve the secondary customer by reducing the voltage from primary levels to

⁴ IIEC Exhibit 2.3 illustrates lines operating at primary voltage levels as blue lines and lines operating at secondary voltage levels as red lines.

233 secondary levels, are defined by ComEd as primary components.⁵ ComEd's
234 explanation for defining these transformers as primary components is that they are
235 electrically connected to the primary voltage lines via a bare, copper "lead" wire; thus,
236 they are part of the primary distribution system.⁶

237 ComEd's P/S analysis focuses on four accounts of the Federal Energy
238 Regulatory Commission's ("FERC") Uniform System of Accounts ("USOA").
239 Specifically, the Company analyzed the costs in Accounts 364 – Poles, Towers, and
240 Fixtures, 365 – Overhead Conductors and Devices, 366 – Underground Conduit, and
241 367 – Underground Conductors and Devices. (ComEd Exhibit 1.0 at 16 and 17). In
242 response to data request CTA 2.01, ComEd indicated that it intends to make an
243 adjustment in rebuttal testimony related to Account 361 as well.

244 Table 2 shows the account balance of FERC Accounts 364 - 367, the
245 percentage of each account that ComEd identified as primary and secondary, and the
246 cumulative balance that ComEd assigned to primary and secondary customers.

FERC Account	Account Description	Account Balance (1)	Primary		Secondary	
			Assigned (2)	Percent (3)	Assigned (4)	Percent (5)
364	Poles, Towers, and Fixtures	\$ 1,133,402	\$ 928,221	81.9%	\$205,180	18.1%
365	Overhead Conductors and Devices	1,648,372	1,390,510	84.4%	257,862	15.6%
366	Underground Conduit	645,195	627,571	97.3%	17,624	2.7%
367	Underground Cables and Devices	<u>3,569,685</u>	<u>3,082,683</u>	86.4%	<u>487,002</u>	13.6%
Totals		\$ 6,996,654	\$ 6,028,986	86.2%	\$ 967,669	13.8%

⁵ ComEd's assignment of transformers is described in detail in ComEd's response to Staff's data request PL 3.16.

⁶ I will discuss the faulty logic of this position later in my testimony.

247 **Q ARE THE PERCENTAGE VALUES PRESENTED IN TABLE 2 REASONABLE?**

248 A No, they are not reasonable. The values shown in Table 2 are based on an analysis
249 that includes unsubstantiated assumptions and outright errors. The most egregious
250 error is that ComEd's analysis does not attempt to identify the cost of serving
251 secondary and primary customers.

252 **Q WHAT DO YOU MEAN WHEN YOU SAY THE COMED ANALYSIS DOES NOT**
253 **ATTEMPT TO IDENTIFY THE COST OF SERVING SECONDARY AND PRIMARY**
254 **CUSTOMERS?**

255 A ComEd's P/S analysis focuses only on the cost of distribution facilities that operate at
256 primary and secondary voltage levels, which focuses on the voltage level of the wires
257 or other components, not on the distribution sub-systems I have described and the
258 associated cost causation. In his direct testimony, Mr. Alongi states:

259 ComEd reviewed detailed plant data, which is the equipment and
260 corresponding costs, in certain Uniform System of Accounts ("USOA")
261 accounts to determine, based on descriptions, *which types of*
262 *equipment are used for distribution of electricity at secondary voltages*
263 *and which types of equipment are used for distribution of electricity at*
264 *electricity at primary voltages.* (ComEd Exhibit 1.0 at 16, emphasis
265 added).

266 Mr. Alongi's limited objective of determining the cost of equipment operating at
267 primary and secondary voltages is very different from the objective of determining the
268 costs of serving primary and secondary customers. The first objective focuses on
269 cost of equipment above and below an operating voltage threshold, regardless of the
270 customers served by that equipment, while the second objective focuses on the
271 actual costs incurred to serve particular customers, regardless of the voltage level of
272 the facilities providing service.

273 Q WHICH OBJECTIVE IS MORE APPROPRIATE, IF ONE IS SEEKING TO
274 DETERMINE THE COST OF SERVING CUSTOMERS?

275 A The second objective is more appropriate. By focusing only on the distribution
276 equipment operating at primary or secondary voltages, ComEd's P/S analysis fails to
277 meet the more important goal of determining the costs of serving ComEd's primary
278 and secondary customers.

