BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

*** * * * ***

IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF COLORADO FOR APPROVAL OF A NUMBER OF STRATEGIC ISSUES RELATING TO ITS DSM PLAN, INCLUDING MODIFIED ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION GOALS, AND REVISED INCENTIVES FOR THE PERIOD 2015 THROUGH TO 2020; FOR APPROVAL OF A DISTRIBUTION VOLTAGE OPTIMIZATION PROGRAM TOGETHER WITH COST RECOVERY AND INCENTIVES, AN LED STREET LIGHTING PRODUCT AND APPROVAL TO INCLUDE BEHAVIORAL CHANGE PRODUCTS IN THE COMPANY'S DSM PORTFOLIO AND OF THE METHODOLOGY TO BE USED TO MEASURE SAVINGS FROM SUCH PRODUCTS; AND FOR COMMISSION GUIDANCE REGARDING THE FACTORS TO BE CONSIDERED AND APPROPRIATE LEVEL OF THE COMPANY'S GAS DSM PROGRAM IN THE FUTURE.	**)**	**DOCKET NO. 13A-XXXEG**

DIRECT TESTIMONY AND EXHIBITS OF JEREMY A. PETERSEN

ON

BEHALF OF

PUBLIC SERVICE COMPANY OF COLORADO

June 17, 2013

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

*** * * * ***

IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF COLORADO FOR APPROVAL OF A NUMBER OF STRATEGIC ISSUES RELATING TO ITS DSM PLAN, INCLUDING MODIFIED ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION GOALS, AND REVISED INCENTIVES FOR THE PERIOD 2015 THROUGH 2020; FOR APPROVAL OF A DISTRIBUTION VOLTAGE OPTIMIZATION PROGRAM TOGETHER WITH COST RECOVERY AND INCENTIVES, AN LED STREET LIGHTING PRODUCT AND APPROVAL TO INCLUDE BEHAVIORAL CHANGE PRODUCTS IN THE COMPANY'S DSM PORTFOLIO AND OF THE METHODOLOGY TO BE USED TO MEASURE SAVINGS FROM SUCH PRODUCTS; AND FOR COMMISSION GUIDANCE REGARDING THE FACTORS TO BE CONSIDERED AND APPROPRIATE LEVEL OF THE COMPANY'S GAS DSM PROGRAM IN THE FUTURE.	)	**DOCKET NO. 13A-XXXEG**

DIRECT TESTIMONY AND EXHIBITS OF JEREMY A. PETERSEN

INDEX

LIST OF EXHIBITS

Exhibit No. JAP-1	Updated Market Potential Assessment completed June 2, 2013
Exhibit No. JAP-2	2010 Home-Use Survey
Exhibit No. JAP-3	2012 Home-Use Survey
Exhibit No. JAP-4	Residential Lighting Technical Assumptions as filed in 2012/2013 PSCo DSM Plan
Exhibit No. JAP-5	Solar Water Heating Cost-Benefit Analysis
Exhibit No. JAP-6	Demand Response Market Potential Study completed June 11, 2013

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

*** * * * ***

IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF COLORADO FOR APPROVAL OF A NUMBER OF STRATEGIC ISSUES RELATING TO ITS DSM PLAN, INCLUDING MODIFIED ELECTRIC ENERGY SAVINGS AND DEMAND REDUCTION GOALS, AND REVISED INCENTIVES FOR THE PERIOD 2015 THROUGH 2020; FOR APPROVAL OF A DISTRIBUTION VOLTAGE OPTIMIZATION PROGRAM TOGETHER WITH COST RECOVERY AND INCENTIVES, AN LED STREET LIGHTING PRODUCT AND APPROVAL TO INCLUDE BEHAVIORAL CHANGE PRODUCTS IN THE COMPANY'S DSM PORTFOLIO AND OF THE METHODOLOGY TO BE USED TO MEASURE SAVINGS FROM SUCH PRODUCTS; AND FOR COMMISSION GUIDANCE REGARDING THE FACTORS TO BE CONSIDERED AND APPROPRIATE LEVEL OF THE COMPANY'S GAS DSM PROGRAM IN THE FUTURE.	**)**	**DOCKET NO. 13A-XXXEG**

DIRECT TESTIMONY AND EXHIBITS OF JEREMY A. PETERSEN

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Jeremy A. Petersen. My business address is 414 Nicollet Mall, Minneapolis, Minnesota, 55401.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT POSITION?

A. I am employed by Xcel Energy Services, Inc., a wholly-owned subsidiary of Xcel Energy Inc., the parent company of Public Service Company of

Colorado. My job title is Principal Technical Consultant, Demand-Side Management ("DSM") and Renewable Strategy and Planning. In this role, I provide quantitative analysis of Xcel Energy's utility operating companies' energy efficiency, demand response, and renewable energy products and programs in the business and residential markets. As relevant to this proceeding, this analysis includes determining the cost-effectiveness of the programs based on the effects they have on the utility system, as well as the potential impacts and costs of future implementation of the programs.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THE PROCEEDING?

A. I am testifying on behalf of Public Service Company of Colorado ("Public Service" or the "Company").

Q. HAVE YOU INCLUDED A DESCRIPTION OF YOUR QUALIFICATIONS, DUTIES, AND RESPONSIBILITIES?

A. Yes. A description of my qualifications, duties, and responsibilities is included as Attachment A.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The purpose of my direct testimony is to support the Company's application as follows. First, I support the Company's application to seek approval of energy and demand savings goals from 2015 through 2020 resulting from energy efficiency products. This is Topic 1 in Table 1 of Ms. Debra L. Sundin's Direct Testimony. I support the request first by discussing the future potential savings available from traditional energy efficiency as estimated by a third-party analysis of Public Service's population of customers, as well as

some significant factors that are affecting this potential, including changes to standards, new products, programs and technologies.

Next I discuss some new, non-traditional products, programs and technologies that the Company is proposing to help close the gap between the existing goals approved in Docket No. 10A-554EG, Decision No. C11-0442, and the savings potential identified from traditional energy efficiency This discussion is not only relevant to Topics 5 and 6 in Table 1 of Ms. Sundin's Direct Testimony, it is also related to Topic 1, which is our request for specific approval of energy efficiency goals for the 2015 through 2020 time period.

I then generally describe how the Company develops energy and demand savings goals for energy efficiency, including the cost-effectiveness metrics used by the Company to determine the appropriate level of energy efficiency potential to pursue, and how these metrics led to the goals the Company proposes for energy efficiency.

Finally, I discuss the future potential of demand response in the Public Service territory, as estimated by a third-party analysis, and how those potentials were used to propose demand response goals. This is Topic 2 in Table 1 of Ms. Sundin's Direct Testimony.

II. ELECTRIC ENERGY EFFICIENCY POTENTIAL

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?

A. In this section of my testimony I discuss the potential savings from traditional electric energy efficiency available in the Company's service territory and how changes to codes and standards, specifically in the Residential and Business Lighting markets, have reduced this potential. A quantification of this reduced potential is included in this section, showing a diminishing ability of the utility to maintain historical achievement levels and to meet the current goals. It is important to take the diminished ability of traditional energy efficiency measures to have an impact on energy usage into account not only when designing energy efficiency products and programs but also when developing overall energy efficiency and DSM goals.

Q. HAS THERE BEEN A RECENT EXAMINATION OF THE POTENTIAL FOR TRADITIONAL ELECTRIC ENERGY EFFICIENCY PRODUCTS AND PROGRAMS IN THE COMPANY'S SERVICE TERRITORY?

A. Yes. In preparation of this filing, Public Service asked DNV KEMA, Inc., a third-party evaluator, to complete an update to the 2010 DSM market potential assessment performed in March 2010. The 2010 assessment was included as Exhibit No. DLS-2 in the Direct Testimony of Public Service witness Debra L. Sundin in the 2010 DSM Strategic Issues filing (Docket No. 10A-554EG). The update to the 2010 assessment was completed in June 2013 and is included in this testimony as Exhibit No. JAP-1. It should be noted that this updated assessment only considered "traditional" energy

efficiency products and programs as that phrase is used in my testimony. In addition the updated assessment considered the current Residential Behavioral pilot the Company is currently conducting. The updated assessment did not examine the potential from any non-traditional products and programs

Q. WHAT ASPECTS OF THE ASSESSMENT WERE UPDATED?

A. The study included updates to: avoided cost assumptions; measure saturations to reflect the three years of actual achievements since the original assessment; discount rates, inflation rates and line loss rates; and lighting measures to better reflect the national lighting standards and better incorporate light-emitting diode ("LED") lighting technologies. The study also performed a re-assessment of the potential savings from Residential Behavioral products. The remaining assumptions and conditions from the original assessment were retained in the update.

Q. PLEASE DESCRIBE THE POTENTIAL SCENARIOS THAT ARE INCLUDED IN THE UPDATED MARKET POTENTIAL ASSESSMENT.

A. The updated assessment estimates the capacity and energy savings potential from energy efficiency products and programs. This potential is measured by taking the energy consumption of a baseline, standard-efficiency technology and subtracting the energy consumption of the energy efficient technology. This potential is presented as three types:

Technical – Technical potential represents the capacity and energy savings realized through the implementation in all cases of the most efficient available technologies regardless of cost.

Economic – Economic potential is a subset of the technical potential, but limits the technology implemented to only those technologies that are cost-effective, given the expected cost of the equipment and the expected benefits of the capacity and energy savings from the energy efficient technologies.

Achievable – Achievable potential is a subset of economic potential, but limits the potential to only those energy efficient technologies that are expected to be implemented. This potential is further limited to the energy efficient technologies implemented attributable to the utility DSM products and programs. Technology implemented in the absence of the DSM products and programs is referred to as naturally-occurring energy efficiency and is not included in the achievable potential estimates.

The rate at which energy efficient technologies are implemented is highly dependent on the cost of the energy efficiency equipment as compared to the cost of standard-efficiency equipment. This cost difference, known as the net incremental cost, is the incremental difference in cost to install the energy efficient equipment over the standard-efficiency equipment minus the rebate offered. In order to estimate the achievable potential at different price points, the market potential analysis considered three scenarios reflecting three different levels of incentive or rebate. The three different levels were expressed in terms of rebates paid as a percent of the incremental cost. The

scenarios include: a “50% incentive” scenario, which assumes rebates are paid at a value equal to half of the incremental cost of the equipment; a “75% incentive” scenario, which assumes rebates are paid at a value equal to 75% of the incremental cost; and, a “100% incentive” scenario which assumes rebates that cover 100% of the incremental costs, which results in a net incremental cost of zero and entirely removes all cost barriers to implementation.

Q. HAVE EMERGING TECHNOLOGIES BEEN INCLUDED IN THIS UPDATED ANALYSIS?

A. Yes, certain emerging technologies were included in the updated analysis. Indeed, the emerging technologies that were identified in the original assessment continued to be included in the update. These emerging technologies include LED lighting technologies and indirect evaporative cooling in the Residential and Business markets. The updated assessment did not identify any new emerging technologies beyond these.

In the case of LED technologies, some are expected to be cost-effective and to produce significant energy savings in the future. These LED technologies are now included in the achievable potential estimates in the updated assessment. Indirect evaporative cooling was also considered, but was not included in the achievable potential estimates as indirect evaporative cooling is not expected to be available to the mass market before the end of the timeframe considered in the potential study update.

Q. WHAT ARE THE RESULTS OF THE UPDATED ASSESSMENT AND HOW DO THEY COMPARE TO THE ORIGINAL ASSESSMENT?

A. The updated assessment provided results very similar to those from the original study. Specifically, the average annual energy achievable potential for traditional DSM slightly increased in the 50 percent incentive (+8 percent) and 75 percent incentive (+4 percent) scenarios, while it slightly decreased in the 100 percent incentive (-2 percent) scenario as seen in Table 1-3 on page 8 of 118 of Exhibit No. JAP-1.

Q. DOES THE ACHIEVABLE POTENTIAL SAVINGS REFLECTED IN THE UPDATED ASSESSMENT VARY THROUGH TIME?

A. Yes. The updated assessment shows that estimates of the annual achievable potential savings from traditional electric energy efficiency products and programs in the Company's service territory are expected to decline between 2015 and 2020. This can be seen in the total achievable potential savings presented as "New Net Energy Savings – kWh" in the updated assessment at the following pages of Exhibit No. JAP-1: page 104 of 118 for the 50 percent incentive scenario; page 108 of 118 for the 75 percent incentive scenario; and page 112 of 118 for the 100 percent incentive scenario.

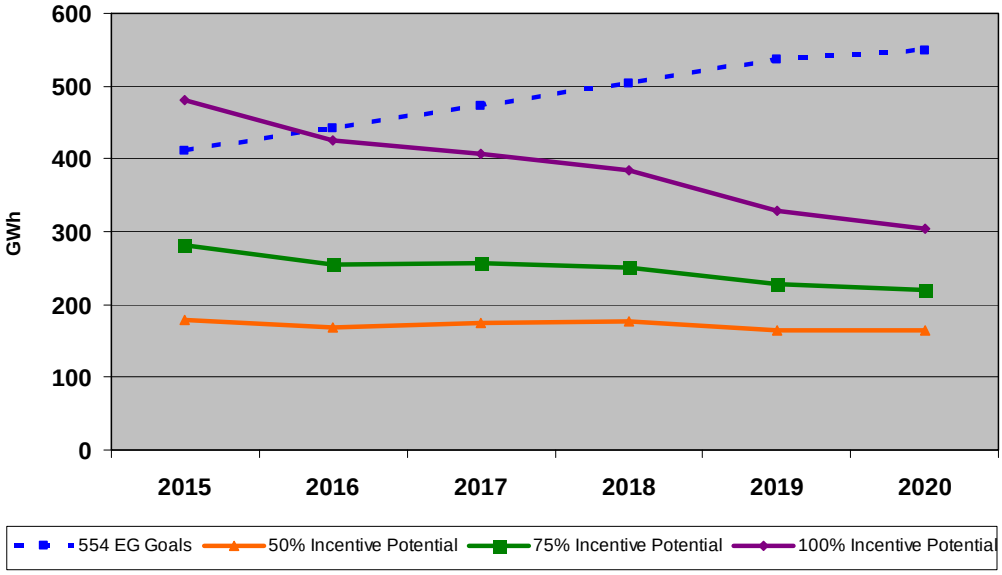
Q. HOW DO THE RESULTS OF THE UPDATED MARKET POTENTIAL ASSESSMENT COMPARE TO THE MOST RECENTLY APPROVED GOALS?

A. The table and chart below show the comparison of the achievable potential savings identified in the updated assessment against the goals approved in Docket No. 10A-554EG:

Table 1: Market Potential Assessment comparison to Docket No. 10A-554EG Goals

YEAR	554 EG Goals Annual GWh Savings	50% Incentive Potential Annual GWh Savings	75% Incentive Potential Annual GWh Savings	100% Incentive Potential Annual GWh Savings
2015	411	179	281	482
2016	441	168	255	425
2017	472	174	256	407
2018	504	176	250	384
2019	537	165	228	328
2020	549	165	220	303

Graph 1: DSM Market Potential Assessment Study & Erosion of Energy Savings



Q. WHAT TRENDS DO THESE UPDATED POTENTIAL ESTIMATES SUGGEST?

A. The table and chart demonstrate that even at the 100 percent scenario, over the six year period the goals currently in place are much higher than the estimated achievable (cost-effective) potential. The updated estimates suggest that the future potential from traditional energy efficiency is declining, contrary to the trend reflected in the currently ordered goals which assumed that the potential from traditional energy efficiency would increase over time. From this and other evidence we conclude not only that the effectiveness of traditional energy efficiency is declining, but that overall DSM potential is declining.

