BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

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IN THE MATTER OF ADVICE LETTER NO. 1535 BY PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 7 ELECTRIC TARIFF TO REFLECT REVISED RATES AND RATE SCHEDULES TO BE EFFECTIVE ON JUNE 5, 2009.	)))))))	DOCKET NO. 09AL-299E

REBUTTAL TESTIMONY OF AHMAD FARUQUI

ON

BEHALF OF

PUBLIC SERVICE COMPANY OF COLORADO

November 25, 2009

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REBUTTAL TESTIMONY OF AHMAD FARUQUI

I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR NAME AND ADDRESS.

A. My name is Ahmad Faruqui. I am a Principal of The Brattle Group, an economic and management consulting firm with offices in the U.S. and the European Union. My business address is Suite 1140, 353 Sacramento Street, San Francisco, CA.

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS.

A. For a summary of my expertise in rate design and energy efficiency, please see my Direct Testimony.

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A. I will rebut three points made in the Answer Testimony that has been filed by Staff of the Public Utilities Commission of Colorado ("Staff"). First, I will rebut Staff's contention that it is inappropriate to assume that customers will change electricity usage behavior in response to inclining block rates.

Second, I will respond to Staff's position that a new methodology should be used for allocating the distribution of class usage to rate tiers when developing inclining block rates. Third, I will explain why the two-tier structure proposed by Public Service is superior to Staff's recommended four-tier structure.

Q. WHAT ARE YOUR BASIC CONCLUSIONS?

A. On the appropriateness of elasticity adjustments, Staff witness Mr. Billy Kwan does not seem to be aware of the literature going back to the first energy crisis in the 1970s, which shows that customers do respond to price signals and will reduce usage in response to higher prices.

On the issue of usage allocation, I conclude that Mr. Kwan has made a calculation error that renders moot his numerical comparison of the two methodologies, Further, upon reviewing his conceptual description of the approach, I conclude that it ignores future changes in the number of Public Service customers; therefore, it is not a better approach than that taken by Public Service.

Regarding Mr. Kwan's proposed rate design, I find some notable weaknesses. Most significantly, I believe his inclining block rate with four tiers introduces an unnecessary level of complication that is likely to confuse customers and, as a result, limits the usage reduction benefits that might be achieved through the rate. Additionally, using the information provided in Mr. Kwan's testimony, it is not clear that he has developed a rate that is revenue

neutral. Maintaining revenue neutrality is, of course, a critical aspect of rate design.

II. THE APPROPRIATENESS OF ELASTICITY ADJUSTMENTS

Q. PLEASE SUMMARIZE MR. KWAN'S POINTS REGARDING THE APPROPRIATENESS OF ELASTICITY ADJUSTMENTS.

A. Mr. Kwan argues that there is no evidence that customers will change electricity usage behavior in response to inclining block rates; therefore, there should be no accounting for price elasticity in developing the rates. Further, he argues that the price elasticities used in my analysis are unsubstantiated and without basis.

Q. DO YOU AGREE WITH THESE CONCLUSIONS?

A. No.

Q. MR. KWAN HAS ARGUED THAT YOUR ELASTICITY ESTIMATES ARE "GUESSTIMATES" WITHOUT SOUND SCIENTIFIC BASIS. DO YOU AGREE WITH THIS ARGUMENT?

A. No. My elasticity factors are based on rigorous analyses described in the RAND Corporation ("RAND") and Electric Power Research Institute ("EPRI") reports, which I provided to Mr. Kwan and which he attached to his testimony as Exhibit BK-10. These reports show conclusively that the elasticity adjustments that I have made are based on a large body of econometric analysis, are indeed specific to residential electric service, and are further

specific to the Mountain region of the United States, of which Colorado is a part.