279 Q HAS COMED'S P/S ANALYSIS INCORRECTLY ASSIGNED COSTS ASSOCIATED
280 WITH THE SECONDARY DISTRIBUTION SUB-SYSTEM?

281 A Yes, ComEd's P/S analysis assigns costs associated with the secondary distribution
282 system to primary customers. In data request IIEC 4.03, IIEC asked ComEd to
283 assume "... a situation where a single customer, perhaps in a rural area, takes
284 service at secondary voltage, transformed from a primary voltage circuit." IIEC asked
285 ComEd to further assume:

286 ... that the lateral line serving the customer is at primary voltage up to
287 the point of transformation on or near the customer's premises,
288 resulting in a situation where certain "primary" facilities (wire, cable,
289 poles, etc.) are dedicated to the service of the "secondary" customer.

290 In part a. of IIEC 4.03, IIEC asked ComEd if there are instances on ComEd's
291 distribution system where such a situation applies. ComEd responded that there are,
292 in fact, situations on its distribution system where secondary customers are served
293 from lateral primary circuits as described.

294 To the extent that lateral primary circuits such as those described above serve
295 *only* secondary customers, the costs of the lateral primary circuit, including poles,
296 cross-arms, aerial conductor and buried cable, insulators, guy wires, transformers and
297 related equipment, etc. are clearly incurred to serve secondary customers. In

298 situations such as this, where no primary customer is served, it is unreasonable to
299 assign any of those costs to primary customers. Yet, in part b. of its response to IIEC
300 4.03, ComEd explains that it does, in fact, allocate some of these costs to primary
301 customers. ComEd states:

302 In ComEd's Primary/Secondary analysis presented in the direct
303 testimony of Lawrence S. Alongi, ComEd Ex. 1.0, lateral primary
304 facilities are not separately identified and are not assigned to
305 secondary in the analysis. Instead, to the extent such situations exist,
306 lateral primary facilities are assigned to primary and the costs of those
307 lateral primary facilities are shared by all customers receiving service
308 from the primary voltage distribution system, including customers that
309 take service from a secondary distribution system and those
310 customers that do not take service from a secondary distribution
311 system.

312 **Q WHAT ASSUMPTIONS DO YOU BELIEVE UNDERLIE COMED'S ALLOCATION**
313 **OF SUCH COSTS TO CUSTOMERS WHO ARE NOT SERVED BY THE**
314 **ASSOCIATED FACILITIES?**

315 A ComEd has made the unsubstantiated assumption that voltage level equates to cost
316 responsibility, i.e., that facilities operating below 4 kV are used exclusively to serve
317 secondary customers, while facilities operating above 4 kV serve all customers
318 equally. As ComEd's response to IIEC 4.03 reveals, this is an erroneous assumption,
319 and it is a significant deficiency in ComEd's P/S analysis. That baseless assumption
320 not only leads to obvious errors, it also substantially overstates the cost responsibility
321 of primary customers.

322 Q IS SUCH AN ASSUMPTION CONSISTENT WITH THE COMMISSION ORDERS
323 THAT LED TO THIS CASE?

324 A No, I do not believe that it is. It is instructive to compare ComEd's objective of
325 determining the cost of facilities operating at voltage levels above and below 4 kV,
326 with the following statements made by the Commission in those orders:

327 ... Although admitting on cross examination that it did not know how
328 expensive this analysis would be, ComEd, nevertheless argues that
329 the cost of the primary secondary analysis exceeds the benefits
330 because the benefits would flow to a small number of customers. This
331 overlooks our explicit policy objective of assigning costs where they
332 belong.

333 * * *

334 Having considered the evidence and arguments of the parties, the
335 Commission finds that the ECOSS is deficient in *not separating and*
336 *properly allocating primary and secondary service costs.* (Initiating
337 Order, Docket 08-0532 at 1-2, quoting Final Order, Docket 07-0566 at
338 206-207, emphasis added).

339 In its Final Order in Docket No. 07-0566, the Commission describes what I
340 believe is the specific problem caused by ComEd's inability to separate the costs
341 incurred specifically to serve secondary customers when it states:

342 This failure of the ECOSS to separate costs results in customers who
343 only take service at primary voltages paying substantial amounts of
344 secondary distribution costs attributable to other customer classes.
345 (Final Order, Docket No. 07-0566 at 206).

346 These statements clearly indicate to me that the Commission is interested
347 both in identifying the costs of components that operate at primary and secondary
348 voltages and in allocating those costs to the customers for whom they were incurred.