Q. DO OTHER UTILITIES IN THE U.S. SHOW DECLINING ENERGY EFFICIENCY POTENTIAL?

A. Yes. PacifiCorp performed an update to their DSM potential estimates ("PacifiCorp DSM Study")[1]. Their study showed a 44 percent decrease in "achievable technical potential" for "Class 2" DSM, identified as "Energy-Focused DSM Resources." This study considered the PacifiCorp system which includes Rocky Mountain Power, serving portions of Idaho, Utah and Wyoming.

Q. TO WHAT DID THE PACIFICORP DSM STUDY ATTRIBUTE THE DECLINE IN DSM POTENTIAL?

A. The PacifiCorp DSM Study identified several drivers for this reduction in achievable potential, including "accounting for newly enacted codes and standards, even if not yet in effect."

Q. IS PUBLIC SERVICE'S DSM POTENTIAL IMPACTED BY THIS FACTOR AS WELL?

A. Yes, newly enacted codes and standards will cause achievable DSM potential to decline over time in Public Service's service territory.

Q. WHY DO YOU DRAW THIS CONCLUSION?

A. Newly enacted codes and standards will lead to increased naturally-occurring adoption of energy efficient technologies outside of utility DSM products and programs. This, in turn, will do two things. First, it will reduce how often an energy efficiency technology is adopted because of a utility DSM product or

program. Second, even if the energy efficiency technology is adopted because of a utility DSM program, it will reduce the amount of energy savings attributable to the energy efficiency technology

Q. DO YOU HAVE AN OPINION AS TO THE MARKETS THAT ARE HAVING THE GREATEST EFFECT ON THE ABILITY OF UTILITY ENERGY EFFICIENCY PRODUCTS AND PROGRAMS TO REDUCE ENERGY USAGE AND THEREBY MAKING IT MORE DIFFICULT TO MEET OVERALL DSM GOALS?

A. Yes. Those markets are the Business and Residential Lighting markets.

Q. DOES THE UPDATED ASSESSMENT REFLECT THE DIMINISHED POTENTIAL SAVINGS THAT CAN BE ACHIEVED FROM PRODUCTS DIRECTED AT THE RESIDENTIAL AND BUSINESS LIGHTING MARKETS?

A**.** Yes it does.

Q. BEFORE YOU EXPLAIN HOW THE UPDATED ASSESSMENT REFLECTS THESE REALITIES, CAN YOU PLEASE EXPLAIN HOW LIGHTING PRODUCTS PERMITTED US TO ACHIEVE DSM GOALS IN THE PAST AND HOW THEIR DIMINISHED EFFECTIVENESS WILL AFFECT OUR ABILITY TO MEET THOSE GOALS IN THE FUTURE?

A. In order to give us a baseline from which to make comparisons, I will start by stating that in the past the DSM portfolio has relied heavily on achievements from Business and Residential Lighting to achieve goals. Indeed, a large

[1] http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/

portion of the Company's historical DSM achievement is attributable to Business and Residential Lighting.

In the Residential segment, lighting is the electric end-use that has traditionally offered the most energy efficiency potential. While there are a greater variety of technologies with energy efficiency potential in the Business segment, lighting has been significant for this segment as well. The table below shows the total energy saved (in GWh) by the DSM portfolio and the portion of the portfolio represented by lighting technologies from 2009 to 2012, and the planned savings for 2013. The table below also shows for those same periods how much of our total portfolio has been comprised of lighting technologies:

Table 2: Historical Energy Savings from Lighting Compared to Total Portfolio

Year	Res. Lighting (GWh)	% of Res Portfolio	% of Total Portfolio	Bus Lighting (GWh)	% of Bus Portfolio	% of Total Portfolio	Lighting Total (GWh)	% of Total Portfolio
2009	68	89%	31%	79	55%	36%	147	67%
2010	74	80%	29%	81	50%	32%	155	61%
2011	106	80%	34%	101	56%	32%	207	66%
2012	141	81%	35%	153	68%	38%	294	73%
2013	92	71%	27%	97	45%	28%	189	55%

This data shows that lighting has ranged from 61 percent to 73 percent of the entire portfolio's energy savings. Clearly, any reduction in the potential due to changes in standards would greatly affect the achievements of the portfolio overall.

DSM_Potential_Study/PacifiCorp_DSMPotential_FINAL_Vol%20I.pdf

Q. WHAT CHANGES TO BUSINESS AND RESIDENTIAL LIGHTING STANDARDS HAVE RECENTLY BECOME EFFECTIVE OR WILL SOON TAKE EFFECT?

A. The Energy Independence and Security Act of 2007 included changes to lighting energy efficiency requirements. Title III Subtitle B, Section 321 reduced the maximum allowable wattage for light bulbs to approximately 30 percent below current standard incandescent wattages. The requirement was phased in, but by January 1, 2014, the requirement will apply to all types of standard incandescent lighting. This change to lighting standards effectively bans the production of incandescent lighting for most applications. There is expected to be some availability of standard-efficiency incandescent lighting for purchase beyond this date, but this availability is expected to quickly diminish.

The Department of Energy also increased efficiency standards for commercial lighting in 2010 and 2012. This standard change effectively prohibited the installation of most new T12 fluorescent lighting technology, making T8 fluorescents the baseline technology.

Q. PLEASE DESCRIBE HOW CHANGES TO STANDARDS AFFECT THE ACHIEVABLE DSM POTENTIAL.

A. In determining the savings resulting from DSM products and programs, the energy consumption from the energy efficient option is compared to the energy consumption from the standard-efficiency option of the technology. The difference between these two consumptions is the resulting savings.

Increased standards cause the energy consumption of the standard-efficiency option to decrease. This, in turn, reduces the difference between the two consumptions, reducing the resulting savings that can be achieved through the use of the energy efficient technology.

Q. CAN YOU ILLUSTRATE THE EFFECT OF THESE ENERGY STANDARD CHANGES ON THE DSM POTENTIAL FOR RESIDENTIAL AND BUSINESS LIGHTING?

A. Yes. In essence, because the new lighting standards have reduced the baseline from which we measure DSM potential, the savings our DSM efforts can achieve has been significantly reduced. For example, in the case of Residential lighting, the baseline has been the 60 watt incandescent bulb. Our product has encouraged customers to switch to compact fluorescent ("CFL") bulbs, which have a corresponding wattage for this application of 13 watts. Thus, each time a customer switches from a standard incandescent to a CFL bulb there was a savings of 47 watts (60 – 13). The new lighting standard will require the use of the higher efficiency halogen incandescent lighting as the baseline technology, which will reduce the baseline to 42 watts. Under these conditions, if a customer switches to CFL bulbs, the savings is only 29 watts (42 – 13) per bulb. This results in a nearly 40 percent decline in potential per bulb.

Table 3: Example Residential Lighting Energy Standard Change – Energy Savings

	Current Standard	New Standard
Baseline Technology	*Standard Incandescent*	*High-Efficiency Halogen*
Wattage	60 W	42 W
High Efficiency Technology	*CFL*	*CFL*
Wattage	13 W	13 W
Wattage Savings	***47 W***	***29 W (~40% reduction)***

For Business Lighting, the new lighting standards affect a wide variety of applications and technologies to varying degrees. One common application affected is the 4-foot, 4-lamp fixture with electronic ballast. These are typically referred to by their shape and diameter, where a T12 refers to a tubular fluorescent bulb of twelve-twelfths of an inch, or one inch diameter. A T8 refers to a tubular fluorescent bulb of eight-twelfths diameter, or two-thirds of an inch. Generally speaking, the smaller diameter tubes are more efficient. A T12 system for this application would use 144 watts, while the standard T8 system would use 107 watts. The high efficiency T8 would use 79 watts. Before application of the new standards, the wattage savings resulting from converting a T12 to a standard T8 system was 37 watts (144 – 107) and converting the T12 to a high efficiency T8 system yielded 65 watts (144 – 79). After application of the new standards, the standard T8 becomes the baseline, and thus no savings can be claimed for its installation. Conversion to the high efficient T8 system yields savings of 28 watts (107 – 79), reducing

the potential savings by 57 percent for the high efficient T8 and 100 percent for the standard T8.

Table 4: Example Business Lighting Energy Standard

Change – Energy Savings

	Current Standard	**New Standard**
Baseline Technology	*T12 system*	*T8 system*
Wattage	144 watts	107 watts
Higher Efficiency Technology	*T8 system*	*T8 system*
Wattage	107 watts	107 watts
Wattage Savings	**37 watts**	**No Savings (100% reduction)**
Highest Efficiency Technology	*High Eff. T8 sys.*	*High Eff. T8 sys.*
Wattage	79 watts	79 watts
Wattage Savings	**65 watts**	**28 watts (57% reduction)**

Q. DO EMERGING TECHNOLOGIES HELP TO CLOSE THE GAP BETWEEN THE COMPANY'S CURRENT GOALS AND THE IDENTIFIED POTENTIAL RESULTING FROM LOST POTENTIAL SAVINGS DUE TO CHANGES IN LIGHTING STANDARDS?

A. They do, but only partially. LEDs are one emerging technology that has the potential to permit us to achieve greater savings in lighting. Indeed, LED technologies are becoming increasingly more common and cost-effective in the Residential lighting market. Even so, in the Residential market, they represent just a small increase in energy savings when compared to CFL bulbs. Under the new standards, where CFL bulbs represent a 29 watt savings, LED bulbs are expected to represent a 33 watt savings, assuming a 9 watt bulb. This 12 percent increase in savings per bulb is not enough to

cover the 40 percent reduction per bulb in residential lighting potential due to new standards. The increased potential savings from LEDs in Business Lighting is similarly low, much less than is needed to overcome the 57 percent to 100 percent reduction in savings attributable to standards changes.

Table 5: Energy Savings from LED vs. CFL Bulbs

	CFL Savings	LED Savings
Baseline Technology	*High-Efficiency Halogen*	*High-Efficiency Halogen*
Wattage	42 watt	42 watt
High Efficiency Technology	*CFL*	*LED*
Wattage	13 watt	9 watt
Wattage Savings	**29 watt**	**33 watt (~12% increase)**

Q. PLEASE DESCRIBE HOW MARKET CHANGES UNDER THE NEW STANDARDS WILL AFFECT ATTRIBUTION OF CFL SALES TO A UTILTY RESIDENTIAL LIGHTING PRODUCT.

A. The market changes coming under the new standards are likely to decrease the price difference between the "standard" (baseline) high efficiency halogen and the more efficient CFL bulb. In the past, the Company provided in-store discounts on the more efficient CFL bulbs and then claimed savings for all of the bulbs sold. However, as the price difference between the more and less efficient bulbs decreases, it is increasingly likely that customers will purchase the efficient bulbs as a matter of course. Public Service cannot claim credit (savings) for CFL bulbs sold to customers who would have bought the efficient bulb regardless of whether the Company offered a product. These customers are considered "free-riders," and due to the changes in lighting

standards, we expect the incidence of free-ridership to increase significantly in coming years.

On the other hand, utility-sponsored programs have also been shown to increase market acceptance of efficient products, regardless of whether customers participate in the utility DSM programs, resulting in an increase in sales of efficient products. This effect is called "spillover" or "market transformation." The likely effect of the changes in standards is that there will be a significant increase in the number of "free-riders" and a reduction in "market transformation" effects that can be attributed to the utility DSM product for CFL bulbs. These effects are combined and captured in a factor call "net-to-gross".

The Net-to-Gross ("NTG") factor represents the adjustment made to gross savings to convert them to net savings. A reduction in this factor reduces the net achievements that can be claimed for a DSM program, diminishing the ability of the utility to meet the current goals.

Q. ARE THERE OTHER CONDITIONS WHICH LIMIT THE POTENTIAL CONTRIBUTION RESIDENTIAL LIGHTING PRODUCTS CAN MAKE TO THE COMPANY'S ABILITY TO MEET ITS GOALS?

A. Yes. Because CFLs have been in the marketplace for over 15 years, many bulbs have found their way into customers' homes. We believe that the CFL market is reaching saturation. It is assumed that customers installed their first CFLs in their most often used fixtures. With the increased market saturation of CFLs, new bulbs are being placed in less frequently used fixtures. This

leads to an overall reduction in the number of hours that the new bulbs are expected to run within a year compared to the first CFLs installed. Further, because there are so many CFLs in homes already, and because CFLs last longer than the traditional incandescent bulbs that were replaced, we are observing a reduction in the number of sockets/bulbs needing replacement each year. This diminishes the Company's ability to meet the current goals.

Q. WHAT SUPPORT DOES THE COMPANY HAVE FOR THESE CONCLUSIONS?

A. The bi-annual internal "Residential Energy Use Survey" the Company conducts of its residential ratepayers supports both of these conclusions. The surveys for 2010 and 2012 are included as Exhibit Nos. JAP-2 and JAP-3. These surveys show that in the average residence in 2010, CFL bulbs occupied 9.4 lighting sockets (page 45 of 77 of Exhibit No. JAP-2). In 2012 this value increased 30 percent to 15.4 sockets (page 47 of 88 of Exhibit No. JAP-3).

Q. PLEASE EXPLAIN HOW REDUCING THE NUMBER OF HOURS THE NEW BULBS ARE EXPECTED TO RUN WITHIN A YEAR WILL LIMIT THE POTENTIAL CONTRIBUTION RESIDENTIAL LIGHTING PRODUCTS CAN MAKE TO THE COMPANY'S ABILITY TO MEET ITS GOALS.

A. As CFLs becomes more widely adopted, customers begin to use them not only in sockets that get a lot of use, but also in sockets that do not get a lot of use. These sockets are operated fewer and fewer hours each year. This is evident in the Deemed Savings Technical Assumptions as filed in the

Company's 2012/2013 Colorado DSM Plan. The assumptions for the Company's Residential Lighting product are included as Exhibit No. JAP-4. Table 2 on page 3 of this exhibit shows how the operating hours assumption per bulb changes as more bulbs are installed in a typical house. The method to determine the number of run-hours of a bulb is based on the assumed number of bulbs installed in the residence. In the 2012/13 Colorado DSM Plan, the assumption for 2012 was that there were 10 CFL bulbs already installed in a typical house. Further, the Plan assumed that the DSM product caused the average participant to install four bulbs and that those bulbs would be installed in the next often-used bulbs in the house – the eleventh through fourteenth most often used sockets. This results in average run-hours of 870 operating hours per year for CFLs eleven through fourteen installed in a home. In 2013, the assumption changes to 12 bulbs installed, resulting in an estimated 864 operating hours each year for CFLs thirteen through sixteen installed in a home.

As can be seen in the table, the operating hours continue to drop as more bulbs are installed. By 2015, these hours may be less than 800 operating hours per year, representing an approximate 10 percent reduction in energy saved per bulb that can be claimed. This effect further diminishes the Company's ability to meet the current goals.

Q. HOW DOES THE INCREASED MARKET PENETRATION OF CFLS LEAD TO FEWER SOCKETS NEEDING REPLACEMENT AND HOW WILL THAT LIMIT THE POTENTIAL CONTRIBUTION RESIDENTIAL LIGHTING PRODUCTS CAN MAKE TO THE COMPANY'S ABILITY TO MEET ITS GOALS?

A. CFLs typically have a much longer expected lifetime than incandescent bulbs. It is estimated that CFLs last around 10,000 hours while incandescent bulbs last only about 1,000 hours. This means that a CFL is ten times less likely to need to be replaced within a year than an incandescent bulb. With the increased market penetration of CFLs, fewer and fewer bulbs will need to be replaced in a single year. This fact limits the potential contribution of residential lighting products, further diminishing the Company's ability to meet its current goals.