To highlight the salient facts that Mr. Kwan appears to have overlooked, I will quote relevant sections of the RAND and EPRI reports. First, please note the following entries from Page 2 of the "Results" section of the referenced EPRI report:

- Estimates of price elasticity derived from a variety of market circumstances and alternative pricing plans suggest that electricity usage falls in the short-run by 10-20% when the price doubles.
- The widely-held belief that only larger customers are price responsive is contradicted by the result of pilot studies.

Second, please consider the following information from Page 11 of the referenced RAND report:

> **Previous Literature on Energy Demand**
>
> Previous studies have found that energy demand is inelastic in the short run but more elastic in the long run. Several studies also found that price elasticities varied across locations, but the same general pattern remained (inelastic demand in the short run and more elastic demand in the long run). The energy demand literature consists of several dozen papers and is too voluminous to describe here in detail. Therefore, this section focuses on a representative handful of survey articles on this subject.

Third, please consider the following results from Page 20 of the referenced EPRI report:

> **Own-Price Elasticity Estimates**

Table 1 summarizes the range of own-price elasticity reported in the selected studies. In summarizing the results, the term mean refers to the central tendency of the collective estimates subjectively determined by this white paper's authors. Low and high values indicate the range of reported values. The values in Table 1 can be summarized as follows:

- The residential mean short-run own-price elasticity of electricity demand is -0.30, but study values range from slightly below that level (-0.2) to twice that level (-0.6);
- The residential mean long-run residential elasticity is three times higher (-0.9) and subject to an even wider range of values, from -0.7 to -1.4. The large difference between short-run and long-run elasticity values reflects the consequences of consumers having time to adjust their consumption to persistent price changes.

Table 1

Table 1. Own-price elasticities of electricity demand

	Short Run			Long Run		
	Mean	Low	High	**Mean**	Low	High
Residential	**-0.3**	-0.2	-0.6	**-0.9**	-0.7	-1.4
Commercial*	**-0.3**	-0.2	-0.7	**-1.1**	-0.8	-1.3
Industrial*	**-0.2**	-0.1	-0.3	**-1.2**	-0.9	-1.4

** The estimates for the commercial and industrial sector are from EPRI (2001).*

Fourth, please consider the following results from Page 76 of the referenced RAND report:

Table 2

Table D.5: Estimated long-run price elasticities for the residential electricity market

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
East South Central	-0.618	0.144	-4.3	0	-0.900	-0.336
South Atlantic	-0.352	0.051	-6.86	0	-0.453	-0.251
New England	-0.325	0.074	-4.37	0	-0.471	-0.179
Mountain	-0.267	0.048	-5.52	0	-0.362	-0.172
Pacific Coast	-0.254	0.078	-3.27	0.001	-0.407	-0.101
Mid Atlantic	-0.247	0.075	-3.28	0.001	-0.395	-0.099
West North Central	-0.244	0.081	-3.01	0.003	-0.403	-0.085
West South Central	-0.174	0.070	-2.48	0.013	-0.311	-0.036
East North Central	-0.058	0.057	-1.02	0.309	-0.169	0.054

As can be seen from these excerpts, there is a significant amount of support for the price elasticities I have used in my analysis. Specifically:

- The EPRI report found, after evaluating a "variety of market circumstances and alternative pricing plans", that the short-run elasticity for the residential class is -0.10 to -0.20 when the price is doubled.
- RAND reports that, based on "several dozen papers too voluminous to describe", it is clear that in all locations, long run elasticities are greater than short-run.
- EPRI reports a mean long-run residential elasticity of -0.9, with a low of -0.7 and a high of -1.4.
- RAND reports a long-run elasticity of -0.267 for the Mountain region.

Q. ARE THERE ADDITIONAL CONCLUSIONS THAT YOU MADE FROM THESE STUDIES?

A. Yes, several conclusions can be drawn from these studies. Based on the specific elasticity data in the RAND study for the Mountain region of which Colorado is a part (and that other studies confirm that the Mountain region results represents a conservative estimate of the elasticity impact), -0.26 is an appropriate elasticity assumption for the second tier.

