BEFORE THE
PUBLIC SERVICE COMMISSION
OF WISCONSIN

Application of Wisconsin Public Service Corporation for its System Modernization and Reliability Project — 6690-CE-198

PRE-FILED REBUTTAL TESTIMONY OF

LAWRENCE KAUFMANN

FOR
WISCONSIN PUBLIC SERVICE CORPORATION

April 23, 2013

INTRODUCTION

Q. Please state your name and business address.

A. My name is Lawrence Kaufmann. My business address is 22 East Mifflin Street, Suite 302, Madison, Wisconsin 53703.

Q. By whom are you employed and in what capacity?

A. I am a Senior Advisor to Pacific Economics Group (PEG) and Navigant Consulting.

Q. What are your responsibilities as a Senior Advisor?

A. I am responsible for advising companies and public agencies, particularly energy utilities and regulators, on various regulatory and industry restructuring issues. My duties include consultation on performance-based regulation (PBR), developing service quality incentive plans, analyzing appropriate code of conduct policies for competitive markets, and providing supporting empirical research. I have supervised dozens of large, empirical projects that address these and other regulatory topics using sophisticated quantitative techniques. I often prepare written reports and expert witness testimony on the results of this empirical work.

Q. Please briefly describe your education and professional background as it relates to this project.

A. I obtained both a B.A. degree and a M.A. degree in Economics from the University of Missouri-Columbia in 1984. Additionally, I received a Ph.D. in Economics from the University of Wisconsin-Madison in 1993.

Prior to co-founding the Madison office of Pacific Economics Group in 1998, I was a Senior Economist at Christensen Associates in Madison, Wisconsin from 1993 until 1998. I became a Vice President at PEG in 1998 and a Partner in 2000, before becoming a Senior Advisor to both PEG and Navigant Consulting in 2008.

During my 20 years as an economic consultant, I have advised utilities and regulators on service reliability topics many times. I have testified on service reliability and related service quality regulatory issues for energy utilities in Michigan, Rhode Island, Massachusetts, Kansas, Hawaii, Oklahoma, and Kentucky. I have advised regulators on these issues in Queensland Australia, Bolivia, and Argentina. I have also been advising the Ontario Energy Board, the energy regulator in Ontario Canada, on a series of service reliability projects for the last three years.

Q. Have you reviewed the pre-filed direct testimony filed in this docket by other parties?

A. Yes.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to respond to Mr. Hahn's direct testimony and provide my calculation of the potential economic benefits for ratepayers associated with the System Modernization and Reliability Project (SMRP).

Q. On Direct-CUB-Hahn-8c, Mr. Hahn asserts that the company has provided no data relating to what Wisconsin Public Service Corporation's (WPS) customers

may be willing to pay for improved reliability. Have you done such a calculation?

A. While I have not specifically surveyed WPS's customers, I have calculated the economic benefits that WPS's customers are likely to see due to the SMRP, which is based on surveys of other utilities' customers willingness to pay for improved reliability.

Q. What types of economic benefits might customers see from SMRP?

A. The main potential benefit to customers from the SMRP will be more reliable service. The SMRP will lead to fewer interruptions in the electricity service of WPS ratepayers. This benefits all customer groups because Americans are more dependent than ever on reliable power supplies. Residential consumers demand electric energy to operate a growing volume and variety of appliances in their households. Electricity is also essential to the operation of nearly every commercial business.

When power supplies are interrupted, electric utilities are not serving their customers' demand for electric energy. This "unserved" energy demand imposes costs on customers. The SMRP will benefit WPS customers by reducing the magnitude of their unserved energy demands. In other words, SMRP will deliver more kWhs to WPS customers at the time these customers are demanding electric energy.

Q. How did you calculate the potential economic benefits associated with SMRP?

A. There were three steps to my calculation.

First, I calculated how much the SMRP is expected to reduce WPS customers' unserved demand for electric energy.

Second, I examined the economic literature on the value of reliability and selected an appropriate, but conservative, estimate of the value of unserved energy

(per kWh) for customers on the WPS system.