Q. HOW HAVE CHANGES TO RESIDENTIAL LIGHTING STANDARDS BEEN HANDLED BY OTHER UTILITIES?

A. Many utilities around the country are grappling with similar issues. In California, for example, the Public Utilities Commission has placed a limit on utility portfolios so that beginning in 2013 no more than 4 percent of a utility's savings may come from standard CFLs. Other utilities, such as Nevada Power, have chosen to limit the types of lighting that they will rebate. For 2013 and 2014, Nevada Power will only rebate reflector and three-way dimmable CFLs and LEDs. Beginning in 2015, they will only rebate LEDs. Still other utilities, such as New York State Energy Research and

Development Authority ("NYSERDA") and ConEdison, have chosen to maintain CFLs in their portfolios, but greatly reduce the savings and net-to-gross ratios for these measures. NYSERDA recently reduced the net-to-gross ratio for its lighting product from 1.6 to 0.9 and reduced the average energy savings it assumes per CFL from 64 kWh to 54 kWh. Clearly, utilities have a number of options to deal with standards changes, but most appear to be transitioning to a CFL-free portfolio in the future.

Q. NOW THAT YOU HAVE EXPLAINED THE CHANGED LANDSCAPE FOR RESIDENTIAL LIGHTING, WHAT ASSUMPTIONS DOES THE UPDATED MARKET POTENTIAL ASSESSMENT USE AND WHAT POTENTIAL SAVINGS DOES THE UPDATED ASSESSMENT CONCLUDE CAN BE ACHIEVED FROM RESIDENTIAL LIGHTING?

A. The updated assessment uses the following assumptions to evaluate the potential savings that can be achieved from Residential Lighting:

- 2015-2016: Baseline technology using EISA standard (30 percent more efficient or high efficiency halogen lighting) for both CFLs and LEDs. Net-to-gross ratio of 50 percent for CFLs.
- 2017-2020: CFLs removed from product as the market is transformed. EISA standard used as baseline technology for LEDs.

Using these assumptions, the updated assessment estimated the Residential Lighting achievable potential savings at the 75 percent incentive level of the following:

Table 6: Net Energy Savings potential for Residential Lighting

(GWh)	LED	CFL	CFL Specialty	TOTAL
2015	5.6	40.5	4.3	50.4
2016	8.9	31.2	3.0	43.1
2017	45.8	0.0	0.0	45.8
2018	56.8	0.0	0.0	56.8
2019	48.2	0.0	0.0	48.2
2020	53.8	0.0	0.0	53.8

Q. DOES THE COMPANY BELIEVE THIS IS A REASONABLE APPROACH FOR RESIDENTIAL LIGHTING?

A. Yes. These assumptions include some potential savings from CFLs early in the time period, but assume that the Company will make a responsible exit from the CFL market once the market is transformed. This approach is similar to the assumptions concerning CFLs that have been used in other states.

Q. WHAT IS THE NET EFFECT OF THE CHANGES DISCUSSED ABOVE FOR RESIDENTIAL LIGHTING POTENTIAL?

A. The achievable potential identified for Residential Lighting of approximately 50 GWh per year falls short of the Company's 2011 and 2012 Residential Lighting achievements by 50+ GWh and 90 GWh, respectively. This significantly diminishes the Company's ability to maintain its historical achievement level and its ability to meet current goals into the future.

Q. HAS THE COMPANY MADE A SIMILAR ASSESSMENT OF THE DIMINISHING POTENTIAL FROM BUSINESS LIGHTING?

A. Yes. The Business Lighting market is much more diverse and includes many more individual applications of available technology. Because of this, it is more difficult to illustrate the effect of standards on the potential savings. However, the updated Market Potential Assessment does provide a comprehensive assessment of the potential savings from Business Lighting across all applications of the technologies available, using the updated standards. Specifically, page 36 of 118 of Exhibit No. JAP-1 shows the Business potential savings by measure. At the 75 percent Incentive level, it is estimated that the Company could achieve 396 GWh from Indoor Lighting and 34 GWh from Outdoor Lighting by 2020. Page 40 of 118 of this same exhibit shows an estimated 59 GWh from Lighting in the Industrial segment through 2020. The total Business Lighting potential savings is estimated to be 489 GWh, which, when divided by the eight year duration of the assessment (2013-2020), suggests that the potential from Business Lighting is around 60 GWh per year at the 75 percent Incentive level.

This 60 GWh per year of future Business Lighting achievable potential is 40 GWh short of the achievement in 2011 and 90+ GWh short of the achievement in 2012. These trends emphasize how difficult it will be for the Company to maintain its historical achievement levels and its established goals into the future.

III. NEW TECHNOLOGIES / PROGRAMS

Q. WHAT IS THE PURPOSE OF THIS SECTION?

A. This section discusses a few new products or programs the Company recommends to assist us in achieving energy efficiency savings in the environment in which we find ourselves today where the results that can be achieved through traditional energy efficiency products and programs are diminishing. The new products and programs the Company is proposing will help us approach historical achievement levels and provide maximum benefit to the population of ratepayers. In this section, I summarize each new product and program and how the Company would propose to measure the impacts and count achievements towards goal. I also discuss the rationale for including these new items in the Company's DSM portfolio.

Q. THE UPDATED MARKET POTENTIAL ASSESSMENT SHOWS THAT THE POTENTIAL SAVINGS THAT CAN BE ACHIEVED FALLS SHORT OF THE ORDERED GOALS. IS THE COMPANY PROPOSING NEW TECHNOLOGIES OR PROGRAMS THAT MAY HELP FILL THIS GAP?

A. Yes, the Company is considering several new technologies for implementation. While there are several new technologies or programs that have been proposed across the country, Public Service has significant concerns about the future cost-effectiveness of some of these technologies and programs, as discussed in Ms. Sundin's testimony. The Company has identified a few of these technologies and programs it believes are cost-effective, including: expansion of the Company's Behavioral product, potential

to add LED Street Lighting in the future, and a Distribution Voltage Optimization ("DVO") program. These new products and technologies may help the Company fill some of the gap. The proposed Behavioral product and LED Street Lighting product are discussed in more detail below. I also discuss our consideration of a Codes and Standards product; however, for the reasons set forth below, we have not included Codes and Standards in the goals we recommend. Ms Sundin and Ms. Bloch provide more details concerning the DVO program.

A. <u>Expansion of the Behavioral Products</u>

Q. PUBLIC SERVICE INCLUDES A BEHAVIORAL PRODUCT AS A PILOT IN ITS CURRENT PORTOFOLIO. HAS THE COMPANY INVESTIGATED EXPANDING THIS PRODUCT TO THE ENTIRE POPULATION?

A. Yes, Public Service is considering expanding its current Residential Behavioral Pilot product. The current Energy Feedback Pilot in Colorado includes scheduled mailings to Residential customers of approximately 80,000 printed energy feedback reports that compare households' current energy consumption to their past energy use and/or the energy use of similar households in their area. The reports also include tips and suggestions for ways to reduce the recipients' energy consumption and improve their rankings among their neighbor-peers. In addition, approximately 20,000 Residential customers receive e-mailed energy feedback reports in an attempt to test responsiveness and energy savings from an e-mail-only channel. At times, we also use a multi-channel approach to deliver e-mailed

reports to print recipients during periods in which we are not normally sending print reports. The Residential Behavioral Pilot has shown promising energy savings results and will continue through 2014.

The Company is looking into expanding this product to a larger portion of the population, but there are concerns about the cost-effectiveness of expansion. The current pilot is limited to an optimized portion of the population composed of some of the largest consuming Residential customers. That universe of customers is likely to provide more energy savings per participant than the average Residential customer. It is expected that expanding the product population to a larger group would significantly reduce the average savings per participant. Because a large portion of the costs of this product is from mailing reports and is thus a fixed cost per participant, this reduction in savings would reduce the cost-effectiveness of the product.

The Company also has long-term concerns about the potential savings associated with this product due to changes to equipment standards, as well as efficiency improvements. Both of these factors may reduce the magnitude of the savings to be expected from the Behavioral products.

Q. WHY WOULD CHANGES TO EQUIPMENT STANDARDS AND EFFICIENCY IMPROVEMENTS REDUCE THE MAGNITUDE OF THE SAVINGS TO BE EXPECTED FROM THE BEHAVIORAL PRODUCTS?

A. The majority of energy savings from Residential Behavioral products typically come from reduced lighting and cooling loads. With the aggressive standard

changes in lighting and on-going efficiency improvements in cooling, it is reasonable to assume that the savings to be expected from these products will be less in the future than they were in the past. For example, if the Behavioral product changes customer behavior to encourage them to turn off a light bulb, turning off the 75W incandescent will save more energy than turning off the 12W LED lamp. This diminishing impact is expected to continue as more incandescent light bulbs are replaced by more efficient technologies and more air-conditioning units are replaced with high-efficiency equipment.

Q. HAS THE COMPANY EXPLORED HOW TO ADDRESS THESE RISKS IF IT WERE TO OPEN THE BEHAVIORAL PRODUCT UP TO THE ENTIRE CUSTOMER POPULATION?

A. Yes. The Company is exploring how to address these risks by looking for less expensive ways to deliver Behavioral products and determining if these products can garner savings from additional market segments. This is being done by exploring three separate solutions, including: web-based information and education for Residential customers; expanding the program to Business customers using print and online communications; and exploring project-specific options for mid- and large-sized customers. These three approaches are described in more detail below.

Q. PLEASE DESCRIBE THE NEW DELIVERY METHODS PROPOSED FOR THE BEHAVIORAL PRODUCT FOR RESIDENTIAL CUSTOMERS.

A. For Residential customers, the Company is developing and exploring new web-based delivery methods that have the potential to entice or persuade customers to adopt the energy-saving behaviors by using a more interactive set of tools and information that can potentially cost less than the current methods used to deliver this information. We call these the "Online Energy Feedback" tools. These Online Energy Feedback tools would be available immediately to any interested customer with adequate billing history information through the Company's MyAccount login. Customers would be able to view a scorecard comparing their energy use to other customers like them in their area. From there, they could: complete a home energy audit online; commit to an energy-savings goal; see a breakdown of how their home uses energy (with tips to save); download energy-use data for personal analysis; and engage in other high-value activities aimed at increasing the likelihood of long-term energy-conscious behavior.

Because there are no printing or mailing costs associated with Online Energy Feedback tools, this method of delivering the information has the potential to deliver savings at a cost that is lower than the cost we incur today to deliver this information by mail. However, several budget items, such as licensing fees, information technology costs, measurement and verification costs, and customer engagement marketing efforts would still be incurred for the Online Energy Feedback product.

The Company is currently testing this Online Energy Feedback product to determine the optimal marketing mix to drive energy savings and cost efficiencies, and determine the energy saving potential of an opt-in only option for all Residential customers, and specifically for low-income customers.

Q. ARE THERE ANY POTENTIAL CONCERNS WITH THE ONLINE ENERGY FEEDBACK APPROACH?

A. Yes. First, as electronic communication channels become more saturated and customers are faced with an increasing number of online services and emails competing for their time and attention, it is uncertain how frequently or deeply an Online Energy Feedback program would engage customers or drive them to take action.

Second, the Company has tested e-mail delivery of Online Energy Feedback reports compared to paper reports and early results indicate that savings, along with costs, are lower with the e-mail delivery option as compared to the paper delivery option. However, the Online Energy Feedback would differ from the e-mail pilot in that the Online Energy Feedback tool would be a purely opt-in program. While target customers would receive promotional messages, they would not receive personalized energy feedback reports unless they opted into the Online Energy Feedback product.

Third, the Company is uncertain about the level of market potential available from an Online Energy Feedback product.

Fourth, the measurement and calculation of savings for an Online Energy Feedback product would necessarily differ from those for a print or email Feedback program. In a print or email Energy Feedback product, the savings are calculated by comparing energy usage and savings from a test group that receives the Energy Feedback reports and information to a control group that does not receive this information. This methodology is controllable and customers do not switch from one group to another.

In contrast to a print or email Energy Feedback product, Online Energy Feedback product that are offered to the entire Residential customer population have no control group with which to compare behavior because all customers have access to MyAccount and the energy feedback tools available there. Therefore, the online program would require a different methodology to calculate savings.

Q. HOW DOES THE COMPANY PROPOSE TO CALCULATE SAVINGS FOR AN ONLINE ENERGY FEEDBACK PRODUCT?

A. The Company plans to work with industry experts to develop a Measurement and Verification ("M&V") methodology using industry-recommended approaches. An example of an industry-recommended approach to M&V can be found in a publication from the State and Local Energy Efficiency Action Network ("SEE Action" -- a state and local led effort facilitated by the U.S. Department of Energy and the U.S. Environmental Protection Agency) entitled ***Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and***

Recommendations, May 2012.[2] While there are several M&V options for a behavioral online opt-in product, all of the options have benefits and drawbacks. We intend to test several options to determine which delivers results that meet industry and regulatory standards while encouraging engagement and efficiency from the largest portion of the customer market. This balanced approach will help us determine how to benefit the most customers while still meeting the recommended rigor for opt-in behavioral products.

Q. PLEASE DESCRIBE THE NEW TOOLS PROPOSED FOR DELIVERY OF BEHAVIORAL PRODUCTS TO BUSINESS CUSTOMERS.

A. For Business customers, new energy feedback options offer information and tools similar to Residential energy feedback resources with the tips and information geared toward Small Business segment. This type of information is expected to be especially useful for hard-to-reach building tenants who often lack the authority to initiate capital improvements to save energy. Because much of this market has not engaged as actively in energy efficiency and conservation as other market segments, there is significant potential for behavior-based energy savings. The Company plans to test and measure the impacts of online and print information services to determine if and how energy feedback can best drive cost-effective energy savings for the small business market.

[2] http://www1.eere.energy.gov/seeaction; Publications tab

While the potential for significant savings seems likely, it is unknown at this time: what level of savings could be achieved; how long savings will persist; or, to what extent a Behavioral product may increase participation in our other DSM products. Because the Company is not launching a universally available Web-based information service for Business customers at this time, we do not anticipate that our Business Energy Feedback efforts will present the M&V challenges the Residential online-only offering presents. The M&V methodology may change if, pending a successful pilot outcome, future plans include offering an Online Energy Feedback product on a larger scale for business customers.

Q. HOW DO THE SAVINGS FROM BEHAVIORAL PRODUCTS DIFFER FROM THOSE ASSOCIATED WITH EQUIPMENT-ACQUISITION PRODUCTS?

A. Behavioral savings are different from equipment-acquisition savings in terms of the measurement, scale, and timing of savings. In order to calculate the product's impacts, first, the savings from Behavioral products are determined by measuring the actual savings achieved by product participants against a control group of statistically equivalent non-participants. These savings are measured and reported for each product year at the 95 percent level of statistical confidence. This ex-post measurement approach is the gold standard for measuring Behavioral products according to the U.S. Department of Energy's State Energy Efficiency Action Network.[3] This

[3] "Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations," May 2012, *State & Local Energy Efficiency Action Network*, available here: http://www1.eere.energy.gov/seeaction/pdfs/emv_behaviorbased_eeprograms.pdf

contrasts with equipment-acquisition products where savings are determined using engineering estimates of the expected annual consumption of the energy efficient technology versus the annual consumption of the baseline efficiency technology through either a deemed savings or custom analysis approach. Only in the occasional case of a large custom project are equipment-acquisition product achievements directly measured.

Second, savings from Behavioral products are generally distributed to a large portion of the population, resulting in significant savings that are realized immediately. This is counter to most equipment-acquisition products which usually rely on replacement of equipment as the equipment gradually fails or burns out. By ramping up quickly, Behavioral products deliver a significant portion of incremental savings in their first year.