As I also explained in my Direct Testimony, usage in the first tier is expected to be less price responsive than usage in the second tier. The reason is that a share of customer usage is non-discretionary, being necessary to maintain a minimum standard quality of life. The other share of usage is discretionary and more likely to be reduced by the customer in response to a change in the electricity rate structure. The non-discretionary share of usage would roughly align with first-tier usage; thus, I recommend a lower price elasticity assumption for this tier of -0.13, or half of the second tier elasticity.

In addition, I assumed that the winter elasticity would be half of the value of the summer second tier elasticity. According to the RAND and EPRI reports, winter energy usage is expected to be less price responsive than summer energy usage. Please consider the following from the EPRI study on Page 25:

> Archibald, et al. (1982) confirmed the seasonal variation of residential electricity demand finding that the mean own-price elasticity in peak (e.g. summer) months was -0.47 while that in off-peak (e.g. winter) months was about half that level (-0.27).

Finally, it is worth noting that a similar seasonal pattern was found in California's Statewide Pricing Pilot, which ran from 2003-2005 and with which I was intimately involved, both as a designer and an evaluator.

In short, the assertion that elasticity estimates were not derived from rigorous and scientific analysis and that they are not specific enough to represent Colorado's product class of residential electricity usage is without foundation.

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS ABOUT PRICE ELASTICITY IN LIGHT OF MR. KWAN'S TESTIMONY.

A. Unlike Mr. Kwan, I conclude that it is entirely reasonable to assume that customers will reduce usage in response to a well-designed inclining block rate. Certain end-uses are essential needs that customers are less likely to reduce, and these will generally fall into their first tier of usage. However, other end-uses are more discretionary in nature and more likely to be reduced in response to the higher second tier rate. A long history of studies on customer price responsiveness bears me out, and that is why I have confidence in the results that I presented in my Direct Testimony.

Q. MR. KWAN ALSO TESTIFIED THAT YOUR ESTIMATES OF PEAK DEMAND REDUCTIONS ARE BASED ON "GUESSTIMATES." DO YOU AGREE WITH THIS STATEMENT?

A. No. As stated above, the elasticity estimates are based on sound econometric analysis covering many time periods and geographic regions.

Consequently, deriving changes in peak demand from them is also rigorous and reasonable and based on the best available information.

Q. ADDITIONALLY, MR. KWAN STATES THAT IF YOU WERE TO ASSUME THE SAME PRICE ELASTICITY FOR THE FIRST AND SECOND TIERS, THERE WOULD BE NO CHANGE IN TOTAL USAGE. DO YOU AGREE WITH THIS STATEMENT?

A. No. Mr. Kwan appears to believe that if the elasticity were the same for both tiers that the usage increases and decreases would balance out. Whether or not the increases and decreases balance out is not just a function of the elasticities, but rather it is a function of both the elasticities plus the rate differences for each tier relative to current rates.

With the use of the same elasticity, the percentage increases and decreases are not the same. The reason is straightforward. The result is the "product" of the price change and the elasticity, so with different price changes, the products are different even with the same elasticity. Furthermore, even if the elasticities were identical and the price changes were identical in the opposite direction, the usage changes would not cancel each other out unless the usage in each tier was also identical.

Q. AS EVIDENCE CONTRARY TO THE PRICE ELASTICITY ASSUMPTION, MR. KWAN POINTS TO A RECENT INCREASE IN TOTAL ENERGY SALES DESPITE RATE INCREASES. IS THIS RELEVANT?

A. No. Mr. Kwan appears to be suggesting that higher rates will not lead to reductions in usage since, over the past decade, rates have increased *and* usage has increased. What Mr. Kwan fails to recognize is that price elasticities are always presented with the *ceteris paribus* proviso (all else being equal). Over the past decade, many other factors such as rising incomes and population have influenced electricity usage besides electricity prices. Econometric studies, such as those discussed in the EPRI and RAND reports above, find that rates have an impact on usage by isolating the price effect and controlling for other factors such as the economy and weather. Based on the available evidence reviewed above, we can be quite certain that increases in rates do cause a decrease in usage, other things equal.