Third, I calculated the potential economic benefits of the SMRP by multiplying the additional kWh expected to be delivered to customers because of the SMRP (step one) by the estimated value of electricity per kWh (step two).

Q. How did you calculate the impact of SMRP on unserved demand for electric energy?

A. First, I determined the total kWh sales to WPS customers in Wisconsin. In 2012, WPS sold 2.844 billion kWh to residential customers, 3.921 billion kWh to small commercial and industrial customers, and 4.055 billion kWh to large commercial and industrial customers in Wisconsin. A total of 10.82 billion kWh was therefore sold to WPS customers in 2012 in Wisconsin.

Second, I calculated the power (in kW) supplied by WPS to its customers in a typical hour in 2012. Since 2012 was a leap year, there were 8784 hours during the year (*i.e.* 366 days * 24 hours/day = 8784 hours). With 10.82 billion kWh sold over 8784 hours in 2012, the average power supplied to WPS customers in a typical hour in 2012 was 1,231,785 kW (*i.e.* (10,820,000,000 kWh / 8784h) = 1,231,785 kW).

Third, I multiplied the power supplied to WPS customers in a typical hour by the increase in the number of hours in which power will flow to WPS customers because of the SMRP. WPS projects that, over the five year term of the SMRP, its annual system average interruption duration index (SAIDI) will decline by about 25%, or by 84 minutes. This is equivalent to 1.4 hours (*i.e.* 84/60 = 1.4). A 1.4 hour reduction in the average, system-wide duration of outages multiplied by the 1,231,785 kW in power delivered to customers on the WPS system in a typical hour implies that the SMRP will lead to an additional 1,724,499 kWh in electric energy to be delivered to WPS customers (*i.e.* 1,231,785 kW * 1.4 h = 1,724,499 kWh).

I therefore conclude the SMRP will reduce the amount of unserved energy demand of WPS customers by 1,724,499 kWh.

Q. How did you calculate the economic value of this unserved energy demand?

A. I took a conservative approach and used an estimate of the value per kWh for residential customers as a proxy for the value of reliability to all WPS customers. I did this because estimates of the value of electricity service to commercial and industrial customers can vary substantially depending on the economic sector. A precise measure of the value of reliability to WPS's commercial and industrial customers would be tailored to the Company's actual mix of these customers. Because of time constraints, I was not able to develop a highly-tailored estimate of the value of service to WPS's actual commercial and industrial customers.

However, residential customers tend to be more homogenous. The value of electricity service to residential customers is also typically less than its value to commercial or industrial customers. Using the estimated value of electricity service for residential customers to proxy the value of service to all WPS customers will therefore produce a conservative estimate of the economic value of the SMRP.

Q. What studies did you rely upon when conducting your analysis of customer value?

A. I considered a large number of studies but chose to utilize *A Framework and Review of Customer Outage Costs: Integration and Analysis of Electric Utility Outage Cost Surveys*. This report was prepared by the Lawrence Berkeley National Laboratory (LBL) and Population Research Systems LLC for the U.S. Department of Energy. The report is Ex.-WPS-Kaufmann-1.

I based my estimate of the value of reliability on the LBL report for four main reasons. First, the report was conducted by, and for, respected institutions. Second,

the LBL report has a broad scope since it compiled data from 24 different datasets and eight different utilities that had conducted research on the value of electricity service. Third, the LBL report standardized the datasets across companies and removed anomalous and outlier observations. The quality of the underlying data in these studies is therefore high. Fourth, the LBL report undertook statistical analyses to estimate the impact of outage and customer characteristics on the value of service. These statistical analyses allow estimates of the value of service to be developed for a variety of different outage scenarios.

Q. How were the studies integrated in the LBL report generally conducted?

A. The residential studies in the LBL report estimated the value of electricity service through survey-based techniques. Customers were asked about their willingness to pay (WTP) for improved reliability. They were also asked about their willingness to accept (WTA) diminished reliability in exchange for monetary compensation. The studies then used customer responses on WTP and WTA and statistical methods to estimate the value of reliability to residential customers.