Finally, the duration of Behavioral product savings is a function of the product length, as the savings are driven by recurring engagement of participants. Importantly, the rate of savings may increase over time due to this recurring engagement. This contrasts with equipment-acquisition products for which where the duration of savings equals the lifetime of the installed technology, up to 20 years.

Q. WHAT OPTIONS ARE THERE FOR COUNTING BEHAVIORAL ACHIEVEMENTS TOWARDS GOAL?

A. Historically, the savings from the Company's Behavioral Pilot were counted towards the achievement of goal. This is despite the large difference in the timing of savings achieved between Behavioral products and equipment-

acquisition products. Another option would be to spread the observed savings over the expected duration of the product. For instance, if a Behavioral product is proposed to last for three years, the observed savings within a year would be divided by three to calculate the achievement towards goal. This would be done to ensure that the Company is not overstating annual savings towards its incremental goal, and would account for the savings in a way that is more consistent with equipment-acquisition measures.

Q. PLEASE DESCRIBE HOW DSM ACHIEVEMENTS ARE INCORPORATED IN SALES FORECASTS AND RESOURCE PLANS, AND HOW THIS AFFECTS THE CHOICE OF THE APPROPRIATE METHOD TO COUNT BEHAVIORAL GOALS?

A. Sales forecasts must account for DSM achievements. This is accomplished by comparing projected annual DSM achievements to the baseline: historical annual DSM achievements. The difference in these rates is subtracted from the sales forecast for the first product year. In later product years, the accumulated impact is even greater – that is, the difference in rates is multiplied by the number of product years. For instance, if the past five years of DSM achievement were 200 GWh annually and the expected DSM achievement for the next ten years is 300 GWh annually, the sales forecast based on unadjusted historical sales data would be adjusted down by 100 GWh [1 x (300 GWh – 200 GWh)] the first year of the forecast, whereas the

forecast for the tenth year would be adjusted down by 1000 GWh [10 x (300 GWh – 200 GWh)].

Most importantly, this method relies on DSM achievements to last for a significant duration. If achievements from Behavioral products are counted as full achievements towards goal, this method no longer works, as the duration of the achievement from Behavioral products is limited just to the year the savings are observed. For instance, in the example above, if the 100 GWh of future achievement above historical achievement is due to a Behavioral product, it would only be appropriate to adjust the forecast by 100 GWh, rather than 1,000 GWh over 10 years, as that would amount to repeatedly taking credit for the same savings.

Q. GIVEN THESE ISSUES WITH RESPECT TO HOW TO ACCOUNT FOR BEHAVIORAL PRODUCT ACHIEVEMENTS TOWARDS GOAL WHAT METHOD DOES THE COMPANY PROPOSE?

A. The Company proposes that the Behavioral product achievements observed each year for the three-year period of 2015 through 2017 be divided by three years. This method is reflected in the proposed goals submitted by the Company in this testimony.

Q. WHAT IS THE RATIONALE FOR USING A THREE-YEAR FACTOR TO COUNT BEHAVIORAL PRODUCT ACHIEVEMENTS TOWARDS GOAL?

A. The choice of three years is based on a few factors. First, while the Company is fairly confident in the cost-effectiveness of a Behavioral product for the next three years, it is less confident in the cost-effectiveness in further years. This

is due to the fact that as more efficient technologies are adopted as discussed above, it is reasonable to expect a reduction in the magnitude of savings realized from Behavioral products. Indeed, this is why we have proposed that Behavioral products be run for only three years.

Second, the filing of our next Strategic Issues filing in two years will permit us to revisit these products and goals as well as the appropriate treatment of Behavioral products and their contribution towards goals.

Q. DOES USING A THREE-YEAR FACTOR TO COUNT BEHAVIORAL PRODUCT ACHIEVEMENTS TOWARDS GOAL AFFECT THE ESTIMATION OF NET BENEFITS FROM BEHAVIORAL PRODUCT ACHIEVEMENTS?

A. No. The net benefits of Behavioral products should be based on the actual achievements as observed each year. The Company proposes only that the credit towards energy and demand goals should be adjusted for Behavioral products.

Q. USING THE COMPANY'S PROPOSED METHODOLOGY, PLEASE ILLUSTRATE HOW THE COMPANY WOULD MEASURE BEHAVIORAL ACHIEVEMENTS IN TERMS OF GOAL ACHIEVEMENT AND NET BENEFITS.

A. For this illustration, assume a Behavioral product results in savings of 15 GWh and 3 MW for each of the years 2015 through 2017, based on actual observed impacts each of those years. For 2015 goal achievement, the actual observed impacts of 15 GWh and 3 MW would be divided by three,

representing the three years 2015, 2016, and 2017, to result in 5 GWh and 1 MW of achievement towards goal. The net benefits for 2015 would be based on the full value of the 15 GWh and 3 MW of savings realized in 2015. This process would be repeated for 2016 and 2017. The cumulative effect over the three years 2015 through 2017 would be 15 GWh and 3 MW of goal achievement with the net benefits based on three years of 15 GWh and 3 MW avoidance, or 45 GWh saved over the lifetime of the product and 3 MW of capacity avoided for three consecutive years. This accounting would be analogous to the accounting of equipment expected to last three years and producing 15 GWh and 3 MW of savings each year, or 45 GWh saved over the lifetime of the measure and 3 MW of capacity avoided for three consecutive years. In this way, this accounting puts Behavioral products on par with equipment-acquisition products in counting towards goal and estimating net benefits.

Q. DO THE BENEFITS OF A BEHAVIORAL PRODUCT CONTINUE BEYOND THE DURATION OF THE BEHAVIORAL PRODUCT?

A. Yes. There are some benefits from Behavioral products that continue even after the product is discontinued. The behaviors that the product induced through the information passed to customers persist even after the information ceases.

Q. ARE THESE BENEFITS CAPTURED IN THE PROPOSED METHOD OF COUNTING NET BENEFITS?

A. No. The benefits that would continue to be realized after a product ends would not be included in the proposed method for counting net benefits. For purposes of this discussion I call these "persistence benefits." In order to capture the persistence benefits, one would have to presume some end date for the proposed Behavioral product. While the Company suggests including only three years of achievement in the goals, it is not necessarily proposing that the Behavioral product end after three years. Thus, without a known end date for the product, it is not possible to determine when these persistence benefits began. These persistence benefits would also have to be based on some assumed factor applied to the measured savings. The persistence benefits themselves would not be measured. For these reasons, the Company does not suggest including persistence benefits in the method of counting the benefits of the Behavioral products.

B. <u>LED Street Lighting</u>

Q. IS THE PROPOSED LED STREET LIGHTING PRODUCT A TRADITIONAL ENERGY EFFICIENCY PROGRAM?

A. No. Unlike traditional energy efficiency programs where the energy efficient equipment is purchased and owned by the program participant, most street lighting in our service area is owned by the Company. The installation and maintenance costs related to standard street lights are paid by the Company and passed on to ratepayers. In the case of LED street lights, the cost of the equipment is much higher than standard-efficiency street lights. Under this concept the Company may add in the future, although the street light would

remain the property of the Company, the participating customer would pay for the cost of the upgrade to the more efficient LED technology prior to the time the existing standard street light technology burns out. This product would be targeted at customers seeking financial assistance to fund the upgrade from standard efficiency to LED technology on Company-owned and maintained street lighting. Please see Section IX in Ms. Sundin's testimony for a more thorough description of this energy efficiency concept and when the Company may add it as a product.

Q. HOW WOULD THE COMPANY PROPOSE TO IMPLEMENT AN LED STREET LIGHTING PROGRAM?

A. Even though the equipment is owned by the Company, the Company believes the product can be implemented in the same manner as a typical energy efficiency product. Street lighting customers choosing to participate would be required to pay the incremental cost of the LED technology. If the technology is proven to be cost-effective using the Modified Total Resource Cost Test, rebates would be available for participants to reduce the cost of the technology.

Q. SHOULD THE ACHIEVEMENTS FROM AN LED STREET LIGHTING PRODUCT COUNT TOWARDS ACHIEVEMENT OF THE GOAL AND TOWARDS THE COMPANY'S FINANCIAL INCENTIVE?

A. Yes. This product produces benefits for ratepayers and should be included in the same incentive mechanism that is applied to other traditional energy efficiency programs.

C. Codes and Standards

Q. PLEASE DESCRIBE THE CODES AND STANDARDS PROGRAM.

A. Public Service is currently conducting a pilot Codes & Standards program in order to determine what a successful, cost-effective product design might look like; what level of interest local communities might have; what methodology could be used for determining energy savings potential; and the potential magnitude of energy savings. The goal of the pilot is to determine if the Company offered support for the development of more stringent codes and increased code for jurisdictions (cities and counties) and building owners and renters in those jurisdictions, would that result in additional energy savings. This pilot program is described in greater detail in the testimony of Ms. Sundin.

Q. HAVE THE POTENTIAL IMPACTS FROM A CODES AND STANDARDS PRODUCT BEEN INCLUDED IN THE PROPOSED GOALS?

A. The Company has not included a specific incremental potential from a Codes and Standards product in the 2015 through 2020 goals. However, the Company believes that some potential impacts from a Codes and Standards product are included in the proposed goals because the potentials included in the updated market potential assessment include adoption of measures that exceed current efficiency levels and standards. Codes and Standards

products achieve the same results as adoption of measures that exceed current efficiency levels and standards; they simply achieve the results through different means, i.e., enforcement of standards, or even earlier implementation of standards. Therefore, the potential from Codes and Standards products are not entirely incremental to the potential from which the proposed goals were calculated.

The Company did not include any incremental impacts from a Codes and Standards product for a few reasons: the potential impacts from a Codes and Standards product are highly variable; these impacts are generally expected to be small; there are significant concerns with the cost-effectiveness of such a product; and, there are difficulties with performing measurement and verification of savings. Therefore, the Company has not included a specific incremental potential from a Codes and Standards product.

IV. QUANTITATIVE TOOLS FOR GOAL SETTING

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?

A. In this section of my testimony I discuss a battery of cost-benefit tests, from varying stakeholder perspectives, which the Company typically runs in each DSM Plan and Status Report. I then discuss the components that are used in each of these tests and how the components have recently trended, impacting a few of these tests. Finally, I discuss how the combination of these tests should be used to determine the appropriate level of goal.

Q. YOUR TESTIMONY TO THIS POINT HAS DISCUSSED THE DSM MARKET POTENTIAL AND GOALS FROM A QUALITATIVE PERSPECTIVE. ARE THERE ANY QUANTITATIVE TOOLS THAT WILL HELP GUIDE APPROPRIATE GOAL SETTING BASED ON THE ESTIMATED MARKET POTENTIAL?

A. Yes. The Company routinely runs a battery of cost-effectiveness tests on DSM measures, products, programs, and the entire portfolio to optimize it for cost, availability to customers, and savings. The results of each of these tests are included in each of the Company's DSM Plans and DSM Annual Status Reports. These tests vary based on different stakeholder perspectives including product or program participants ("Participant Test"), the utility ("Utility Cost Test"), ratepayers not participating in products/programs ("Rate Impact Test"), and the rate-base as a whole ("Modified Total Resource Cost Test"). While the Modified Total Resource Cost Test currently used in Colorado is effective in determining the universe of technologies which are cost-effective, these other tests may be used to determine the appropriate level of DSM to pursue and thus inform the setting of goals.

Q. ARE THESE TESTS COMMONLY USED?

A. Yes. These are the tests recommended for use in DSM evaluation by the California Standard Practices Manual[4], which serves as the primary reference for DSM analysis nationally.

Q. HOW ARE THE RESULTS OF THESE TESTS EXPRESSED?

A. Each of the tests provides both a benefit-cost test ratio and either a net benefit dollar value, or total cost dollar value. To determine these values, the net present value of the benefits and costs over the lifetime of measures installed are calculated. The ratio is then the benefits divided by the costs. If the benefits exceed the costs, the net benefit dollar value is the difference between the two. If the costs exceed the benefits, the difference between the two is the total cost dollar value. The portfolio, program, product, or measure is considered to pass when the benefit-cost ratio ("test result") is above 1.0. The resulting benefit-cost ratios of the different tests serve as good measures of the absolute cost-effectiveness from the different perspectives (participant, non-participant, utility, and total population), but are not the best way to measure the relative cost-effectiveness of different DSM scenarios because the ratio does not capture the absolute magnitude of the benefits or costs of a portfolio, program, product or measure. For the purposes of my testimony, which discusses different DSM goal scenarios, the net benefit dollar value or total cost dollar value of the DSM portfolio for each scenario will be used to

[4] http://www.energy.ca.gov/greenbuilding/documents/background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF

determine the relative cost-effectiveness of different scenarios. Each of the tests is described in more detail below.

A. <u>Participant Test</u>

Q. PLEASE DESCRIBE THE PARTICIPANT TEST, INCLUDING THE COMPONENTS USED AND THE STAKEHOLDER PERSPECTIVE IT ADDRESSES.

A. This test measures whether participants benefit financially from participation in the DSM product or program (*i.e.* does the bill savings outweigh the cost of an efficiency measure). Benefits in this test include the bill savings and any operations and maintenance ("O&M") savings realized by the participant over the lifetime of the energy efficient technology implemented through participation in the DSM product/program, as well as the DSM rebates. Costs include the extra ("incremental") cost the participant pays for the energy efficient technology above the cost of the standard-efficiency option, as well as any O&M costs the participant may incur over the lifetime of the energy efficient technology implemented.

B. <u>Utility Cost Test</u>

Q. PLEASE DESCRIBE THE UTILITY COST TEST, INCLUDING THE COMPONENTS USED AND THE STAKEHOLDER PERSPECTIVE IT ADDRESSES.

A. Despite the name, this test does not measure the profitability to the utility, or the impact to utility shareholders. Rather, this test measures whether the DSM product or program assists in a function with which the utility is tasked with – serving the population of ratepayers at the lowest possible cost. The benefits included in this test are the reduced costs needed to serve customers due to the energy and capacity savings resulting from implementation of the energy efficient technology attributable to the DSM product or program. Specific cost savings ("benefits") included in the Utility Cost Test are those costs avoided by not building generation plants in the future, not adding transmission and distribution investments to deliver the additional energy, and not purchasing fuel that would be burned to produce the energy. The costs in this test are limited to the DSM product or program costs.

Q. HOW ELSE CAN THE UTILITY COST TEST BE INTERPRETED?

A. This test is also sometimes referred to as the Revenue Requirements test and is similar to a criterion used in resource planning which is to select resources so as to minimize revenue requirements. These benefits are also sometimes called avoided revenue requirements. Revenue requirements are defined as the amount of revenue a utility must take in to cover the sum of its estimated operation and maintenance expenses, and debt service and

coverage. As the costs included in this test - the DSM program costs - are collected from ratepayers, they can be called additional revenue requirements. Subtracting the costs from the benefits calculates the net avoided revenue requirements.

Q. DOES USE OF THE UTILITY COST TEST ESSENTIALLY EQUATE DSM TO A SUPPLY-SIDE RESOURCE?

A. Yes. In fact, the Utility Cost Test offers the same analysis that is performed in resource planning to determine the appropriate generation mix, where DSM is treated as a potential resource. This Utility Cost Test compares the costs recovered from ratepayers for running DSM products and programs to the generation costs they avoid by not building a new power plant, or running a power plant to supply energy (because it is no longer needed as it has been avoided through DSM). For the purposes of resource planning calculations, we assume that the DSM programs avoid energy that would have otherwise been generated by the build of a new power plant, or running a power plant to supply energy that the Company could pursue through a Resource Plan.