349 The Commission's objective of "properly allocating primary and secondary
350 service costs," recognizes that a component defined by ComEd to be a "primary"

351 component⁷ may still be incurred for the sole purpose of serving secondary
352 customers. If such is the case, then the cost of that component should be allocated
353 to secondary customers, regardless of voltage level.

354 **Q YOU HAVE SUGGESTED THERE ARE OTHER MISALLOCATION ERRORS IN**
355 **COMED'S P/S ANALYSIS. CAN YOU PROVIDE SPECIFIC EXAMPLES OF SUCH**
356 **ERRORS?**

357 A Yes, I will provide two examples. The first involves the cost of components used in
358 conjunction with line transformers. The second involves the costs of single- and
359 three-phase primary circuits.

360 **Line Transformers and Transformer-Related Costs**

361 **Q PLEASE EXPLAIN THE FIRST MISALLOCATION EXAMPLE.**

362 A In its P/S analysis, ComEd defines line transformers to be part of the primary
363 distribution system because line transformers have a single "lead"⁸ wire that attaches
364 to the primary voltage wire. However, line transformers are generally used to reduce
365 the voltage from primary to secondary levels (i.e., below 4 kV). Also, line
366 transformers typically have three or more wires that are energized to secondary
367 voltage levels. These facts notwithstanding, ComEd arbitrarily focuses only on the
368 "source" (i.e., the highest) voltage to classify transformers in its P/S analysis.⁹

369 Once ComEd erroneously classifies transformers as part of the primary
370 distribution system, it was predictable (under the narrow analysis Mr. Alongi

⁷ ComEd defines line transformers, transformer mountings, circuits disconnects, single-phase primary lines, 4 kV and 15 kV cables, etc. as "primary" components.

⁸ This is also sometimes referred to as a "tap" wire.

⁹ Based on ComEd's response to Staff data request PL 3.16

371 described) that the cost of “transformer-related” components also would be classified
372 erroneously as part of the primary system costs assigned to primary customers.
373 Therefore, ComEd defines the cost of platforms and mounting hardware, which are
374 necessary to attach and support the transformers on ComEd’s utility poles, as
375 primary. Similarly, the cost of lead wire (solid, bare copper conductor), fuses, and
376 circuit “cutouts” that are necessary to energize the transformers and allow ComEd
377 linemen to service them safely are also defined as primary.

378 These transformer-related costs are not trivial. According to ComEd
379 workpapers provided in support of ComEd Exhibit 1.5, the accumulated cost of
380 “Transformer Mounting[s]” in FERC Account 364 is \$24.6 million. The accumulated
381 cost of the solid, bare copper conductor used as transformer lead wire is
382 \$27.5 million, and the total cost of cut-out disconnect switches, accumulated in FERC
383 Accounts 365 and 367, is \$299.8 million and \$31.7 million, respectively. Thus,
384 ComEd defines \$383.6 million in “transformer-related” costs as primary, based solely
385 on the fact that lead wires on the “high” side of the transformer are typically energized
386 to more than 4 kV, ignoring entirely the more numerous lines on the low side that
387 determine the customer’s service voltage.

388 In its ECOS study, ComEd allocates these costs to primary and secondary
389 customers on the basis of their respective non-coincident peak demand. The net
390 result is that primary customers are allocated a significant portion of the cost incurred
391 to mount, operate, and maintain line transformers, even though nearly all of ComEd’s
392 line transformers are purchased to reduce the electricity to secondary voltage levels
393 to serve secondary customers.

394 **Q HOW DO YOU KNOW THAT NEARLY ALL OF COMED'S LINE TRANSFORMERS**
395 **ARE PURCHASED TO REDUCE ELECTRICITY TO SECONDARY VOLTAGE**
396 **LEVELS?**

397 A ComEd's accounting data proves this to be the case. In Attachment 1 to its response
398 to Staff data request PL 4.01, ComEd provided a spreadsheet containing information
399 pertaining to FERC Account 368 – Line Transformer costs.¹⁰ The data in this
400 workpaper explicitly shows that \$903 million of the total account balance of
401 \$1.017 billion, or approximately 89%, was “associated with transformers that serve a
402 secondary voltage”, (i.e., that serve secondary customers). The remaining
403 \$114 million, or 11%, was identified as “Cost Associated with Transformers That Do
404 Not Serve a Secondary Voltage.” Presumably, these remaining costs were incurred
405 to serve primary customers, but ComEd provided no additional information to show
406 that this is, in fact, the case.