III. USAGE ALLOCATION METHODOLOGY

Q. PLEASE SUMMARIZE MR. KWAN'S BASIC POINTS REGARDING USAGE ALLOCATION METHODOLOGY.

A. Mr. Kwan argues that there are conceptual problems with the way Public Service has allocated the distribution of customer usage to rate tiers and then scaled it to test year usage levels. He then proposes what he considers to be a better approach.

Q. DO YOU AGREE WITH HIS CONCLUSIONS?

A. No. I believe there is a basic error in his computations that impairs his quantitative analysis. Further, conceptually I find that Mr. Kwan's approach is

based on an overly simplistic understanding of rates and not preferable to that of Public Service.

Q. WHAT IS THE COMPUTATIONAL ERROR THAT YOU HAVE FOUND IN MR. KWAN'S APPROACH?

A. There appears to be an inconsistency between Mr. Kwan's description of his methodology and his actual calculations as shown in Exhibit BK-4. In his calculations, Mr. Kwan is incorrectly allocating 100 kWh per customer to the second tier. This mistake causes incorrect usage allocations for the second, third, and fourth tiers in Mr. Kwan's four-tier analysis. The second tier usage is too large, while the third and fourth tier usage allocations are too small. These errors impede the execution of his own methodology.

Q. DOES THIS MISTAKE IN THE HISTORICAL ALLOCATION IMPACT MR. KWAN'S FURTHER ANALYSIS?

A. Yes. Mr. Kwan's adjustment from the historical to future test year flows from these incorrect results. Thus, this error carries through to the resulting test year adjusted numbers. It is important to note that much of Mr. Kwan's testimony focused on the difference between the Staff and Public Service adjustment methodologies. When Mr. Kwan notes the differences in the results of the Public Service approach and his approach, many of these differences stem from this initial calculation error rather than the difference in the two methodologies.

Q. PUTTING THE COMPUTATIONAL ERROR ASIDE, WHAT ARE YOUR VIEWS ON MR. KWAN'S CONCEPTUAL APPROACH TO ALLOCATING USAGE?

A. His approach is overly simplistic. Mr. Kwan simply multiplies monthly usage in each block by a single ratio of test-year to historical-year monthly usage. While any approach requires that some judgment be exercised in the absence of more granular data, Mr. Kwan's approach fails to explicitly account for a change in the forecasted number of bills and the subsequent forecasted usage per bill.

Q. DOES PUBLIC SERVICE'S APPROACH TAKE THE NUMBER OF CUSTOMERS INTO ACCOUNT?

A. Yes. Public Service normalizes the number of bills in each block to account for the changing number of customers. Then, the usage in each block is calculated according to the adjusted test year bills and historical usage per bill. The advantage of this approach is that it accounts for the number of bills and the usage per bill, whereas Mr. Kwan's approach does not explicitly account for these factors.

Q. MR. KWAN SUGGESTS THAT PUBLIC SERVICE'S USAGE ALLOCATION METHODOLOGY DOES NOT PROPERLY APPORTION FUTURE YEAR USAGE TO EACH INDIVIDUAL RATE TIER. DO YOU AGREE WITH HIS STATEMENT?

A. No. Due to a lack of availability of more granular data, any methodology for developing the test-year allocation will require that some informed assumptions be made. I do not see any evidence to indicate that Mr. Kwan's methodology is a better or preferred approach to that used by Public Service.

Q. WHAT ARE THE IMPLICATIONS OF THE DIFFERENCES BETWEEN PUBLIC SERVICE'S ALLOCATION METHOD AND THE CORRECTED VERSION OF MR. KWAN'S METHOD?

A. In the end, I don't believe there are any major implications. In my opinion, the question of which methodology to use to estimate the usage per block is a "red herring." The key issue is what the underlying demand elasticity is. Unfortunately, an understanding of this issue does not seem to inform Mr. Kwan's analysis.