Q. CAN THE UTILITY COST TEST BE USED TO COMPARE DIFFERENT DSM SCENARIOS?

A. Yes. As I described above, the net benefit dollar value that the Utility Cost Test measures is the net avoided revenue requirement. Similar to the process used in Resource Planning to determine the appropriate generation mix, the avoided revenue requirements of different DSM scenarios may be compared to determine the DSM scenario that minimizes revenue

requirements. Selecting the DSM scenario that produces the greatest Utility Cost Test net benefits achieves this goal.

Q. WILL THE DSM SCENARIO THAT ACHIEVES THE MOST ENERGY SAVINGS MINIMIZE REVENUE REQUIREMENTS?

A. No. To maximize the energy savings from DSM would require unlimited DSM program spending. Limiting the DSM program spending so that it simply passes the Utility Cost Test would result in a ratio of 1.0, but would leave no avoided revenue requirements. While this would put the DSM scenario on par with the costs of supply-side resources it would not minimize revenue requirements. The DSM scenario that minimizes revenue requirements will be at an energy savings level that is less than the maximum energy savings potential and less than the energy savings that would be achieved if one were to limit the DSM portfolio so that it passes the Utility Cost Test with a ratio of 1.0.

Q. PLEASE ILLUSTRATE HOW THE AVOIDED REVENUE REQUIREMENTS CHANGE ACROSS DIFFERENT LEVELS OF ENERGY SAVINGS ACHIEVEMENT.

A. As a baseline for this illustration, assume a DSM portfolio that includes the following:

- Rebates equal to 50 percent of the incremental cost the participant pays for the energy efficient technology above the cost of the standard-efficiency option totaling $20 million;
- Marketing and administration costs totaling $5 million;

- Energy savings of 100 GWh; which results in $80 million in energy and capacity savings resulting from implementation of the energy efficient technology attributable to the DSM program.

In this baseline, the Utility Cost Test net benefits equal $55 million ($80 million - $20 million - $5 million). Now consider an alternate portfolio with the following characteristics:

- Awards rebates equal to 75 percent totaling $36 million;
- Doubles the marketing and administration costs to $10 million;
- A 20 percent increase in energy savings to 120 GWh, which results in a 20 percent increase in energy and capacity savings to $96 million.

In this alternate portfolio, the Utility Cost Test net benefits equal $50 million ($96 million - $36 million - $10 million), or $6 million less than the baseline scenario. In this case, the scenario achieving the lesser of energy savings of 100 GWh minimizes revenue requirements.

Table 7: Example of Avoided Revenue Requirements across Different Levels of Energy Achievement

	Baseline Portfolio	Alternate Portfolio
Rebate %	50%	75%
Rebate Total	$20M	$36M (75%/50%) * (120 GWh / 100 GWh)
Marketing and Admin.	$5M	$10M
Energy Savings	100 GWh	120 GWh
Energy and Capacity Savings Reduced Costs (Benefits)	$80M	$96M
Utility Cost Test Ratio	3.20 = ($80M / ($20M + $5M))	2.09 = ($96M / ($36M + $10M))

Utility Cost Test Net Benefits	$55M = ($80M - $20M - $5M)	$50M = ($96M - $36M - $10M)

Q. WHAT FACTORS AFFECT THE UTILITY COST TEST?

A. The main factors affecting this test are the system conditions that determine the avoided costs or benefits of this test. On the cost side, the main factor is the estimate of the costs necessary to achieve the savings. This is dependent on the willingness of a large and diverse population of ratepayers to implement energy efficiency technologies given information or economic incentives from the utility. As market potential decreases, there are fewer willing participants in the DSM products and programs, and thus, these potential participants require higher rebates in order to encourage their participation. If savings goals continue to grow while market potential continues to decrease, then the utility will be forced to increase its economic incentives (rebates) beyond levels that have been observed historically. Until products and programs are operated under these future conditions, it will be difficult to accurately estimate the costs necessary to achieve the savings.

C. <u>Rate Impact Test</u>

Q. PLEASE DESCRIBE THE RATE IMPACT TEST, INCLUDING THE COMPONENTS USED AND THE STAKEHOLDER PERSPECTIVE IT ADDRESSES.

A. This test, sometimes called the Rate Impact Measure ("RIM") Test, measures the effect of a DSM product or program on rates. Since ratepayers who do not participate in DSM products or programs do not see any change in

consumption from the DSM product or program, this rate impact represents the impact on non-participant bills, so it is also sometimes called the Non-Participant Test. The benefits of this test are the same as the Utility Cost Test – the reduced costs necessary to serve customers, or the avoided revenue requirements. The costs also include the DSM program costs or additional revenue requirements. In this way, the Rate Impact Test measures the same net avoided revenue requirements as the Utility Cost Test. However, the Rate Impact Test also includes as a cost the lost revenue expected from the DSM program due to reduced consumption from product or program participants. If this lost revenue exceeds the net avoided revenue requirements, the utility no longer recovers enough revenue to cover costs. The only remedy to this is a rate increase. In this way, the test measures the impact of DSM products and programs on rates.

Q. WHAT FACTORS AFFECT THE RATE IMPACT TEST?

A. There are several ever-changing factors that affect the Rate Impact Test. For capital intensive generation, transmission and distribution assets, the extent to which DSM permits the utility to avoid acquiring assets in the future must be measured against the lost base rate revenue that would be dedicated to pay for those assets if they had been acquired. For energy, the extent to which DSM permits the utility to avoid marginal fuel costs must be compared to the average fuel costs that would be recovered through a fuel rider had the fuel been acquired. The costs to run the DSM products or programs also

affect the test. These costs are recovered directly from ratepayers and represent an immediate rate increase.

Q. HOW DOES THE RELATIONSHIP BETWEEN ENERGY AND CAPACITY SAVINGS AFFECT THE RATE IMPACT TEST?

A. DSM products and programs that save significantly more energy than capacity, as compared to the total utility generation system, tend to increase rates. For instance, a product or program that results in 1.0 percent system energy savings but reduces the capacity needs by only 0.5 percent would tend to increase rates. This occurs because the costs of capacity investments are recovered through volumetric rates which are tied closely to energy savings. In the case of Residential and Small Business ratepayers, these capital costs of capacity are recovered directly through energy volumes. For large Business and Industrial ratepayers, the capital costs of capacity are recovered through a monthly demand charge. This monthly demand charge is closely tied to the annual energy savings. If the reduction in recovery of the capacity costs through these volumetric rates exceeds the reduction in capacity costs, the only remedy is to increase the rates.

Q. HOW DOES THE COST DIFFERENTIAL BETWEEN MARGINAL ENERGY AVOIDED BY DSM PROGRAMS AND THE AVERAGE SYSTEM ENERGY AFFECT THE RATE IMPACT TEST?

A. A large cost differential between the marginal energy (the cost to produce the last kWh of energy) avoided by a DSM program, product or measure and the average system energy (average cost to produce one kWh) may cause the

DSM programs, products or measures to hold neutral or even reduce rates. If the marginal energy avoided by a DSM program, product or measure is very close to or even less than the average system energy, the DSM program, product or measure will likely increase rates.

For example, a Residential Lighting product produces energy savings concentrated during non-Summer or off-peak hours when the avoided energy comes from a base load plant, with a value of marginal energy at or below the average system energy. A Residential Cooling product, on the other hand, produces energy savings concentrated during summer on-peak hours when the avoided energy comes from a peaking plant, with a value of marginal energy above the average system energy. In this example, the Lighting product likely increases rates, whereas the Cooling product likely reduces rates.

Q. HOW DO DSM PROGRAM COSTS AFFECT THE RATE IMPACT TEST?

A. DSM program costs represent a direct rate increase and are treated as a cost in the Rate Impact Test. For a DSM product, program or portfolio to be neutral on rates or decrease rates, the rate reductions - from capacity savings compared to lost capacity cost recovery and the avoided marginal energy compared to average system energy – must be large enough to overcome the rate increase from DSM program cost recovery.

Q. HAVE THE RATE IMPACT TEST RESULTS FOR THE PORTFOLIO CHANGED OVER TIME?

A. Yes. This is evidenced in the Company's historical Status Reports and its current DSM Plan. The table below shows the RIM Test ratio presented in Status Reports for program years 2009 to 2012 and the expected 2013 RIM Test result included in the current DSM Plan:

Table 8: Historical Rate Impact Test Scores for DSM Portfolio

Year	RIM Test Ratio
2009	1.45
2010	1.41
2011	1.10
2012	0.84
2013	0.90

Q. WHY HAS THE RIM TEST RESULT DECREASED SIGNIFICANTLY SINCE 2009?

A. One main reason for the reduction in RIM Test results is a shift towards more energy intensive DSM portfolios. To capture this change, the table below shows the annual load factor (average demand reduction / peak demand reduction) from the DSM portfolio since 2009:

Table 9: Historical Annual Load Factor of DSM Portfolio

Annual Load Factor of DSM	
2009	41.93%
2010	42.70%
2011	47.02%
2012	50.46%
2013	47.06%

The higher the load factor, the more energy-intensive are the reductions from the DSM portfolio. While these load factors still show that the DSM portfolios

are more capacity-intensive than the typical system conditions, which are at a 58 percent load factor, the DSM portfolio has become more energy-intensive.

The table below shows the net present value of each of the components of the RIM Test per lifetime kWh from the DSM portfolio since 2009.

Table 10: Historical Net Present Value of RIM for DSM Portfolio

	Lost Revenue	Cost of DSM	Avoided Capacity	Marginal Energy
2009	$0.047/kWh	$0.014/kWh	$0.034/kWh	$0.055/kWh
2010	$0.045/kWh	$0.015/kWh	$0.032/kWh	$0.053/kWh
2011	$0.038/kWh	$0.015/kWh	$0.030/kWh	$0.027/kWh
2012	$0.059/kWh	$0.017/kWh	$0.031/kWh	$0.033/kWh
2013	$0.061/kWh	$0.020/kWh	$0.038/kWh	$0.035/kWh

This table above shows the following trends:

Lost Revenue: The lost revenue is increasing due to both a general increase in rates and in a greater concentration of achievements in the Residential Lighting product. With Residential volumetric rates generally higher than Business rates, this increased concentration of achievements from Residential products increases the rate of lost revenue. Included in this change is a drop in fuel cost recovery from ratepayers due to reduced natural gas prices. Despite this drop in fuel cost, the other factors are significant in that they cause a significant rise in lost revenue.

Cost of DSM: The costs to run the DSM programs that are recovered from ratepayers continues to increase. This is caused by higher rebate levels and marketing efforts to drive achievements, as well as a focus on shorter lifetime measures.

Avoided Capacity: This value is expected to increase in 2013, but it has generally dropped since 2009. This drop is due to the decrease in capacity-intensity of the DSM portfolio, evidenced by the increasing load factor of the DSM portfolio. This is countered somewhat by an increase in the value of avoided capacity.

Marginal Energy: This value has dropped significantly since 2009, due to the significant drop in natural gas prices. With the majority of marginal energy avoided by DSM programs coming from natural gas-fired generation, the drop in natural gas prices leads directly to a drop in marginal energy.

Q. DOES THE RATE IMPACT VARY OVER TIME?

A. Yes. The Rate Impact Test ratios presented earlier are an assessment of the rate impact over the lifetime of the measures installed in each of those program years. The rate impact within those lifetimes varies significantly over time. In all cases, there is an immediate rate increase due to the near-immediate recovery of the DSM program costs. The remaining rate increase or decrease is realized over the life of the measures.

Q. HAVE THE INCREASING DSM ENERGY GOALS CONTRIBUTED TO THE RECENT TREND IN RATE INCREASES?

A. Yes, in part. The increasing DSM energy goals have caused the Company to aggressively pursue energy-intensive products and programs regardless of the rate impact characteristics of the products and programs.

D. Total Resource Cost Test

Q. PLEASE DESCRIBE THE TOTAL RESOURCE COST TEST INCLUDING THE COMPONENTS USED AND THE STAKEHOLDER PERSPECTIVE IT ADDRESSES.

A. The Total Resource Cost ("TRC") Test is the most comprehensive of the cost-effectiveness tests in that it includes the costs and benefits experienced by program participants, the costs to run the DSM products and programs, and the benefits of reduced costs to serve the population realized on the system, or the avoided revenue requirements. Additionally, the Commission ordered that the test should also include benefits beyond those of the system, such as non-energy benefits, which are incorporated into the test through an adder, specified by the Commission.[5] With the addition of non-energy benefits, the TRC Test became the Modified Total Resource Cost ("MTRC") Test. In the same docket, the Commission ruled that all DSM programs must pass the MTRC Test in order to be included in our DSM portfolio.

This test is unique in that it treats one component – rebates – both as a cost and as a benefit. Rebates are included as a cost in the DSM program costs, but also as a benefit to the program participant. The rebate is treated as a "transfer payment" as it is just passed between two parties included in this comprehensive test. Because of this, the level of rebate does not have a large effect on the cost-effectiveness of a program as measured with the Modified TRC Test, as it does not change the net benefits.

E. <u>Simple Payback</u>

[5] Decision No. C08-0560, Docket No. 07A-420E

Q. DOES THE COMPANY USE ANY OTHER METRICS TO DETERMINE THE COST-EFFECTIVENES TO PARTICIPANTS?

A. Yes. The Company also uses a simple payback criteria to determine the lowest appropriate incentive level to offer program participants, thereby holding down the costs of its DSM programs. In general, the lower the payback, the more likely a customer is to implement the energy efficiency measure.

Q. HOW DOES THE COMPANY USE THE SIMPLE PAYBACK CRITERIA METRIC TO LIMIT THE COST OF DSM?

A. It is everyone's best interest to implement DSM products and programs at the lowest cost with the highest participation and savings. Therefore, it is key to determine the "sweet spot" where we are paying customers a large enough rebate, but no more than is necessary, to move them to action. We use the simple payback as a guide to the sweet spot. For instance, in the Custom Efficiency product, the Company follows a policy that incentives may not provide a simple payback of less than 12 months. At a 12-month payback, it is believed that participants consider the project worth the investment and will implement. Rebating above this level is not believed to result in any significant additional project implementation. In this way, the Company limits the cost of the DSM products and programs, the impact on rates, and thus the impact on non-participants.

F. Utility Cost Test to be Used as the Metric to Identify Which Cost Effective Technologies or Programs should be Pursued

Q. IT HAS BEEN SUGGESTED THAT THE UTILITY COST TEST BE USED AS THE METRIC TO IDENTIFY WHICH COST-EFFECTIVE TECHNOLOGIES, PRODUCTS OR PROGRAMS SHOULD BE PURSUED. DOES THE COMPANY SUPPORT THIS APPROACH?

A. No, the Company does not support this approach. As illustrated in the following example, use of the Utility Cost Test to determine measures for inclusion in our DSM portfolio would lead to the Company offering rebates that are non-cost-effective for the participant. This result emphasizes the need for the Company to look at a variety of factors or tests when developing its DSM portfolio.

Q. PLEASE DESCRIBE A HYPOTHETICAL EXAMPLE OF A MARGINAL TECHNOLOGY THAT WOULD PASS THE UTILITY COST TEST BUT FAIL THE TOTAL RESOURCE COST TEST.

A. The Utility Cost Test allows all technologies that save energy to be included in a DSM portfolio. As long as the program costs - including rebates paid and costs to administer the program - are lower than the value of the costs savings, the technology would pass the Utility Cost Test. Thus, a technology that avoids $1,000 in supply-side costs over the life of the technology could be rebated up to $1,000 and still pass the Utility Cost Test, even if the technology costs $5,000 to purchase.

