ILLINOIS COMMERCE COMMISSION

DOCKET No. 12-0244

REBUTTAL TESTIMONY ON REHEARING

OF

DR. AHMAD FARUQUI

Submitted on Behalf Of

AMEREN ILLINOIS COMPANY
d/b/a Ameren Illinois

September 11, 2012

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7 **I.**   **INTRODUCTION**

8 **Q.**   **Please state your name and business address.**

9 A.   My name is Dr. Ahmad Faruqui, Ph.D. I am a Principal with The Brattle Group. My

10 business address is 201 Mission Street, Suite 2800, San Francisco, CA 94105.

11 **Q.**   **Are you the same Dr. Faruqui who previously sponsored testimony in this**

12 **proceeding?**

13 A.   Yes. I sponsored direct testimony on rehearing in this proceeding on behalf of Ameren

14 Illinois Company d/b/a Ameren Illinois ("AIC" or the "Company").

15 **II.**   **PURPOSE OF TESTIMONY AND IDENTIFICATION OF EXHIBITS**

16 **Q.**   **What is the purpose of your rebuttal testimony on rehearing in this proceeding?**

17 A.   The purpose of my rebuttal testimony is to comment on and respond to certain Illinois

18 Commerce Commission Staff ("Staff") and Intervenor witnesses' direct testimony. Specifically,

19 I am responding to questions raised about the validity of my analysis, my data sources and

20 conclusions.

21   **Q.   Are you sponsoring any exhibits with this testimony?**

22   A.   Yes. These are included here as Ameren Exhibits 10.1RH – 10.9RH.

23   **III.   AMENDMENTS TO PREVIOUS TESTIMONY**

24   **Q.   Dr. Faruqui, are there any amendments to your previous testimony that you would**

25   **like to submit?**

26   A.   Yes, I have amended my analysis to include Direct Load Control ("DLC") costs which

27   were inadvertently omitted in my testimony. In 2012, I estimate the technology that enables

28   DLC will cost $150; this includes the installation cost. In the first ten years of the forecast,

29   nominal technology costs decrease at a rate of 16% per year. In the next ten years, the costs

30   decrease at a rate of 8% per year. The nominal costs in 2012 and 2032 are shown in Ameren

31   Exhibit 10.1 RH. When updating my analysis to include DLC costs, the net present value of the

32   incremental benefits of the programs in my analysis decreases from $338,168,022 to

33    $337,602,171, or a 0.17% decrease. Please refer to Ameren Exhibits 10.2RH and 10.3RH for my

34   amended projections of net benefits.

35   **IV.   DEMAND RESPONSE AND ENERGY EFFICIENCY NET BENEFITS**

36   **Q.   Dr. Brightwell states in ICC Staff Exhibit 5.0 that Dr. Faruqui "ignored**

37   **unfavorable results from other studies in his attempts to quantify benefits." Is this true?**

38   A.   No, to do so would be to deviate from commonly accepted scientific principles. In my

39   work, I always review the literature and use its results wherever they are appropriate and

40   relevant.

41   **Q.   Dr. Brightwell states the Navigant study "found that energy use increased as a result**

42   **of participation in the PSP Pilot (Power Smart Pricing 2010 Annual Report, April 26, 2011,**

43   **p.56). Instead of using an Ameren-specific result that would be unfavorable to the cost-**

44   **benefit analysis, Dr. Faruqui chose to use more favorable savings that were assumed in a**

45   **previous analysis for the Institute for Energy Efficiency." Do you agree with this**

46   **characterization of your methodology?**

47   A.   No. I did not use the estimates from the Institute for Energy Efficiency study to project

48   the net benefits of the Power Smart Program ("PSP") because that program was not modeled in

49   that study. I relied solely on the Navigant study, which stated that if summers in the future were

50   warmer and more humid, the PSP program would probably induce a mild conservation effect.[1]

51   In the most recent issue of the National Geographic magazine, the cover story states that "the

52   atmosphere is getting warmer and wetter. Those two trends, which are clear in data averaged

53   globally and annually, are increasing the chances of heat waves, heavy rains, and perhaps other

54   extreme weather."[2] Therefore, I have used a mild conservation effect of 0.5% to model the PSP

55   program.

56   **Q.   Doesn't the Navigant report also suggest that the conservation effect of the PSP**

57   **program might be zero?**

58   A.   Yes, it does. I have modeled what happens if there are zero energy efficiency impacts

59   from PSP. The results are contained in Ameren Exhibit 10.4RH. Using a zero conservation

60   effect of the PSP program would decrease the present value of societal net benefits by 0.62%.