Q. Based on your analysis, what is the economic benefit to WPS ratepayers per kWh of outage time recouped under the SMRP?

A. I estimate that, at the time the SMRP is completed in 2019, the value of service to WPS customers will be $12.22 per kWh. I determined this estimate in the following manner.

First, the LBL study estimated that the average WTP for a one-hour outage is $6.90 per residential customer per outage event. This estimate was expressed in 2002 dollars. Mathematically, this estimate is expressed as the value ($) of electricity service per residential customer (N) per hour (h), or $/(N*h) = $6.90.

This estimate of the value of service has to be updated to reflect the impact of

price (and value) inflation between the year in which this estimate was prepared (2002) and the time the SMRP is projected to be complete in 2019. The ratio of the average U.S. consumer price index (CPI) value in 2012 to the average US CPI in 2002 is 1.276. This implies that cumulative consumer price inflation between 2002 and 2012 was 27.6%.

Consumer price inflation between 2012 and 2019 is not known, of course, but I believe a conservative inflation forecast over this seven-year period is actual consumer price inflation over the seven years preceding 2012 *i.e.* consumer price inflation from 2005 through 2012. This estimate is conservative because it includes the most severe and prolonged recession in the US in 70 years, and the unusually slow economic growth during this period constrained inflationary pressures. The ratio of the US CPI in 2012 to the US CPI in 2005 is 1.176. I therefore forecast cumulative consumer price inflation between 2012 and 2019 of 17.6%.

The LBL estimate of the value of service to residential customers is updated by multiplying the $6.90 estimate by the product of actual consumer price inflation between 2002 and 2012 and forecast consumer price inflation from 2012 to 2019. The latter product is equal to 1.501 (*i.e.* 1.276 * 1.176 = 1.501). Multiplying the initial value of $6.90 by 1.501 raises the value of electricity service per residential for a one-hour outage to $10.35.

This estimate also has to be transformed to be expressed in $/kWh terms. This is necessary because the impact of the SMRP is expressed in terms of the additional kWh that it will deliver to WPS customers. An overall dollar value of the SMRP therefore requires these additional kWh deliveries to be multiplied by an estimate of the value of electricity service that is expressed in $ per kWh terms (*i.e.* kWh * $/kWh = $).

If the $10.35 estimate for a one hour outage currently expressed in $/Nh terms is multiplied by the ratio of residential customer numbers (N) per power (kW) delivered to residential customers in a typical hour, the product will be expressed in $/kWh terms (*i.e.* ($/N*h) * (N/kW) = $/kWh). In 2012, WPS sold 2,843,973,000 kWh over 8784 hours to 382,379 residential customers. This implies 323,767 kW delivered to residential customers in a typical hour (*i.e.* (2,843,973,000 kWh/8784h) = 323,767 kW). The ratio N/kW for WPS residential customers is therefore (382,379/323,767) = 1.18. When the $10.35 value of service estimate is multiplied by 1.18 so that the value is expressed in $/kWh terms, the result is $12.22/kWh.

Q. Based on this figure, what do you estimate the annual economic benefit to ratepayers of SMRP will be?

A. After the SMRP is completed, I estimate the annual economic benefit of improved reliability to WPS ratepayers will be $21,069,375. This is equal to the product of the additional 1,724.499 kWh delivered to WPS customers because of the SMPR and the estimated value of $12.22 per kWh. This estimated economic benefit is conservative because the value of service estimate does not fully account for the higher value that commercial and industrial customers place on reliability, compared with residential customers. Nevertheless, with an estimated value of more than $21 million per year to WPS customers after 2019, I believe the benefits generated because of the SMRP will certainly exceed the total costs of the program in less than 20 years, which is less than half of the 60-year expected life of the assets to be installed under the program.

Q. Does this complete your rebuttal testimony?

A. Yes.