As I stated above, the Total Resource Cost Test includes the costs and benefits experienced by program participants, the costs to run the DSM programs, and the benefits of reduced costs to serve the population realized on the system, or the avoided revenue requirements. Assume for the purposes of our example that the bill savings realized by the participant is $1,500. The net cost of the installation for the participant is $4,000 ($5,000 in technology cost minus $1,000 in rebate). The bill savings realized by the participant is $1,500, which is slightly higher than the $1,000 in avoided supply-side costs The $1500 in bill savings are not nearly enough to cover the net costs ($4,000 in costs versus $1,500 in benefits). Therefore, if we were to use the Utility Cost Test to determine which DSM measures were offered, we would likely end up offering rebates to customers for technologies that are not cost-effective to the participant.

Q. DOES THIS EXAMPLE SUGGEST THAT THE INSTALLATION OF THE TECHNOLOGY IN THIS CASE IS ATTRIBUTABLE TO FACTORS OUTSIDE THE DSM PROGRAM?

A. Yes. In any case where a technology installed is not cost-effective to the participant, we must assume that factors other than the utility's rebate drove their decision. This suggests a low probability that the utility product or program was the reason that the customer installed the technology. Further, if the installation was not caused by our DSM product or program, then the net-to-gross ratio for the product or program will be reduced, which will

reduce the cost-effectiveness of the DSM product or program rebating the technology.

G. Avoided Costs

Q. HOW DO AVOIDED COSTS AFFECT THE COST-EFFECTIVENESS OF DSM PROGRAMS?

A. Avoided costs determine the system benefits for electric DSM programs. Avoided generation, transmission, and distribution capacity benefits are determined based on the marginal capacity needs on the system for generation, transmission, and distribution. The avoided energy is also dependent on the expected portfolio of generation assets and the marginal generation plant providing energy at any hour throughout the year.

Q. WHAT ARE THE ASSUMED AVOIDED COSTS USED IN THE COST-EFFECTIVENESS RESULTS PRESENTED IN THIS DOCKET?

A. While the costs of electricity plant and fuel have been updated, the Company used the same methodology for calculating avoided costs as used in the Company's 2012-2013 Colorado DSM Plan. In that DSM Plan, a proxy plant was used to determine the avoided generation capacity and energy benefits. This proxy plant was either a combined-cycle gas-fired generation plant ("CC") or a gas-fired combustion turbine ("CT").

Q. DOES THE COMPANY ANTICIPATE REVISITING THESE ASSUMPTIONS IN THE FUTURE?

A. Yes. The Company plans to re-evaluate avoided costs and include any changing assumptions in future DSM dockets.

Q. HAVE OTHER STATES RECENTLY IMPLEMENTED CHANGES TO THE AVOIDED COSTS ATTRIBUTABLE TO DSM?

A. Yes. California provides a good example of these changes. In 2012 the California Public Utilities Commission adopted changes to avoided cost assumptions that resulted in a "roughly 15% increase (on a TRC basis) in the cost-effectiveness of the current 2010-2012 portfolio." (Order Instituting Rulemaking to Examine the Commission's Post-2008 Energy Efficiency Policies, Programs, Evaluation, Measurement, and Verification, and Related Issues, Decision 12-05-015, Adopted May 10, 2012, p. 29) The increase was due to updated capacity costs, modifications to use an after-tax WACC in cost-effectiveness calculations and the addition of a few different cost components. The additional cost components included: 1) ancillary services; 2) separating energy and capacity costs with capacity costs further separated into short and long-term capacity costs; and, 3) the avoided cost of renewable procurement (because energy efficiency reduces utility renewable requirements).

Q. ARE THE CHANGES LEADING TO THE 15 PERCENT INCREASE IN AVOIDED COSTS IN CALIFORNIA APPLICABLE TO THE PUBLIC SERVICE OF COLORADO SERVICE TERRITORY?

A. They may or may not be. The factors used in California (and other relevant jurisdictions) will be included in the re-evaluation of system avoided costs in the Company's next DSM Plan, but it is not clear if the inclusion of these factors along with the changing systems conditions will yield the same 15%

increase seen in California. The re-evaluation may still result in a decrease in avoided costs.

H. Criteria for Goal Setting

Q. AS YOU STATED EARLIER, THE COMMISSION HAS RULED THAT ALL DSM PROGRAMS MUST PASS THE MTRC TEST IN ORDER TO BE INCLUDED IN OUR DSM PORTFOLIO. SHOULD THE MTRC BE USED TO DETERMINE THE APPROPRIATE GOAL LEVEL FOR THE COMPANY?

A. No. While the Company believes that the MTRC Test is appropriately used at the measure, product, program or portfolio-level to determine which DSM measures are cost-effective, it is not a good tool to use to distinguish between different DSM scenarios or goal levels. As described above, the rebate is considered as a transfer payment in this test. The MTRC is not sensitive to the rebate level and thus cannot inform the proper rebate level. The rebate paid to participants largely drives the goal that can be achieved. Because of these facts, the MTRC should not be used to determine the appropriate goal level.

Q. IT HAS BEEN SHOWN THAT THE UTILITY COST TEST MATCHES THE CRITERIA USED BY RESOURCE PLANNING TO DETERMINE THE APPROPRIATE SUPPLY-SIDE RESOURCES TO PURSUE. DOES THIS NOT ARGUE FOR USE OF THE SAME TEST FOR DEMAND-SIDE RESOURCES?

A. No. The costs for a demand-side investment differ fundamentally from a supply-side investment. For supply-side investments, the costs are limited to

the costs recovered from ratepayers. In demand-side investments, costs also include the costs paid by individual program participants to purchase the energy efficient technology, as well as costs recovered from ratepayers. The effects on different stakeholders vary significantly for demand-side investments, because these investments also change the consumption on the demand side.

While the test used for supply-side investments matches the same components specified in the Utility Cost Test, it can also be shown that this test matches both the Rate Impact and Total Resource Cost Tests. The test matches the Rate Impact test because there are no lost revenues due to a supply-side investment. Therefore, the supply-side resources that minimize revenue requirements also result in the minimized rates. The test matches the Total Resource Cost Test because there are no costs paid by individual ratepayers outside of the revenue requirements calculated in the Utility test. Therefore, the supply-side resources that minimize revenue requirements also produce the greatest Total Resource Cost Test net benefits.

Q. YOU HAVE EXPLAINED WHY THE MRTC AND THE UTILITY COST TEST SHOULD NOT BE USED TO DETERMINE THE APPROPRIATE GOAL LEVEL FOR THE COMPANY. WHAT TEST SHOULD BE USED?

A. The Company supports continued use of the current process of determining which technologies, products or programs should be pursued through demand-side management by using the Total Resource Cost Test. The Utility and Rate Impact Tests should only be used to determine the appropriate level

of pursuit of these technologies, products or programs based on the costs collected from ratepayers.

Q. HAS THE COMPANY ENCOUNTERED TECHNOLOGIES THAT PASS BOTH THE PARTICIPANT TEST AND THE UTILITY COST TEST? IF SO, PLEASE DESCRIBE THE CASE.

A. Yes, the Company has investigated the Solar Water Heating technology for inclusion in its DSM portfolio but has found that despite passing the Utility Cost and Participant Tests, the technology failed the Total Resource Cost Test.

The Company worked with the Colorado Solar Energy Industries Association ("COSEIA") to determine the assumptions to be used to conduct a cost-benefit estimate for a Solar Water Heating Technology. Exhibit No. JAP-5 summarizes that cost-benefit estimate. This cost-benefit estimate was presented at the Company's February 1, 2011 DSM Roundtable meeting. This serves as a good example of a technology that, at the time it was analyzed, passed both the Participant and Utility Cost Tests, but failed the Total Resource Cost Test.

In this example, the technology passes the Participant Test with a 1.36 ratio, and the Utility Cost Test with a 5.42 ratio. It fails the Total Resource Cost Test, however, with only ratio of 0.63.

Q. PLEASE DESCRIBE HOW IN THIS CASE THE TECHNOLOGY PASSES THE PARTICIPANT AND UTILITY COST TESTS YET FAILS THE TOTAL RESOURCE COST TEST.

A. This seemingly conflicting result is due to a couple of factors.

First, while the Total Resource Cost Test considers the total net costs paid by the utility and by the participant, the individual Participant and Utility Tests include only the costs from these individual stakeholder perspectives. In the Solar Thermal Water Heating Case:

- Total Resource Cost Test includes the net costs of **$102,717** ($93,400 in Incremental Capital Costs and $9,317 in Rebates)
- Participant Test includes **$93,400** in costs (Incremental Capital Costs)
- Utility Cost Test includes **$9,317** in costs, which is the cost of the rebates

This shows that the Participant and Utility Cost Tests are inflated, because they each only consider a portion of the costs of the technology.

Second, the value of the benefits related to energy savings from the technology in the Participant Test are $117,974 in Bill Savings. This amount greatly exceeds the Avoided Revenue Requirements of $50,542 used in the Utility and Total Resource Costs tests. This large difference between the Bill Savings and Avoided Revenue Requirements of $67,432 would result in a rate increase of this approximate amount to the remaining ratepayers. Thus, the additional $67,432 in costs is really a transfer of funds from the ratepayers not participating in the program, to a few select customers that are willing or able to participate in the program.

Q. DOES THIS SOLAR WATER HEATING EXAMPLE SUPPORT THE COMPANY'S STANCE THAT THE CURRENT MTRC TEST SHOULD

CONTINUE TO BE USED AS THE TEST THAT ALL PROGRAMS MUST PASS?

A. Yes. The Solar Water Heating example shows that even with the added requirement of passing the Participant Test, the Utility Cost Test is still not sufficient to determine whether a technology is cost-effective. This treatment of using the Participant Test in conjunction with the Utility Test benefits from including only a portion of the costs in each test, and in including as benefits in these tests transfer payments from ratepayers not participating in the program to program participants. For these reasons the MTRC Test should remain as the criteria for determining if programs are cost-effective and should be included in the Company's DSM portfolio.

Q. WHAT OTHER CRITERIA DOES THE COMPANY SUGGEST BE USED TO DETERMINE THE APPRORIATE GOAL LEVEL?

A. The Company believes a combination of factors should be used, including:

- A limit on rebates: Rebates should be limited to a percentage of the incremental cost of energy efficient technologies in order to prevent over-compensating program participants and limit the amount of cost recovery necessary from the entire population of ratepayers.
- Impact on rates: The impact of a DSM portfolio on rates should also be considered using the Rate Impact Test. Several factors unrelated to DSM are contributing to rate increases. Very aggressive pursuit of DSM would significantly further this increase in rates. One should exercise care when increasing rates for ratepayers that are simply

unable to participate in DSM programs, either because they have performed DSM outside of the Company's programs or they do not have technologies eligible for rebates.

- Revenue Requirements: The effect of a DSM portfolio on revenue requirements should also be considered using the Utility Cost Test. The test can be used to moderate DSM plan where it can be shown that pursuit of DSM beyond a certain level actually increases revenue requirements when compared to a more moderate pursuit of DSM.

V. DEVELOPMENT OF PROPOSED ENERGY EFFICIENCY SCENARIO

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?

A. In this section of my testimony I discuss how the proposed Energy Efficiency scenario was developed by combining the results from the market potential assessment update, along with some reasonable adjustments, and internal projections of the potential from the proposed LED Street Lighting product and DVO program. I then present and comment on the resulting cost-benefit analyses using the battery of tests summarized in the prior section. These results are then offered as rationale for these goals.

Q. WHAT ENERGY EFFICIENCY ENERGY AND DEMAND GOALS DOES THE COMPANY PROPOSE?

A. The tables below show the expected energy and demand impacts and expected program costs each year for energy efficiency, given achievement

of the goals proposed by the Company. It should be noted that, while the DVO impacts listed below are specific to each year, the DVO goals for which the Company is seeking approval are for the cumulative achievements over the five-year roll-out of DVO. These impacts include the proposed pursuit of "traditional" energy efficiency, as identified in the potential study, as well as two new non-traditional programs and technologies that the Company is proposing. Each of these components is discussed in my testimony below:

Table 11: Energy Efficiency – Energy Savings Goals

GWh Saved in Year	2015	2016	2017	2018	2019	2020	TOTAL
Traditional Energy Efficiency	309	280	282	276	250	242	1,639
Unidentified Emerging Technologies	-	-	-	-	25	34	59
Behavioral	28	28	28	-	-	-	85
LED Street Lighting	12	12	12	12	12	-	60
EE Subtotal	**349**	**321**	**322**	**288**	**288**	**276**	**1,842**
DVO	50	101	101	102	102	51	506
DSM TOTAL	**399**	**422**	**423**	**389**	**389**	**327**	**2,349**

Table 12: Energy Efficiency – Demand Savings Goals

MW Saved in Year	2015	2016	2017	2018	2019	2020	TOTAL
Traditional Energy Efficiency	66	62	60	58	54	52	351
Unidentified Emerging Technologies					4	6	10
Behavioral	7	7	7				21
LED Street Lighting	0	0	0	0	0		0

MW Saved in Year	2015	2016	2017	2018	2019	2020	TOTAL
Energy Efficiency Subtotal	**73**	**69**	**67**	**58**	**58**	**58**	**382**
DVO	5	11	11	11	11	6	56
Total Energy Efficiency	**79**	**80**	**78**	**69**	**69**	**63**	**437**

Please note, the energy and demand savings from DVO are projected annual savings based on expected activity.

Table 13: Estimated 2015-2020 Energy Efficiency Budgets

Spend ($M) in Year	2015	2016	2017	2018	2019	2020	TOTAL
Traditional Energy Efficiency	108	104	100	96	93	90	591
Unidentified Emerging Technologies	-	-	-	-	9	13	22
Behavioral	6	6	6	-	-	-	19
LED Street Lighting	6	6	6	6	6	-	32
Energy Efficiency Subtotal	**121**	**117**	**113**	**102**	**109**	**102**	**664**
DVO	9	18	18	18	18	9	90
Total Energy Efficiency	**$130**	**$134**	**$130**	**$120**	**$127**	**$112**	**$753**

A. <u>Achievable Potential Estimation</u>

Q. PLEASE DESCRIBE HOW THE PROPOSED TRADITIONAL ENERGY EFFICIENCY GOALS WERE DEVELOPED.

A. For the purposes of this proposal, the Traditional Energy Efficiency goals are based on the achievable potential estimated under the 75 percent incentive

scenario in the updated market potential assessment completed in June 2013. These goals, ranging from 281 GWh in 2015 to 220 GWh in 2020, are provided by year in the "New Net Energy Savings – kWh" table on page C-6 of the assessment (Exhibit No. JAP-1, page 108 of 118).

Q. WHY DOES THE COMPANY PROPOSE TO USE THE 75 PERCENT INCENTIVE SCENARIO INSTEAD OF THE 50 PERCENT OR 100 PERCENT SCENARIOS OF ACHIEVABLE POTENTIAL IN THE MARKET ASSESSMENT?

A. As discussed previously in this testimony, the amount of market potential is decreasing over time. The Company does not believe there is sufficient potential at the 50 percent scenario to meet its commitment to DSM in Colorado. Conversely, the Company feels that paying a 100 percent incentive would be extravagant and over-pay customers for their efficiency choices. The 75 percent scenario is the reasonable option, paying customers sufficiently to cause them to purchase and install efficiency measures, while limiting free-ridership.

Table 14: Traditional Energy Efficiency Achievable Market Potential

Annual GWh	50% Incentive Potential	75% Incentive Potential	100% Incentive Potential
2015	179	281	482
2016	168	255	425
2017	174	256	407
2018	176	250	384
2019	165	228	328
2020	165	220	303

Q. WHAT ASSUMPTIONS FOR RESIDENTIAL LIGHTING POTENTIAL ARE INCLUDED IN THESE PROPOSED GOALS?

A. Consistent with my previous testimony, the following assumptions are included in these goals:

- 2015-2016: Baseline technology using EISA standard (30 percent more efficient) for both CFLs and LEDs. Net-to-gross ratio of 50 percent for CFLs.
- 2017-2020: CFLs removed from program as the market is transformed. EISA standard used as baseline technology for LEDs.