407 The data shown in PL 4.01_Attach 01.xls prove that ComEd incurred nearly
408 90% of its line transformer account balance to serve secondary customers. In
409 addition, ComEd, in its response to Staff data request PL 4.04 states:

410 ... The vast majority of customers on ComEd's system utilizes a
411 secondary voltage and takes service from these line transformers.

412 These facts notwithstanding, ComEd erroneously assigns 100% of the
413 transformer-related¹¹ costs to primary.

¹⁰ This analysis of FERC Account 368 was not part of the Company's P/S analysis.

¹¹ The term “transformer-related” refers to transformer mountings, hardware, tap wires, and disconnects. All of these items are necessary to support, operate, and safely maintain line transformers.

414 **Q SHOULD THE TRANSFORMER-RELATED COSTS DESCRIBED ABOVE BE**
415 **ASSIGNED TO SECONDARY?**

416 A Yes. If nearly 90% of the transformer costs in FERC Account 368 are incurred to
417 serve secondary customers, then it is reasonable to conclude that 90% of transformer
418 mounting costs are incurred to serve secondary customers. Similarly, if ComEd
419 connects a copper lead wire from the primary source to every pole-mounted line
420 transformer on its distribution system, and installs fuses and cutout switches to allow
421 the transformer to be disconnected from the primary, then it is also reasonable to
422 conclude that a portion of the cost of copper conductor, fuses, and cutout switches
423 should be assigned to secondary. ComEd's P/S analysis, however, makes none of
424 these adjustments. Instead, ComEd improperly assigns all transformer-related costs
425 to the primary system, and subsequently allocates these costs to primary customers
426 in its ECOS study.

427 A properly conducted P/S analysis would include transformer-related costs as
428 part of the total cost of serving secondary customers, since absent the secondary
429 customers, line transformers are not needed. ComEd's P/S analysis does just the
430 opposite of this. ComEd's designation of transformers as "primary," on the basis of a
431 single wire connection and without consideration of the customers served by the
432 transformer, is inconsistent with its own data that show nearly 90% of the line
433 transformers serve secondary customers. This flawed analysis combines and
434 obscures cost responsibility, rather than separating and identifying it.

435 **Single-Phase and Multi-Phase Primary Circuit Costs**

436 **Q PLEASE IDENTIFY THE OTHER ALLOCATION ERROR YOU FOUND.**

437 A ComEd did not account for the fact that many of the aerial and underground circuits
438 that are used exclusively to serve secondary customers operate at primary voltage
439 levels.

440 **Q PLEASE EXPLAIN WHAT YOU MEAN.**

441 A In his direct testimony, ComEd witness Mr. Alongi states:

442 Page 5 of ComEd Ex. 1.5 displays the assets or equipment in USOA
443 account 365 – Overhead Conductors and Devices. Each item of
444 equipment is described in the column titled “Retirement Unit.” The
445 equipment designated as “Cable-Other” is either three conductor
446 (“3/C”) or four-conductor (“4/C”) secondary wire and, therefore, is
447 assigned 100% to secondary costs. *The only other item of equipment*
448 *that may be considered a secondary facility is the one-conductor*
449 *(“1/C”) wire with a weather resistant cover. (ComEd Exhibit 1.0 at 18,*
450 *emphasis added).*

451 The last sentence in Mr. Alongi’s excerpted statement is incorrect. ComEd owns and
452 maintains single- and multi-phase primary circuits that serve only secondary
453 customers, the cost of which should properly be included in the cost of serving
454 secondary customers. Instead, ComEd’s analysis assumes that every aerial or
455 underground primary circuit serves both primary and secondary customers. When
456 the results of the Company’s analysis are included in the ECOS study, customers
457 taking service at primary voltage levels receive an allocation of these circuit costs
458 even though no portion of those costs was incurred to serve them.

459 **Q HOW DO YOU KNOW THAT THE COMPANY OWNS AND MAINTAINS CIRCUITS**
460 **LIKE THIS?**

461 A In addition to my general experience and understanding of distribution systems, I
462 have found two sources of confirmation. First, I reviewed ComEd's response to data
463 request IIEC 4.04, which asked:

464 Are there instances on the ComEd system where overhead and/or
465 underground distribution circuits or facilities, although energized at
466 primary voltage levels, nonetheless serve only customers at secondary
467 voltage levels? (Such facilities or circuits may include not only single-
468 or multi-phase "taps" from primary circuits to pole-mounted or
469 pad-mounted transformers, but also single-phase or multi-phase
470 primary laterals that serve large networks of secondary customers.)