61   **Q.   Dr. Brightwell argues that your "analysis cannot help but be speculative." Do you**

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[1] Navigant, "Power Smart Pricing 2010 Annual Report," Prepared for Ameren Illinois, April 26, 2011 and further annualized updates provided to The Brattle Group.

[2] Peter Miller, "Weather Gone Wild," *National Geographic* 222, No. 3 (September 2012): 41.

62   **agree?**

63   A.   No. In common parlance, "speculative" implies that the analyst relied on guesswork or

64   opinion rather than scientific knowledge to draw his or her conclusions. There are of course no

65   facts about the future and one has to rely on projections to analyze different policy options. The

66   projections that I have made are based on sound economic analysis and empirical data and not on

67   speculation.

68   **Q.   Dr. Brightwell asserts that you are, "attempting to predict two alternative versions**

69   **of the future and comparing the benefits and costs of each version." Is that correct?**

70   A.   Yes, but that is standard industry practice. There is no other way to compare the effect of

71   a new program or policy in the future other than to project a future with that policy or program

72   and compare it to a future without that policy or program. Such an approach is widely used in

73   integrated resource planning in the electric utility industry.

74   **Q.   Dr. Faruqui, you cite the "polling of experts" as a source for some of the**

75   **information and data you use in your analysis. Can you elaborate on how you carried out**

76   **this polling?**

77   A.   Because of the nature of my work, I am in constant contact with experts in North

78   America and around the globe on a variety of topics related to the societal benefits of AMI. This

79   communication occurs through a variety of channels, including telephone conversations, Webex,

80   participation in conferences, and so on. Just to give you an idea of the scale of this

81   communication, attached in Ameren Exhibit 10.8 RH is a list of all conferences I have attended

82   in the previous five years. In many cases, I have presented at these events and had several

83   conversations with the attendees. It is not possible to document every conversation.

84 **Q.   Staff and Interveners are unclear about the source of the energy efficiency benefits**

85 **in your analysis. Can you explain how these are being developed?**

86 A.   Yes. AMI will allow the installation of web portals through which customers can review

87 their energy use patterns and associated costs. It will also allow the installation of enabling

88 technologies. Consistent with the work we did for the Institute for Electric Efficiency, we are

89 assuming that this information, coupled with enabling technologies, will allow customers to use

90 energy more wisely and result in a small reduction in their monthly energy consumption. Some

91 small savings in energy consumption will also accrue from demand response programs when

92 customers lower peak use but don't shift all the reduced peak load to off-peak periods.

93 **Q.   Mr. Hornby suggests that your estimate of societal benefits from DLC should be**

94 **removed since DLC can be deployed without AMI. Do you agree?**

95 A.   No. While DLC can indeed be deployed without AMI, it has nothing to do with how I

96 am modeling its benefits. I am only counting benefits from DLC that would be incremental to

97 the deployment of AMI. These have to do with better measurement and verification of the

98 impacts of DLC that are made possible by the two-way communication character of AMI.

99 **Q.   Mr. Hornby undertakes his own review of what he states are the actual levels of**

100 **residential participation in time-varying rates. Have you read his review?**

101 A.   Yes.

102 **Q.   Mr. Hornby states that your projections of customer participation and per customer**

103 **impacts are not reasonable. Do you agree with this statement?**

104 A.   No.

105   **Q.   Mr. Hornby's review of residential participation in time-of-use ("TOU") programs**

106   **for two Arizona utilities shows high participation levels. Mr. Hornby says that "the**

107   **financial incentive residential customers have to participate in time-of-use (TOU) pricing is**

108   **much higher than associated with dynamic pricing." Do you agree with his explanation of**

109   **these results?**

110   **Q.**   No. In Arizona, the participation rates for TOU programs are higher not because the

111   TOU rates are intrinsically more attractive to customers than Critical Peak Pricing ("CPP") rates,

112   since the latter have yet to be offered to them, but because the TOU rates are marketed more

113   creatively to customers and, most importantly, because they are more attractive than the non-

114   TOU rate, which is an inclining block rate. The larger customers avoid the upper tier blocks by

115   going with the TOU rates which do not have a block structure. Furthermore, there is no evidence

116   to show that customers are more likely to sign up for TOU rates than for CPP rates. Indeed,

117   intuition suggests that some customers might prefer CPP rates over TOU rates because they are

118   not in effect on every day in the summer.