Q. WHAT IS THE RESULTING ACHIEVABLE POTENTIAL ESTIMATED FOR RESIDENTIAL LIGHTING BASED ON THE PREVIOUSLY DISCUSSED ASSUMPTIONS, AND HOW DO THOSE POTENTIALS COMPARE TO RECENT ACHIEVEMENTS IN RESIDENTIAL LIGHTING?

A. Repeated from Section II of my testimony for convenience, the following potential achievable savings estimates from Residential Lighting are included in these market potentials:

Table 6: Net Energy Savings potential for Residential Lighting

GWh	LED	CFL	CFL Specialty	TOTAL
2015	5.6	40.5	4.3	50.4
2016	8.9	31.2	3.0	43.1
2017	45.8	0.0	0.0	45.8
2018	56.8	0.0	0.0	56.8
2019	48.2	0.0	0.0	48.2

2020	53.8	0.0	0.0	53.8

These potentials are around 90 GWh short of the 2012 achievements of 141 GWh from Residential Lighting. This is the main cause for the difference between potential in 2015 of 281 GWh falling 119 GWh short of the 2012 DSM Portfolio achievements of 400 GWh.

Q. WERE ANY OTHER ADJUSTMENTS MADE TO THE POTENTIAL ACHIEVEMENTS?

A. Yes. Historical actual achievements have typically surpassed the achievable potential identified in potential studies. This is likely due to potential studies being unable to accurately estimate the potential from custom DSM projects implemented by industrial customers. These projects include unique equipment replacements or changes to unique industrial processes. A comparison of the Company's actual achievement from 2010 through 2012 against the 75 percent incentive scenario over the same period from the original assessment shows that actual achievement exceeded achievable potential by 8 percent in energy and 7 percent in demand reductions. In order to account for this prior difference between actual achievements and achievable potential, in the present goals, we have increased the expected achievable potential GWh by 10 percent. For example, the 2015 goal, listed as 281 GWh of achievable potential under the 75 percent scenario, has been increased to 309 GWh.

We also believe that the potential study is unable to accurately predict potentials well into the future as currently undeveloped emerging technologies

materialize. To account for this, we have increased the proposed goals by 25 GWh in 2019 and by 34 GWh in 2020. These values are estimated by assuming that the 2018 achievable potential of 276 GWh (250 GWh + 10 percent increase) can be maintained in 2019 and 2020.

Q. HOW WERE THE GOALS FOR THE DVO PROGRAM DEVELOPED?

A. Please see the testimony of Ms. Kelly Bloch for a description of the expected impacts and assumed rollout of DVO that led to the estimated potential impact of DVO included in these goals.

Q. HOW WERE THE GOALS FOR THE BEHAVIORAL PRODUCTS DEVELOPED?

A. For the Behavioral products, we have proposed goals that equate to the "High Users and Medium E/G Users" scenario included on page C-15 of the updated market potential assessment (Exhibit No. JAP-1, page 117 of 118).

Q. WHY WAS THE HIGH/MEDIUM USERS SCENARIO CHOSEN?

A. This scenario was selected over the "All Cost Effective Customer Groups" scenario on page C-16 of the assessment (Exhibit No. JAP-1, page 118 of 118) because of concerns about how naturally-occurring energy efficiency will reduce the potential and the cost-effectiveness among Residential Behavioral products. This naturally-occurring energy efficiency would lead to reduced consumption and be the result of changes to codes and standards in the two main end-uses expected to be reduced by a Residential behavioral product – lighting and air-conditioning. This reduced consumption may shrink the

savings resulting from Behavioral products, which, in turn, limits the cost-effective population of customers who may take advantage of the Behavioral products. The concern about naturally-occurring DSM was incorporated into the potential estimates and is evident in the reduced TRC ratio between the scenarios and into the future.

Q. WHAT ACHIEVEMENT LEVEL WAS CHOSEN FROM THIS SCENARIO?

A. The achievable potential included in the Market Assessment includes a gradual expansion of the Behavioral product through 2020. The final expansion to about 500,000 customers is achieved in 2020, as described on page 4-29 of the Assessment. The goals above assume immediate expansion to the 500,000 customers by 2015, at the total potential of 84.6 GWh as estimated in the assessment in 2020, appearing on page C-15 in the assessment.

Q. HOW IS THE ANNUAL GOAL CONTRIBUTION FROM THE BEHAVIORAL PRODUCTS CALCULATED?

A. Consistent with my earlier testimony, the methodology used to calculate how the annual energy savings from the Behavioral product contribute to meeting the goals should differ from the method used to attribute savings for traditional equipment acquisition products. The annual goal contribution from the Behavioral product in the proposed scenario spreads the expected impact of 84.6 GWh across three years of anticipated program duration, or 28 GWh each year from 2015 to 2017.

Q. HOW MUCH POTENTIAL DOES THE PROPOSED STREET LIGHTING PRODUCT REPRESENT?

A. The potential for LED retrofits for Company-owned street lights in Colorado over a five year period is 60 GWh.

Q. WHAT ASSUMPTIONS WERE USED TO DEVELOP THESE PROJECTIONS?

A. The market potential was calculated by first taking current energy consumption from utility-owned street lights from January 2013 to determine the size of the market. This value was then multiplied by 0.8 to reflect the actual time the lights will be on. The 0.8 was derived by adjusting for monthly seasonal usage, based on the expected daylight hours in January and for the average month of the year. This average monthly usage was then multiplied by twelve to annualize the sales volume. The assumption was made that LED street lights, on average, would result in a 50 percent reduction in energy use based on the expected load of LED street lighting versus current technology. 80 percent of the market would participate was also assumed. This represents a very aggressive goal for the product. The combination of these factors and inputs was used to determine the 60 GWh projection.

B. Quantitative Test Results

Q. GIVEN THE QUANTITATIVE TESTS PROPOSED EARLIER IN THIS TESTIMONY, WHAT IS THE COST-EFFECTIVENESS OF THE PROPOSED SCENARIO?

A. The next several pages show the cost-benefit ratios and net-benefit estimates of the different quantitative tests mentioned:

Table 15: Modified TRC Test Results

Ratio	2015	2016	2017	2018	2019	2020
Traditional Energy Efficiency	2.27	2.22	2.36	2.39	2.33	2.37
Behavioral	1.47	1.47	1.47			
LED Street Lighting	1.00	1.00	1.00	1.00	1.00	
DVO	5.04	5.04	5.05	5.07	5.08	5.01
TOTAL	**2.35**	**2.42**	**2.54**	**2.61**	**2.58**	**2.52**

Table 16: Modified TRC Results - Net Benefits

Net Benefits ($M)	2015	2016	2017	2018	2019	2020	TOTAL
Traditional Energy Efficiency	263.8	242.5	276.0	278.7	275.7	283.7	$1,620.5
Behavioral	3.0	3.0	3.0				$9.0
LED Street Lighting	0.0	0.0	0.0	0.0	0.0		$0.0
DVO	35.7	71.5	72.1	72.8	73.5	37.1	$362.7
TOTAL	**$302.5**	**$317.0**	**$351.2**	**$351.5**	**$349.2**	**$320.7**	**$1,992.1**

Q. WHAT DO THE MODIFIED TRC TEST RESULTS TELL US ABOUT THE PROPOSED PORTFOLIO?

A. These results show that the proposed energy efficiency scenario is cost-effective when all of the costs and benefits are considered, resulting in almost $2.0B in net benefits over the lifetime of the measures installed over the six program years 2015-2020.

Q. WHAT WOULD THE EFFECT BE ON THE MODIFIED TRC TEST RESULTS IF THE COST-EFFECTIVENESS CRITERIA WERE CHANGED TO THE UTILITY COST TEST?

A. The marginal effect of changing to the Utility Cost Test would be an allowance of technologies that fail the Modified TRC Test. This would result in a direct reduction in the Modified TRC Test Results, reducing the net benefits when all of the costs and benefits are considered.

Table 17: Participant Test Results

Ratio	2015	2016	2017	2018	2019	2020
Traditional Energy Efficiency	4.73	4.65	5.24	5.46	5.32	5.52
Behavioral	INF	INF	INF			
LED Street Lighting	2.39	2.39	2.39	2.39	2.39	
DVO	INF	INF	INF	INF	INF	INF

Table 18: Participant Test Results – Net Benefits

Net Benefits ($M)	2015	2016	2017	2018	2019	2020	TOTAL
Traditional Energy Efficiency	369.9	345.9	413.9	427.6	425.8	444.2	2,427.4
Behavioral	8.9	8.9	8.9				
LED Street Lighting	4.5	4.5	4.5	4.5	4.5		22.4
DVO	35.7	71.5	72.1	72.8	73.5	37.1	362.7
TOTAL	**$414.5**	**$426.3**	**$494.9**	**$500.4**	**$499.3**	**$481.2**	**$2,812.4**

Q. WHAT DO THE PARTICIPANT TEST RESULTS TELL US ABOUT THE PROPOSED ENERGY EFFICIENCY SCENARIO?

A. These results show that the proposed energy efficiency scenario is cost-effective when limiting the impacts to those realized just by program participants, resulting in $2.8 billion in net benefits. For the Behavioral product and DVO program, the ratio is Infinite, due to the fact that participants in this product or program have no costs.

Table 19: Utility Cost Test Results

Utility Cost Test Ratio	2015	2016	2017	2018	2019	2020
Traditional Energy Efficiency	3.62	3.52	3.82	3.90	3.75	3.81
Behavioral	1.47	1.47	1.47			
LED Street Lighting	3.28	3.28	3.28	3.28	3.28	
DVO	5.04	5.04	5.05	5.07	5.08	5.01

Table 20: Utility Cost Test Results – Net Benefits

Net Benefits ($M)	2015	2016	2017	2018	2019	2020	TOTAL
Traditional Energy Efficiency	285.8	264.2	298.7	301.3	299.0	306.9	1,755.9
Behavioral	3.0	3.0	3.0				9.0
LED Street Lighting	4.4	4.4	4.4	4.4	4.4		21.9
DVO	35.7	71.5	72.1	72.8	73.5	37.1	362.7
TOTAL	**$324.5**	**$338.6**	**$373.9**	**$374.1**	**$372.5**	**$344.0**	**$2,149.5**

Q. WHAT DO THE UTILITY COST TEST RESULTS TELL US ABOUT THE PROPOSED ENERGY EFFICIENCY SCENARIO?

A. These results show that the proposed energy efficiency scenario is cost-effective when limiting the impacts to the revenue requirement impacts considered in the Utility Cost Test, resulting in $2.1 billion in net benefits. This is a good estimate of the net bill savings that will be realized by the population of ratepayers over the lifetime of the measures installed over the six program years 2015-2020.

Table 21: Rate Impact Test Results

RIM Test Ratio	2015	2016	2017	2018	2019	2020
Traditional Energy Efficiency	0.79	0.78	0.75	0.73	0.73	0.72
Behavioral	0.62	0.62	0.62			
LED Street Lighting	1.00	1.00	1.00	1.00	1.00	
DVO	0.48	0.48	0.48	0.48	0.48	0.49

Table 22: Rate Impact Test Results – Net Benefits

Net Benefits ($M)	2015	2016	2017	2018	2019	2020	TOTAL
Traditional Energy Efficiency	-106.1	-103.4	-137.9	-148.9	-150.1	-160.5	-806.9
Behavioral	-5.9	-5.9	-5.9				-17.6
LED Street Lighting	0.0	0.0	0.0	0.0	0.0		0.0
DVO	-47.4	-94.8	-95.7	-96.6	-97.4	-49.2	-481.1
TOTAL	**-$159.4**	**-$204.1**	**-$239.4**	**-$245.4**	**-$247.5**	**-$209.7**	**-$1,305.5**

Q. WHAT DO THE RATE IMPACT TEST RESULTS TELL US ABOUT THE PROPOSED ENERGY EFFICIENCY SCENARIO?

A. Although bills will go down overall, over the lifetime of the measures installed over the six program years 2015-2020, we estimate that a rate increase of $1.3 billion attributable to the proposed energy efficiency scenario will occur.

Q. HOW IS IT POSSIBLE THAT RATES WOULD GO UP DUE TO THE ENERGY EFFICIENCY PORTFOLIO WHILE BILLS WILL GO DOWN?

A. This occurs because there are tremendous energy savings, resulting in reduced energy and bill demand sales volumes. This reduction in sales volume is not only large enough to overcome the rate increase, but results in significant total bill savings.

Q. DO THE RATE IMPACT AND UTILITY TESTS SUGGEST THAT THE PROPOSED GOALS REPRESENT A REASONABLE LEVEL OF PURSUIT OF DSM?

A. The Company believes that they do. While there is no perfect formula to identify the optimal scenario, the proposed scenario has a reasonable balance between rate increases and bill savings. An increase in goal would necessarily exacerbate the rate increase, requiring escalated utility spend to

achieve the higher goals. It is not clear if this increase would actually increase bill savings, as the increase in spend may be just as large as any resulting incremental increase in avoided revenue requirements.

Q. THE DVO PROGRAM AND LED STREET LIGHTING PRODUCT BOTH FAIL THE RATE IMPACT TEST. WHY DOES THE COMPANY SUGGEST PURSUIT OF THIS PROGRAM AND PRODUCT?

A. The resulting rate increase from DVO and LED Street Lighting is due to the fact that they are very energy-focused and result in relatively little capacity avoidance. However, this program and product both spread benefits across a wide population. In the case of DVO, nearly every ratepayer is expected to see savings. In the case of LED Street Lighting, the residents of each municipality will realize savings. Because of this, the rate impacts should be less of a consideration in determining pursuit of this product and program.

Q. HOW WERE THE QUANTITATIVE TEST RESULTS DETERMINED?

A. For Traditional Energy Efficiency and Behavioral products and programs, the results from the updated market potential assessment were used. Over the lifetime of the measures expected to be installed, the updated assessment estimated the net-present-value of: Avoided Cost Benefits, Annual Program Marketing and Admin Costs (Utility Spend), Net Measure Costs (Participant Incremental Capital Costs) and Lost Revenue. These are the components necessary to perform the battery of cost-effectiveness tests. For LED Street Lighting and DVO, estimates of each of these components were made internally.

VI. DEMAND RESPONSE POTENTIAL AND GOALS

Q. THE DISCUSSION UP TO THIS POINT HAS FOCUSED ON ENERGY EFFICIENCY. HAVE YOU INCLUDED DEMAND RESPONSE WITH THIS FILING AS NOTED IN DECISION NO. C12-0442?

A. Yes. Demand response has also been included within this filing. Below I will provide an overview of our recent market potential study for demand response, our proposed goals and an explanation of how these goals were determined.

Q. DID THE COMPANY CONDUCT A COMPREHENSIVE DEMAND RESPONSE MARKET POTENTIAL STUDY TO MEET THE REQUIREMENTS OF DECISION C11-0442?

A. Yes, we commissioned *The Brattle Group* to complete a potential study for demand response in March of 2013, included as Exhibit No. JAP-6 to this testimony. Decision C11-0422 included a requirement of the Company to file an application "to address more generally the market potential for demand reductions from load management, demand response and interruptible service." The 2013 market potential study was intended to help the Company address future demand goals. To meet these requirements the study included an in-depth analysis of market potential and the cost-effectiveness of these opportunities.