471 ComEd responded to this data request, stating:

472 ComEd does have radial taps from ComEd's primary distribution
473 system that serve transformers that may serve a secondary distribution
474 system as well as transformers that have one or more service
475 connections directly to customers' service entrance equipment without
476 a secondary distribution system ...

477 This response by ComEd addressed only the part of the data request that involved
478 transformer taps.¹² ComEd did not answer the question regarding "single-phase or
479 multi-phase laterals that serve large networks of secondary customers." The
480 Company did, however, object to this question stating:

481 ... Any attempt to develop the information would require the
482 development of a special study that would be unduly time-consuming
483 and costly.

484 This is surprising since "a special study" is precisely what the Commission-
485 ordered P/S analysis was intended to be. IIEC's question addressed the core
486 purpose of the P/S analysis; i.e., to identify the cost of distribution components
487 installed to serve primary and secondary customers. In any case, it is clear from

¹² These "taps" are the solid copper conductors that I referred to as "leads" earlier in my testimony.

488 ComEd's response that the Company did not take this system configuration into
489 consideration in its P/S analysis or ECOS study.

490 Lacking a clear response from ComEd to the question regarding single- or
491 multi-phase primary circuits, I reviewed portions of ComEd's distribution system
492 visually. This task was greatly simplified by an online feature of *Google Maps* called
493 StreetView which allows the user to "walk" down a city street, or county road and view
494 a photographic record of the surrounding area. Of particular importance to this
495 discussion is that StreetView allows the viewer to zoom into the photographs to
496 obtain a closer look at items such as transformers, primary wires, places where
497 circuits pass from aerial to underground, etc.

498 Using StreetView, I visually inspected approximately 100 different locations on
499 ComEd's distribution system. The areas I viewed ranged from portions of the City of
500 Chicago, to the suburban areas of Chicago, to the town of Dixon, IL, to the rural
501 farmland areas of Livingston, Grundy, LaSalle, Lee, DeKalb, Winnebago, Boone, and
502 Ogle Counties.

503 **Q WHAT HAVE YOU CONCLUDED FROM YOUR VIRTUAL INSPECTION OF THESE**
504 **AREAS?**

505 A ComEd does, in fact, install and maintain single- and multi-phase laterals that serve
506 large networks of secondary customers, but do not appear to serve any primary
507 customers whatsoever. ComEd did not reflect this fact in its P/S analysis.¹³ IIEC
508 recognizes that the task of determining the primary circuits that only serve secondary
509 customers can be daunting. However, if the necessary data are not available, or if
510 the labor and financial cost of acquiring and processing such data is prohibitive, then

¹³ ComEd stated in response to data request IIEC 3.04 that it conducted no field audits for verification of its analysis.

511 a reasonable alternative process would be to *estimate* the cost of single- and
512 multi-phase primary lines that serve only secondary customers.

513 **Q WHAT METHODS EXIST TO ESTIMATE THE COST OF SINGLE- AND**
514 **MULTI-PHASE PRIMARY LINES THAT SERVE ONLY SECONDARY**
515 **CUSTOMERS?**

516 A A variety of methods exist, yet most of these employ a combination of the following:
517 (1) a thorough review of the Company's plant and accounting records, (2) a review of
518 distribution system maps, electric diagrams, or a geographic information system
519 ("GIS"), (3) systematic field audits (including field surveys and sampling) to confirm
520 the validity of the records, and (4) estimates derived from experience and engineering
521 judgment.

522 One of the most common methods of estimating the costs in question is a
523 four-step (which I will call "4 Step" for convenience) method, performed on the
524 itemized costs accumulated in a FERC Account. This method is particularly
525 applicable when a distribution component is used on both primary and secondary
526 circuits.

527 For example, all utility poles, regardless of the voltage level of the circuit they
528 support, require guy wires for stability and support. However, the process of
529 examining every guy wire on the distribution system to determine if they are attached
530 to poles supporting primary or secondary circuits is prohibitive. Therefore, the 4 Step
531 method is useful in that it effectively splits the cost of guy wires using the percentage
532 of known primary and secondary poles. This is the exact method ComEd uses in its
533 P/S analysis to split guy wire costs between primary and secondary.

534 The first step in the 4 Step method is to perform the P/S analysis using only
535 the cost of components for which primary or secondary percentages are known, (i.e.,
536 the cost of components operating at secondary voltages, and the cost of primary
537 distribution sub-system components.) The second step is to factor in the costs of
538 general distribution sub-system components. The third step is to calculate the
539 secondary ratio by dividing the secondary costs determined in the first two steps by
540 the total costs determined in those two steps. The fourth step is to apply the
541 secondary ratios to the cost of the components in question.