119   **Q.**   **Mr. Hornby argues your opt-in penetration rates are too high and cites evidence in**

120   **Ameren Exhibit 1.4 on Rehearing to make the point that most participation rates are less**

121   **than 10%. Do you agree with this assertion that your rates are too high?**

122   A.   No, I do not agree with the assertion. Mr. Hornby states that the results of his analysis

123   indicate residential participation levels in time-varying rates are most commonly less than ten

124   percent. My analysis indicates this as well. As seen in Ameren Exhibit 10.6 RH the

125   participation rates in 2020, five years after the initial rollout of AMI, show that all residential

126   participation rates are below 10%. Ameren Exhibit 10.7RH shows the participation rates in

127   years one, five, ten, and twenty and again indicates that most residential participation rates

128   modeled will be less than 10% in all years. I believe my customer participation and per customer

129   impacts are quite conservative. In 2032, twenty years into the planning horizon, I assume that

130   six out of ten customers will not participate in any of these AMI-enabled programs.   Of the 40%

131   that are engaged, the majority will be on the Peak Time Rebate ("PTR") program, which is a no-

132   lose proposition for customers. The most a customer will pay on this program is the regular rate

133   that they would have paid in the absence of the program. Since the PTR program can only

134   benefit the customer, I have assumed that one out of four customers will sign onto this program

135   by 2032. Even for this no-lose program I am assuming that less than one out of ten customers

136   will be on it by 2020. No objective analyst will consider that to be an optimistic or aggressive

137   estimate.

138   **Q.   Are participation rates of pilot projects such as the PTR and CPP pilots Mr.**

139   **Hornby uses appropriate to use for future projections?**

140   A.   No, for two reasons. Firstly, these pilot projects were not designed to test participation

141   rates but to measure load shape changes. Secondly, and more importantly, most of these pilots

142   only lasted for a few months or a year. In full scale programs, such as the ones we have

143   modeled, the participation rates will not stay constant over time. They will rise steadily, as

144   word-of-mouth spreads among customers and as utilities and third parties develop better

145   marketing designs through test-and-learn-and-adapt algorithms.

146   **Q.   Did you also consider any other participation assumptions?**

147   A.   Yes, we also ran a high and low case participation scenario. The present value of societal

148   net benefits in the high participation scenario is $506 million, while the present value of societal

149   net benefits under the low participation scenario would be $169 million.

150   **Q.   Mr. Hornby states that the per-customer impacts in your analysis are too high. Do**

151   **you agree with his assessment of these rates?**

152   A.   No. The per-customer impacts used in my analysis are based on scores of pilot programs

153   with statistically sound experimental designs and concrete empirical results.

154   **Q.   Mr. Hornby asserts that the Company's projection of avoided generating capacity**

155   **costs is likely too high. What would happen to the present value of incremental net benefits**

156   **of the programs in your analysis if the avoided generating capacity cost were lower than**

157   **originally modeled?**

158   A.   Company witness Mr. James Blessing discusses the Company's projection of avoided

159   generating capacity cost in his rebuttal testimony and has run a variation using an avoided

160   generating capacity cost that is 80% of the original cost. I find that the present value of net

161   benefits decreases from $338 million to $301 million in my analysis. Please see Ameren Exhibit

162   10.5RH.

163   **Q.   Dr. Faruqui, in response to ICC Staff DAB 3.01, subpart 3, you were asked if *The***

164   ***Brattle Group* has compared the iGrid predictions of benefits to actual benefits observed in**

165   **the areas where the iGrid model has been used. Why has this not been done?**

166   A.   The iGrid model is a forward-looking model for examining alternative long-range futures

167   involving AMI and other smart grid features. Program implementation is just beginning to

168   happen and it will take years for benefits to be realized. In Ameren Illinois' case, the benefits

169   projected in my analysis from AMI will not begin to occur until 2016, so we will not be able to

170   analyze benefits for another four years from now.