IV. INCLINING BLOCK RATE DESIGN

Q. IN HIS TESTIMONY, MR. KWAN PROPOSES A FOUR-TIERED INCLINING BLOCK RATE DESIGN. DO YOU AGREE WITH THIS RECOMMENDATION?

A. No. Company witness Scott Brockett's Direct Testimony discusses the objectives of an inclining block rate. If this rate becomes too complicated or difficult to understand, then customers are less likely to respond. The simplest form of inclining block rate is a two-tiered rate structure, which Public Service has proposed. It is my considered opinion that increasing the number of tiers to four provides an added level of complication for the customer

without providing any benefit. If it is the objective of the Commission and of Public Service to encourage efficient energy usage through rate design, then a simpler approach should be pursued.

Q. HAVE YOU IDENTIFIED ANY OTHER PROBLEMATIC ISSUES WITH MR. KWAN'S PROPOSED RATE DESIGN?

A. Yes. If I understand his data correctly, I believe that the rates he has proposed are not revenue neutral. In other words, if the residential class were to be enrolled in Mr. Kwan's proposed tariff, my calculations suggest that this would lead to an increase in revenues for Public Service before accounting for customer response.

Using Mr. Kwan's own rates, usage allocations and assumptions, I calculate the total revenue change to be positive 1.2%, with the summer having a revenue change of 7.4% and the winter having a revenue change of -2.4%. Because Mr. Kwan does not use any elasticity or price response adjustments, the usage change is zero.

After correcting for his computational error the analysis changes slightly, yielding greater revenue impacts than before. With the corrected usage numbers, the projected revenue increase is positive 2.5%, with an 8.8% increase in the summer and a 1.0% decrease in the winter.

I conclude that Mr. Kwan's proposed rates fail to meet the criterion of revenue neutrality and should be rejected.

Q. HOW DO THE PROJECTED IMPACTS CHANGE WHEN YOU ACCOUNT FOR THE ELASTICITY ADJUSTMENT?

A. When I redo the analysis to account for the price responsiveness of consumers, using elasticities of -0.13, -0.13, -0.26, -0.26 for tiers 1 through 4, respectively, there is a system usage change of negative 0.6%, with a change of -1.2% in the summer and -0.3% in the winter. The revenue change after accounting for the elasticity changes is lower, but is still positive at 1.5% annually.

The key takeaway from this analysis is that Mr. Kwan's rates are not revenue neutral, regardless of the usage allocation methodology or the application of the elasticity adjustment. In fact, the rates are revenue positive, meaning that his suggested rates must be decreased in order to achieve revenue neutrality.

Q. MR. KWAN, WHILE CONTENDING THAT THERE IS NO EVIDENCE TO SUPPORT PRICE ELASTICITIES, HAS PUT FORWARD A COMPLEX INCLINING BLOCK RATE WITH FOUR TIERS. IS THERE ANY BENEFIT TO BE GAINED BY INTRODUCING SUCH A RATE IF ONE BELIEVES THAT THERE WILL BE NO CUSTOMER RESPONSE TO INCLINING BLOCK RATES?

A. No. In fact, there is a significant transaction cost associated with such a change. The tariff will be difficult for customers to understand and will complicate the Company's billing. In the end, if one accepts Mr. Kwan's

opinion that there is no elasticity impact, then the rate will yield no gains in efficiency. Such a rate proposal would yield no benefits, but impose costs.

Q. IN SUMMARY, WHAT ARE YOUR CONCLUSIONS ABOUT INCLINING BLOCK RATE DESIGN?

A. Inclining block rates need to be simple and understandable by customers. In my professional opinion, a two-tiered rate best meets these criteria. Further, as I have discussed previously, if one is working under the assumption that there is no customer response to price signals, as Mr. Kwan has in his analysis, it makes no sense to consider inclining block rates at all, least of all a four-tier rate design. I believe that customers can and will respond to clear price signals, and this is supported by decades of studies, reports, and analyses.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.