542 A second method of estimating the cost of primary lines used to serve only
543 secondary customers is to identify the cost of single-phase primary circuits from the
544 Company's records. If the process of directly determining whether a three-phase
545 primary circuit serves only secondary customers is too labor intensive to be
546 cost-effective, the same cannot be said for single-phase primary circuits (i.e., the
547 "Single-Phase" method). This is because single-phase primary circuits are almost
548 never used to serve primary customers.¹⁴ It is reasonable to assume that every
549 single-phase primary circuit is part of the secondary distribution sub-system. The
550 cost of those circuits would be added to the other costs of serving secondary
551 customers.

¹⁴ In my experience, the only occasion where a primary customer was connected to a single-phase circuit was a temporary arrangement and was performed as a test to determine the effect of such an arrangement on system stability.

552 Q ARE YOU AWARE OF ANY ELECTRIC UTILITY THAT USES ONE OR BOTH OF
553 THESE METHODS TO DETERMINE THE PRIMARY AND SECONDARY
554 PERCENTAGES?

555 A Yes. All of the electric companies whose P/S analyses I reviewed used one or both
556 of these methods. As I have already stated above, ComEd used the 4 Step
557 estimation method in its own P/S analysis. I have performed P/S analyses on many
558 occasions, and have used these methods in every one of those studies.

559 Furthermore, the Single-Phase method is used by the two Michigan
560 companies, Consumers Energy and Detroit Edison. In their ECOS studies, both
561 companies identify the cost of single-phase primary circuits and allocate those costs
562 solely to secondary customers in recognition of the fact that the costs of single-phase
563 primary circuits are only incurred to serve secondary customers.

564 **P/S Analyses of Other Utilities**

565 Q YOU STATED EARLIER THAT P/S ANALYSES ARE PERFORMED AS A MATTER
566 OF COURSE BY OTHER UTILITIES IN ILLINOIS AND IN THE MIDWEST.
567 PLEASE IDENTIFY THE UTILITIES WHOSE ANALYSES YOU EXAMINED.

568 A I have compiled the results of P/S analyses performed by 11 other electric companies
569 operating in Midwestern states, including Illinois. Those utilities are:
570 (1) AmerenCILCO, (2) AmerenCIPS, (3) AmerenIP, (4) Aquila WPC, (5) Aquila L&P,
571 (6) Aquila MPS, (7) Aquila WPK, (8) Kansas City Power and Light Company
572 (“KCP&L”), (9) AmerenUE, (10) Detroit Edison, and (11) Consumers Energy.

573 **Q HOW DID YOU OBTAIN THE RESULTS OF P/S ANALYSES PERFORMED BY**
574 **THESE OTHER UTILITIES?**

575 A I personally performed the P/S analyses for the Aquila companies; Aquila WPC,
576 Aquila L&P, Aquila MPS, and Aquila WPK while an employee of that utility. The
577 primary and secondary results of the Ameren Illinois Utilities; AmerenCILCO,
578 AmerenCIPS, and AmerenIP were provided in ICC Docket Nos. 07-0585, 07-0588,
579 07-0586, 07-0589, 07-0587, and 07-0590 Consolidated. The P/S results for KCP&L,
580 AmerenUE, Detroit Edison, and Consumers Energy are available online from the
581 Missouri Public Service Commission website, or the Michigan Public Service web
582 site, respectively.

583 **Q HOW DO THE RESULTS OF COMED'S P/S ANALYSIS COMPARE TO THOSE OF**
584 **NEIGHBORING ELECTRIC COMPANIES?**

585 A IIEC Exhibit 2.4 depicts a bar chart showing how ComEd's P/S analysis results
586 compare to the P/S results of 11 other electric companies.

587 Each bar shown on IIEC Exhibit 2.4 indicates the percentage of the combined
588 balances of FERC Accounts 364 through 367 that should be allocated to both primary
589 and secondary customer classes. The remainder of costs from these FERC accounts
590 should be allocated only to secondary customer classes.

591 For example, IIEC Exhibit 2.4 shows that ComEd's P/S analysis suggests that
592 86.3% of the total balance from FERC Accounts 364 through 367 should be allocated
593 to primary and secondary customers, and the remaining 13.7% of the combined
594 balance should be allocated to secondary customers.