Q. DID THE DR MARKET POTENTIAL STUDY PROVIDE ANNUAL POTENTIAL GOALS?

A. No. Unlike the energy efficiency Market Potential Study provided by DNV KEMA, Inc., the demand response market potential study did not define specific annual or cumulative goals.

Q. PLEASE EXPLAIN WHY THE DEMAND RESPONSE STUDY DID NOT PROVIDE ANNUAL GOALS.

A. It is difficult to summarize the market potential of demand response into specific goals since specific customer load reductions are dependent on the portfolio of programs offered by the Company and by which program a customer chooses to participate in. Unlike energy efficiency programs in which a customer could potentially participate in multiple programs simultaneously without overlap, customers may not participate in multiple demand response programs simultaneously because they only have one load to shed. Participation in demand response programs is generally limited to a single program per customer in order to reduce the likelihood of double-paying for the same peak demand reductions. For example, a residential customer participating in our Saver's Switch® program is not allowed to simultaneously participate in a Critical Peak Pricing ("CPP") program. This could theoretically cause double payment for and double counting of the same customer demand reduction. Because it is unknown which programs customers will choose to participate in, it is difficult to estimate the demand response portfolio potential.

Demand response programs are also dependent on the available infrastructure. Most non-dispatchable or pricing programs require specific

metering technologies such as an Advanced Metering Infrastructure ("AMI"). The costs and other barriers to install such systems or implement system changes in metering technology, impact how to characterize the demand response potential available.

Q. WHAT WAS THE POTENTIAL IDENTIFIED WITHIN THE 2013 DEMAND RESPONSE STUDY?

A. In order to address overlap and the manner in which the Company may implement differing programs, *The Brattle Group* constructed four portfolios of demand response measures to represent a range of plausible program offerings and deployment strategies within the Company's service territory.

- **Portfolio 1**: Voluntary demand response options including direct load control and interruptible rates but exclude pricing (essentially a mix of current offerings plus additional dispatchable programs yet to be designed);
- **Portfolio 2**: Portfolio 1 plus additional opt-in Time-of-Use rates for all customer classes;
- **Portfolio 3**: Portfolio 1 plus opt-in Critical-Peak Pricing (CPP) rates for all customer classes;
- **Portfolio 4:** Portfolio 1 plus opt-out Peak Time Rebates for residential and small commercial and industrial ("C&I") customers, and opt-out CPP for medium and large C&I customers.

Each of the four portfolios has a benefit-cost ratio that is greater than 1.0. Certain demand response measures in the portfolios, however, were not

found to be individually cost-effective under base case assumptions. These include the CPP, Peak Time Rate ("PTR"), and Time of Use ("TOU") pricing options for residential and small business customers, direct load control for small business, and TOU rates for medium and large businesses in a scenario where opt-in deployment is assumed. When the measures that fail the total resource cost test are removed from the portfolios described above, the peak reduction potential from demand response is between 798 MW and 955 MW in 2020. This is an incremental increase of 267 MW to 424 MW in 2020.

The study also identified an upper bound on market potential of up to 552 MW; however this would include opt-out pricing options that would require changes in infrastructure. Much of this potential was found to be non-cost effective given today's pricing assumptions.

Q. *KEMA, INC*. COMPLETED A DEMAND RESPONSE POTENTIAL STUDY IN 2011, BUT THAT STUDY WAS FOUND TO HAVE LIMITATIONS. HAVE THESE BEEN ADDRESSED IN THE 2013 STUDY?

A. Yes, the 2013 study was intended to address several limitations noted in Docket No. 11A-869E in the testimony of Staff Witness Keith Hayes. These limitations are described and addressed as follows:

- **Difficulty determining the level of demand savings available within the Company's service territory** – By utilizing data specific to the Company's territory, as well as conducting primary research with the Company's Colorado customers, *The Brattle Group* was able to

determine a range of demand savings potential specific to the Company's service territory.

- **Lack of a cost-benefit analysis of procuring additional demand response resources specific to PSCo and utilizing Company rates, customer costs, etc.** – As noted above, data specific to the Company was incorporated into the analysis in order to determine the cost-effectiveness of demand response options utilizing the Total Resource Cost test.
- **Need to identify the customer acceptance of demand response opportunities** – Primary research was conducted with Company customers to identify their acceptance of demand response options. Survey examples can be found in the 2013 DR Market Potential Study.
- **Which DR options could be addressed by third-parties** – The 2013 market potential analysis did not specifically review this limitation; however, the study provides information that identifies how much load could be obtained in areas for which we currently do not provide direct programs. These types of programs could be addressed by third-parties.
- **Address the impact of rebates and differing rebate levels on customer acceptance** – *The Brattle Group's* primary research provided data on customer acceptance of demand response options based on varying rebate levels provided by the Company.

Q. WHAT WAS THE BRATTLE GROUP'S BASIC APPROACH TO ESTIMATING DEMAND RESPONSE POTENTIAL?

A. Potential DR impacts were estimated using empirically-based assumptions about the eligible customer base, participation, and per-customer impacts. The fundamental equation for calculating potential system impact of given DR option is shown in the below figure from Exhibit No. JAP-6.

Figure 1: Demand Response Potential Estimation Framework

Potential DR Impact	**=**	***Total Demand of Customer Base***	***X***	***% of Base Eligible to Participate***	***X***	***% of Eligible Customers Participating***	***X***	***% of Reduction in demand per participant***

The Company provided market characteristics and observed per-participant impacts where available. In the case of price-based options, the Company has limited experience; therefore, these estimates utilized information from *The Brattle Group's* extensive library of recent pilots across the country, as well as current results of the Company's pricing pilot. For further details see the full 2013 DR Market Potential Study.

Q. WHAT CUSTOMER INSIGHTS WERE GAINED FROM THE BRATTLE GROUP'S PRIMARY RESEARCH FOR THIS STUDY?

A. Three specific insights were identified through *The Brattle Group's* primary research. First, customer preference was identified by asking a series of questions regarding likelihood of participation. On the whole, over half of the residential customers were likely to participate in a demand response program while less than half of the business population was highly interested.

Second, the Business sample showed interest in demand response programs, but did not indicate a preference to a specific type of program -- there was just as much interest in interruptible programs as there was pricing options. Finally, the research indicated no significant demographic, such as age, square footage, facility type, that could be utilized to target participation. This lack of demographic information can make it more difficult to gain rapid adoption of new demand response offerings. Results from the primary research were used within the potential analysis to provide a measure of customer interest.

Q. WHAT CONCULSIONS CAN BE DRAWN FROM THE DEMAND RESPONSE MARKET POTENTIAL ANALYSIS?

A. There are three important conclusions that can be drawn from the 2013 demand response market potential study.

- **Incremental potential exists within our service territory**

  As indicated in the market potential study, there are 267 MW to 424 MW of additional cost effective load potential, depending upon the implementation of an AMI infrastructure.

- **Mass Market Dynamic Pricing is currently not cost-effective**

  The mass market pricing programs (TOU, PTR, CPP) are currently failing the Total Resource Cost Test indicating there are better options for DR for residential customers at this time. The caveat to this conclusion is that these numbers draw upon current costs, including AMI deployment, and

assume no operational savings from AMI. Changes in the market would warrant additional review of these strategies.

- **Demand Response opportunity remains with dispatchable programs including Saver's Switch and Business interruptible programs**

  The study indicates that there is significant additional cost-effective potential available using the Saver's Switch and interruptible tariffs for Medium C&I programs.

Q. DO YOU HAVE CAUTIONARY REMARKS REGARDING THE BRATTLE GROUP'S DEMAND RESPONSE POTENTIAL STUDY?

A. The study was intended to provide a market potential study indicating what potential may be available within our service territory. The potential data is only as good as the numbers provided and the assumptions created at a particular point in time. Demand response is a quickly changing market; costs continue to fluctuate, new technologies are introduced, and further analysis is needed on the actual use of these programs in the field on a nearly daily basis. The analysis provided by *The Brattle Group* is a result at one particular moment in time and actual implementation and review of programs and opportunities must be reviewed by measured as required by the Company.

Q. WHAT DEMAND RESPONSE GOAL DOES THE COMPANY PROPOSE?

A. The table below shows the Company's proposed cumulative demand response goal, including load management, per year. This indicates the potential load relief available within each year given the identified incremental

goals. These numbers have been updated from those projected in the 2011 Resource Plan and will be reflected in future resource filings.

Table 23: Cumulative Demand Response – Demand Savings Goals

MW	2015	2016	2017	2018	2019	2020
Total System Controllable Load (DR)	528	537	555	575	598	623

The annual increases reflected in the table above include new incremental load, such as load identified within our market potential study, plus replacement of the load lost due to customer attrition. It is not uncommon for demand response programs to adjust assumptions or lose customer demand due to customer choice or changes in situation. Part of maintaining a demand response portfolio is to understand that within the load pool there is normal loss that will need to be replaced.

Note that the energy savings from demand response programs are negligible, and therefore, it is not provided or discussed in this testimony.

Q. DESPITE YOUR CAUTIONARY REMARKS, HOW WERE THE GOALS FOR THE DEMAND RESPONSE PROGRAMS DETERMINED?

A The demand response goals were developed using the Company's estimates of future resource needs, as well as the results of the 2013 demand response market potential study.

Q. HOW WERE THE COMPANY'S RESOURCE NEEDS USED IN DEMAND RESPONSE GOAL SETTING?

A. As noted within our 2011 Resource Plan, the Company is long in generation through 2017. Our current resource planning and acquisition process will

cover the gap in resources for 2017 and 2018. Therefore, there is little need for additional resources within demand response besides making up the lost load pool that exists from 2015 to 2018. Our goals are a reflection of these realities, and reflect a focus on future resource needs as opposed to increasing program participation. Our goals include expected natural growth in demand reduction from the Company's existing ISOC program, the 40 MW of demand reduction currently committed by a third party aggregator, as well as additional potential found within our medium commercial and industrial customer sector.

Q. DID THE COMPANY'S PROPOSED DR GOALS INCORPORATE THE POTENTIAL FOUND WITHIN THE 2013 MARKET POTENTIAL STUDY?

A. The market potential identified within the study was used directionally to guide the Company in its demand response goal setting. The Company had to keep many other considerations in mind while determining future goals.

Q. WERE ANY ADJUSTMENTS MADE TO THE 2013 DEMAND RESPONSE POTENTIAL STUDY ACHIEVEMENTS?

Yes, the Company made adjustments to the potential estimates related to its Saver's Switch program, the adoption rates possible amongst medium-sized Business customers, and potential pricing programs, such as CPP, PTR, and/or TOU.

Q. WHAT ADJUSTMENTS WERE MADE TO THE SAVER'S SWITCH POTENTIAL?

A. While the demand response potential study provided direction towards how much new load was potentially available within our service territory, the Company has concerns regarding the Saver's Switch potential.

The market assessment estimated that an additional 129,000 Saver's Switches could be installed by 2020, providing potential savings of 149 MW. However, the Company does not feel that additional marketing dollars would be well-spent with this program. We are further worried about diminishing savings per switch, and thus have limited the goals to 73,000 new switches by 2020. These additions bring the participation rate to 60%+ of the eligible residential customer household population.

Q. UPON WHAT DOES THE COMPANY BASE ITS CONCERNS ABOUT THE SAVINGS PER SWITCH?

A. The concern that the savings per switch estimate (currently estimated at one kW per switch) will drop in future years is based on the Company's experience in Minnesota. On a yearly basis, the Company uses data logging on a sample of installed Saver's Switches to identify the stable load relief estimate for summer forecasting purposes. Over the last several years, the data loggers have recorded a drop in the savings per switch in our Minnesota territory. We attribute this phenomenon to be based on lower temperatures and humidity, increased air conditioner efficiencies, and increased conservation efforts. More efficient air conditioners provide fewer saving per unit than older, inefficient models. We expect that these factors will impact

the savings achieved per switch in Colorado over the next several years as well.

The study also shows a significant potential (40MW) in Saver's Switch for multi-family residents. The Company does not currently offer a multi-family load control program. These programs have been studied in the past and the Company has historically not approached multi-family residences due to increased installation costs, maintenance challenges and assumed lower load relief. While there was potential found within the market potential study, the Company has chosen not to include this demand for the purposes of goal setting in this docket, given other more cost-effective opportunities such as those found with medium sized businesses. Therefore, we have limited our current potential to only single family homes.

Q. WHAT ADJUSTMENTS WERE MADE TO THE ESTIMATED POTENTIAL FROM MEDIUM-SIZED BUSINESS CUSTOMERS?

A. The adoption rate by medium-sized business customers of demand response programs was estimated to be higher than what we would expect from previous experience in this market. Our experience with our Peak Savings program has shown us the difficulty of gaining participation within this customer segment. This phenomenon was shown within our primary research when there were no distinguishable characteristics shown that indicated a difference between those interested in participation and those that were not. Therefore, we have grown this class at a lower level than what was

noted within the potential study based on expected customer response and resource needs.

Q. WHAT ADJUSTMENTS WERE MADE TO THE ESTIMATED POTENTIAL FROM PRICING PRODUCTS?

A. Pricing products have not been included in the Company's proposed goals in this docket. The reasons for this omission are discussed more fully in the Direct Testimony of Mr. Scott B. Brockett.

Q. GIVEN THESE ADJUSTMENTS, HOW DID YOU DETERMINE FINAL GOALS?

A. The sum of all these changes resulted in an incremental increase of 92 MW above what was expected within our current portfolio through 2020. This 92 MW was based on incremental load of current programs and the addition of a new program for medium business customers balanced within the years in which there was an identified resource need.

VII. SUMMARY

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. My Direct Testimony covers various topics related to setting energy efficiency and demand response goals. First, it supports the Company's application to seek approval of energy and demand savings goals from the 2015 through 2020 time period resulting from energy efficiency products. This is topic 1 in Table 1 of Ms. Sundin's Direct Testimony. It

discusses the declining potential savings expected from traditional energy efficiency over this time period and describes and illustrates significant reasons for this decline. Further, it discusses some new non-traditional products, programs and technologies that the Company is proposing in reaction to this decline, resulting in proposed goals that approach the existing goals approved in Docket No. 10A-554EG, Decision No. C11-0442. This discussion is not only relevant to topics 5 and 6 in Table 1 of Ms. Sundin's direct testimony, it is also related to Topic 1 which is our request for specific approval of energy efficiency goals for the 2015 through 2020 time period.

The testimony then generally describes how the Company develops energy and demand savings goals for energy efficiency, including the cost-effectiveness metrics used by the Company to determine the appropriate level of energy efficiency potential to pursue, and how these metrics led to the goals the Company proposes for energy efficiency.

Finally, the testimony discusses the future potential of demand response in the Public Service territory, as estimated by a third-party analysis, and how those potentials were used to propose demand response goals. This is topic 2 in Table 1 of Ms. Sundin's Direct Testimony.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

Attachment A

Statement of Qualifications

Jeremy A. Petersen

I graduated from Iowa State University with a Bachelor of Arts degree in Statistics.

I have been employed by Xcel Energy (previously Northern States Power Company) for 16 years. I worked in the Load Research Department for the first nine of these years. My primary responsibilities in the Load Research Department included evaluating the demand savings impacts of load management programs; such as interruptible rate programs and air conditioning cycling programs, as well as preparing jurisdictional, class, and customer energy and demand data to be used in cost of service studies for rate cases and in forecasting utility loads.

In May of 2006, I assumed my current position as CIP/DSM Regulatory and Technical Consultant in the DSM Regulatory Strategy and Planning Department. My primary responsibilities are to analyze the cost-effectiveness of demand-side management programs and portfolios in each of Xcel Energy's eight states, and to provide long-term forecasts of the expected impacts from these portfolios on the Xcel Energy electric and gas systems.