171   **V.   SOCIETAL BENEFITS OF PLUG-IN ELECTRIC VEHICLES**

172   **Q.   In AG Exhibit 1.0 on Rehearing, Mr. Hornby states that "actual societal benefits**

173   **will be lower than projected because projected benefits from incremental adoption of PEVs**

174   **should be excluded since Ameren could achieve those benefits without implementing AMI."**

175   **In the sensitivity analysis Dr. Brightwell conducted, he eliminated all benefits from AMI-**

176   **induced PEV adoption. Should PEV benefits be excluded from your analysis?**

177   A.   No.

178   **Q.   Why should PEV benefits be included in societal benefits?**

179   A.   The introduction of AMI to Ameren Illinois's customer base will allow customers to

180   participate in the Time-Of-Use program that uses a Home Energy Management System which

181   automates smart charging and ensures that PEV owners will save money. These savings will

182   cause more customers to buy PEVs than would happen in the absence of AMI.   It would be

183   inappropriate to ignore these benefits of AMI.

184   **Q.   On page 4 of AG Exhibit 1.6 on Rehearing, Mr. Hornby challenges how you apply**

185   **"the effect of electricity cost savings on BEV adoption to that of a PHEV." Please respond.**

186   A.   In my analysis, I model PHEVs to be conservative.   PHEVs are a proxy for the wide

187   spectrum of PEVs that are likely to be offered in the future with BEVs being a special case that

188   is included in the wide spectrum. PHEV savings are less because they partially run on gas.

189   Therefore, my benefits are conservative, since they include smaller estimates of avoided gasoline

190   costs, which is the biggest driver of PEV benefits in my analysis.

191   **Q.   Dr. Faruqui, in your analysis, you used fuel economy projections for vehicles from a**

192   **2007 EPRI study. Recently, the EPA and Department of Transportation's National**

193   **Highway Traffic Safety Administration has announced that it is issuing final rules to**

194   **improve fuel economy for model years 2017 through 2025 light-duty vehicles. Are you**

195   **aware of this report?**

196   A.   Yes.

197   **Q.   Do you think your report should be updated to reflect these new standards?**

198   A.   No. The quoted Corporate Average Fuel Efficiency Standards deal with the average

199   efficiency that is calculated across an automaker's entire light vehicle fleet. One way to meet

200   new standards of fuel efficiency would be to increase the proportion of the fleet that are PHEVs,

201   since PHEVs are already far more fuel efficient than the new CAFE standard. Thus, it is quite

202   possible that the push to raise the CAFE standards will lead to higher PHEV penetration. If we

203   were to update the assumptions of fuel economy made in our analysis, we would then have to

204   update all other areas of the analysis. Such a revision would have to include benefits brought up

205   during this process that we did not previously consider.

206   **Q.   Dr. Faruqui, your use of a $9,500 PHEV premium has been challenged by Mr.**

207   **Hornby. In response to Data Request AIC-AG 5.22 Attachment A, Mr. Hornby provides a**

208   **recent New York Times article that compares the prices of electric vehicles to non-electric**

209   **vehicles. Are you aware of this article?**

210   A.   Yes.

211   **Q.   How does Mr. Hornby use this document?**

212   A.   As shown in response to Data Request AIC-AG 5.22-5.25, Mr. Hornby uses this article to

213   support his use of the Chevy Malibu and Toyota Corolla as appropriate vehicles to compare to a

214   Chevy Volt and Toyota Prius PHEV, respectively, to determine the price premium for PHEVs.

215   He also cites this article as all supporting documentation used to determine the price differences

216   of these vehicles. The NY Times article referenced is attached in Ameren Exhibit 10.9RH.

217   **Q.   Do you agree with Mr. Hornby's analysis of PEV premiums based on this article?**

218   A.   No. Mr. Hornby has chosen makes and models of vehicles to compare in his analysis that

219   are inconsistent with his supporting documentation. This erroneously inflates the PHEV

220   premium he calculates.

221   **Q.   Can you elaborate on these inconsistencies?**

222   A.   Mr. Hornby compares a Chevy Volt to a Chevy Cruze[3] and a Toyota Prius PHEV to a

223   Toyota Corolla. This comparison differs from the article that Mr. Hornby quoted in two respects.

224   First, both of the gasoline cars used as PEV comparisons by Mr. Hornby are cheaper models than

225   those mentioned in the article. The article compares a Chevy Volt to a Chevy Cruze Eco and a

226   Toyota Prius to a Toyota Camry. Second, Mr. Hornby chooses the base model specifications

227   with the lowest prices for the gasoline cars he uses to compare to plug-in electric vehicles, again

228   yielding price differences below those quoted in the article.