595 IIEC Exhibit 2.4 clearly shows that ComEd's results produced a much higher
596 portion than any of the other utilities examined. IIEC Exhibit 2.4 also shows that the

597 other 11 electric companies produced P/S analyses with an average percentage of
598 61.1% (which indicates that 38.9% of the total costs in FERC Accounts 364 through
599 367 were dedicated to serving secondary customers). ComEd's P/S analysis results
600 are nearly 25 percentage points higher than this average.

601 **Q DOES THE FACT THAT COMED'S PERCENTAGE IS HIGHER THAN ALL OF THE**
602 **OTHER UTILITIES YOU REVIEWED ON IIEC EX. 2.4 AND SIGNIFICANTLY**
603 **HIGHER THAN THE AVERAGE OF THE UTILITIES' PERCENTAGES PROVE, BY**
604 **ITSELF, THAT COMED'S P/S ANALYSIS IS IN ERROR?**

605 A No, but it certainly suggests that ComEd's analysis should be carefully checked for
606 errors, such as those I have identified.

607 It is important that the relationships I observed and reported be kept in
608 perspective. My comparison of ComEd's P/S results to the P/S analyses performed
609 by other electric companies does not confirm the quality or accuracy of the other
610 utilities' studies. The comparison does, however, indicate that electric companies
611 with experience in performing P/S analyses consistently obtain results with lower
612 primary percentages and higher secondary percentages than ComEd's first-ever P/S
613 analysis.

614 **Q WHY DO COMED'S P/S ANALYSIS RESULTS PRODUCE A HIGHER PRIMARY**
615 **PERCENTAGE THAN THE P/S ANALYSES PERFORMED BY NEIGHBORING**
616 **ELECTRIC COMPANIES?**

617 A Some portion of this difference may relate to different geographic situations,
618 Nevertheless, ComEd fails to recognize that many of its costs are incurred to install
619 and maintain components that operate at primary voltage levels yet serve only

620 secondary customers. Because of this, ComEd's analysis mis-identifies costs that
621 are incurred to provide service exclusively to secondary customers, as costs incurred
622 to provide service to both primary and secondary customers. This failure results in a
623 significant overstatement of primary customer costs.

624 **Q DID YOU ATTEMPT TO CORRECT THE ERRORS YOU FOUND IN COMED'S P/S**
625 **ANALYSIS?**

626 A Yes.

627 **Q PLEASE DESCRIBE WHAT YOU DID TO CORRECT THE ERRORS IN COMED'S**
628 **P/S ANALYSIS.**

629 A My modifications to ComEd's P/S analysis are as follows:

630 1. ComEd's analysis of FERC Account 368 – Line Transformers showed that 88.8%
631 of the account balance was incurred for transformers to step the voltage down to
632 secondary levels. However, within FERC Account 364, ComEd had allocated
633 100% of "Transformer Mounting" costs to primary. I adjusted ComEd's P/S
634 analysis to allocate 88.8% of the "Transformer Mounting" costs in FERC Account
635 364 to secondary.

636 2. The nature of the primary and secondary systems within the City of Chicago is
637 different than that of the primary and secondary systems in the suburbs and
638 communities surrounding the City of Chicago. ComEd's P/S analysis was
639 inconsistent in recognizing this difference. As a result, ComEd's analysis
640 assigned certain costs, incurred outside the City of Chicago, based on primary
641 and secondary ratios developed inside the City of Chicago. To eliminate this
642 error, I grouped costs in each FERC account by location; separating components
643 located inside and outside of Chicago.

644 3. I used the 4 Step estimation process to allocate the costs of 4 kV and 12 kV cable
645 to primary and secondary customers, performing a separate 4 Step estimate for
646 components located inside Chicago and outside Chicago.

647 4. I used the 4 Step estimation method to allocate the costs of "Switch-
648 Cutout/Disconnect[s]" and of bare, copper, single-conductor wire to primary and
649 secondary, performing a separate 4 Step estimate for components located inside
650 Chicago and outside Chicago.

651 **Q** **WHAT IMPACT DID YOUR CORRECTIONS HAVE ON THE P/S ANALYSIS**
652 **RESULTS?**

653 A The impact of my corrections to ComEd's P/S analysis can be seen in IIEC
654 Exhibit 2.4 where the post-modification results are labeled "Adjusted ComEd." By
655 coincidence, my modifications bring ComEd's P/S results close to the Mean of the
656 other 11 companies.