229   **Q.   What are the correct PEV premiums for the Chevy Volt and Toyota Prius PHEV**

230   **based on the article?**

231   A.   The PEV premium for the Chevy Volt is $11,842 and for the Toyota Prius PHEV $7,400.

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[3] In Mr. Hornby's original testimony, he states that he compares a Chevy Volt to a Chevy Malibu. He amended this statement in AIC AG 5.22, stating that the reference of a Chevy Malibu should have been to a Chevy Cruze.

232   These amounts are far lower than those suggested by Mr. Hornby's misleading comparisons.

233   **Q.   Does the article compare any other PHEV's to their gasoline equivalents?**

234   A.   Yes, the article compares a Nissan Leaf to a Nissan Versa. Mr Hornby omits this from his

235   analysis.

236   **Q.   What is the price differential between a Nissan Leaf and a Nissan Versa?**

237   A.   The article shows a price difference of $9,781.

238   **Q.   If you were derive a PHEV premium using relevant comparisons made in the NY**

239   **Times article, what would the results be?**

240   A.   The price of a Toyota PHEV, as listed by Mr. Hornby in response to Data Request AIC

241   AG 5.22, is $29,500. This amounts to a price difference of $7,400 with the Toyota Camry. The

242   price difference between the Chevy Volt and Chevy Cruze Eco is $11,842. The article also

243   shows a price difference between the Nissan LEAF and Nissan Versa of $9,781. Averaging

244   these three price differences would result in an average price premium of $9,674, which falls in

245   line with our estimate of a $9,500 premium.

246   **Q.   What would happen to the present value of incremental net benefits if the PHEV**

247   **premium were $9,674 instead of $9500?**

248   A.   The present value of net benefits would decrease from $337,602,171 to $337,430,624, a

249   difference of less than $200,000, or 0.051 percent.

250   **Q.   Dr. Schlaf asserts your analysis is dependent upon the estimated number of PEVs**

251   **purchased by Ameren Illinois customers and that at this stage of PEV development, expert**

252   **opinions differ widely on the prospects for future PEV adoption. Do you agree?**

253 A.   I agree that the analysis I conducted takes into consideration certain assumptions

254 regarding the estimated number of PEVs purchased by Ameren Illinois customers. But I

255 disagree that variation in expert opinion annuls my analysis of PEV purchases remains. I

256 reviewed a range of PEV adoption predictions; some predictions of the cumulative share of

257 PEVs in the light vehicle fleet such as those seen in the 2012 Annual Energy Outlook were lower

258 than my estimate, while other projections were higher. For example, in AG Exhibit 1.6 on

259 Rehearing, Mr. Hornby cites a 2011 EPRI report that he uses in a portion of his analysis. That

260 report contains PEV market adoption forecasts.[4] It provides estimates for projected total sales of

261 PEV between 2010 and 2030 under low, medium, and high scenarios. It estimates that there will

262 be 35 million PEVs in the United States by 2030 under its medium scenario. Using the 2030

263 total light vehicle fleet estimate of 264 million vehicles as shown in Mr. Hornby's testimony,[5]

264 this would amount to roughly a 13.3% share of PEVs of the total fleet. This share is higher than

265 the 11% share of PEVs that is used in my analysis.

266 **Q.   Dr. Faruqui, do Staff and Intervenors take into account any other benefits**

267 **attributable to AMI beyond the ones that you quantified in your testimony?**

268 A.   No, they don't. There are numerous other societal benefits from AMI. Such benefits

269 include bidding of demand response into the ancillary services market, better integration of

270 renewable resources into the grid, the avoided social cost of carbon, and the avoided damages

271 from criteria pollutants that result from the decreased energy use.   To be conservative, my

272 analysis only quantifies avoided carbon costs from 2025 onwards. These are avoided carbon tax

273 costs to Ameren, not society. Avoided carbon costs from 2016 until 2025 are not quantified,

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[4] EPRI. 2011. Transportation Electrification: A Technology Overview. July 2011.
[5] AG Exhibit 1.6 on Rehearing, page 6

274   even though there is a clear social cost associated with carbon emissions. Energy efficiency

275   programs enabled by AMI result in a decrease in energy consumption per year. Therefore, there

276   will be a significant amount of avoided damages from criteria pollutants such as sulfur dioxide,

277   nitrogen oxides, and particulate matter not addressed by the other parties.   In that my analysis

278   does not quantify these benefits, it actually understates the true societal benefits of AMI.

279   **VI.   <u>CONCLUSION</u>**

280   **Q.   Does this conclude your rebuttal testimony on rehearing?**

281   A.   Yes, it does.