657 **Q** **DID YOU MODIFY COMED'S ECOS STUDY TO REFLECT YOUR CORRECTED**
658 **P/S ANALYSIS RESULTS?**

659 A Yes. My modification of ComEd's ECOS study did not alter the methodology of the
660 study except to replace the Company's primary and secondary customer cost
661 percentages with those that resulted from my Adjusted ComEd P/S analysis. I
662 followed these costs through the ECOS study to ensure that I had not inadvertently
663 altered the Company's study in any other way.

664 **Q** **WHAT IS THE IMPACT OF YOUR MODIFICATIONS TO THE ECOS STUDY?**

665 A This impact is shown in IIEC Exhibit 2.5. This information forms the basis for the rate
666 design testimony presented by IIEC witness Stephens.

667 **Q** **DO YOU BELIEVE THAT YOUR CORRECTIONS TO COMED'S P/S ANALYSIS**
668 **COMPLETE THE PROCESS OF DIFFERENTIATING THE IMPACT OF PRIMARY**
669 **AND SECONDARY FACILITIES ON CUSTOMERS' RATES?**

670 A No. As ComEd witness Alongi acknowledged at page 15 of his testimony, quoted
671 earlier, ComEd has not maintained its records over the decades in a way that
672 facilitates this distinction. The P/S analysis in this case, as I have corrected it, is a

673 significant improvement in assigning costs to cost causers, as compared to no such
674 analysis at all, or to the flawed ComEd P/S analysis. However, I expect that further
675 refinements and improvements will be available and made in the future, as ComEd
676 becomes more accustomed to including the impacts of a primary/secondary analysis
677 into its cost of service studies. These incremental refinements and improvements
678 may take multiple cases to fully achieve.

679 **Q DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

680 **A** Yes, it does.

Qualifications of David L. Stowe

1 **Q PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

2 A David L. Stowe. My business address is 16690 Swingley Ridge Road, Suite 140,
3 Chesterfield, MO 63017.

4 **Q PLEASE STATE YOUR OCCUPATION.**

5 A I am a consultant in the field of public utility regulation with the firm of Brubaker &
6 Associates, Inc. ("BAI"), energy, economic and regulatory consultants.

7 **Q PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND EXPERI-**
8 **ENCE.**

9 A I was graduated from the Kansas State University's College of Electrical and
10 Computer Engineering in 1987, with a Bachelor of Science degree in Electrical
11 Engineering. Following my graduation, I worked with the Kansas Corporation
12 Commission ("KCC") as a Utilities Engineer. My responsibilities included the review
13 and engineering analysis of utility filings, investigations of compliance with the
14 Commission's Orders and State laws, and filing and defending testimony regarding
15 those filings. In addition, I served as Geographic Information Systems Coordinator as
16 the KCC digitized and automated its utility facilities and territory maps from the
17 original velum sheets.

18 In April of 1993, I accepted a position with the Missouri Public Service
19 Commission where, again in the capacity of a Utilities Engineer, focused primarily on
20 depreciation, jurisdictional allocations, and production cost modeling. My

21 employment with the Commission also allowed me to complete the requirements for
22 Professional Engineer registration. I acquired my certificate for Professional
23 Engineering registration in 1996.

24 From October 1995 until January 2002, I developed my expertise in computer
25 engineering and communications; first acting as a Unix System Administrator and
26 Oracle DBA with Kansas City Power and Light, and later offering both hardware and
27 software consulting services to corporations with enterprise-wide application
28 requirements with Digital Equipment Corporation and Compaq. During this time, I
29 was also the president and owner of a company that installed analog and digital
30 communication systems in cellular phone towers.

31 In January of 2002, I joined the Analytic Services Department of Aquila, Inc.
32 as a Senior Regulatory Analyst where I was primarily responsible for developing and
33 maintaining cost of service models for each of Aquila's electrical territories. In
34 addition, I was solely responsible for completing associated engineering studies to
35 determine the P/S portions of each subsidiary's distribution systems, calculating the
36 zero intercept values for the subsidiaries' poles, conductors, conduits, and
37 transformers, performing customer impact analyses, and assisting in rate design.

38 In October of 2007, I joined Brubaker & Associates, Inc. as a consultant.
39 Since that time, I have assisted on cost of service, revenue requirement, and tariff
40 issues in Illinois, Michigan, Montana, Wyoming, and New York.

41 I have testified before the State Commissions of Kansas, Missouri, Illinois, and
42 Colorado.

43 In addition to our main office in St. Louis, the firm has branch offices in
44 Phoenix, Arizona and Corpus Christi, Texas.