

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

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IN THE MATTER OF THE APPLICATION OF)
PUBLIC SERVICE COMPANY OF COLORADO)
FOR APPROVAL OF ITS 2011 ELECTRIC) DOCKET NO. 11A-869E
RESOURCE PLAN)

IN THE MATTER OF THE APPLICATION OF)
PUBLIC SERVICE COMPANY OF COLORADO)
FOR APPROVAL OF THE ACQUISITION OF)
THE BRUSH 1, 3, AND 4 GENERATION)
FACILITIES AND, IN CONNECTION) DOCKET NO. 12A-782E
THEREWITH, THE GRANT OF CERTIFICATES)
OF PUBLIC CONVENIENCE AND NECESSITY)
IF REQUIRED AND THE APPROVAL OF COST)
RECOVERY THROUGH A GENERAL RATE)
SCHEDULE ADJUSTMENT)

IN THE MATTER OF THE APPLICATION OF)
PUBLIC SERVICE COMPANY OF COLORADO)
FOR APPROVAL OF THE POWER PURCHASE)
AGREEMENT FOR 118.8 MW OF NATURAL) DOCKET NO. 12A-785E
GAS GENERATION, EARLY RETIREMENT OF)
ARAPAHOE UNIT 4, AND A GAS SALES)
AGREEMENT.)

SUPPLEMENTAL REBUTTAL TESTIMONY AND EXHIBIT OF GEORGE E. HESS

ON BEHALF OF

PUBLIC SERVICE COMPANY OF COLORADO

OCTOBER 5, 2012

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1 **I. INTRODUCTION**

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

3 A. My name is George E. Hess. My business address is 9500 Interstate 76,
4 Henderson, CO 80640.

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

2 A. I am employed by Public Service Company of Colorado (“Public Service” or the
3 “Company”), as General Manager, Power Generation Colorado. Public Service
4 is a wholly-owned, public utility subsidiary of Xcel Energy Inc.

5 **Q. ON WHOSE BEHALF ARE YOU TESTIFYING?**

6 A. I am testifying on behalf of Public Service Company of Colorado (“Public Service”
7 or the “Company”). Much of my Rebuttal Testimony addresses the operating and
8 maintenance experience by all of the Xcel Energy Operating Companies
9 including Public Service, Southwestern Public Service Company, Northern States
10 Power Company – MN, and Northern States Power Company – WI. When I am
11 referring to more companies than just Public Service, I will use the term “Xcel
12 Energy” to explain the collective experience of all of the Xcel Energy operating
13 companies.

14 **Q. HAVE YOU PROVIDED DIRECT TESTIMONY IN THIS DOCKET?**

15 A. Yes I provided Direct Testimony in Dockets 12A-782E and 12A-785E.

16 **II. PURPOSE OF TESTIMONY**

17 **Q. WHAT IS THE PURPOSE OF YOUR SUPPLEMENTAL REBUTTAL**
18 **TESTIMONY?**

19 A. The purpose of my testimony is to respond to the criticisms and concerns raised
20 by the Supplemental Answer Testimony of Mr. Camp and Mr. Markell concerning
21 the quality of the Brush facilities.

1 **III. USEFUL LIFE OF THE BRUSH UNITS**

2 **Q. MR. MARKELL STATES SOME OPINIONS REGARDING THE AGE AND**
3 **LIKELY REMAINING LIFE OF THE REFURBISHED UNITS AT BRUSH. CAN**
4 **YOU SUMMARIZE YOUR UNDERSTANDING OF HIS CONCLUSIONS?**

5 A. Yes. In his report attached as Exhibit No. TJM-1, Mr. Markell makes a sweeping
6 conclusion that from his experience, the typical life cycle for a simple cycle or
7 combined cycle facility is “approximately 20 to 30 years depending upon the
8 mode of operation.” He also concludes that “the remaining Useful Life of the
9 Brush Facilities is 10 to 15 years”. He bases his assessment on a cursory review
10 of the equipment and documentation. I think his conclusions are too broad to be
11 useful to the Commission. As described in more detail in the testimony of Ms.
12 Perkett, the Company proposed a useful life of the Brush facilities is 45 years
13 from the time the equipment was reconditioned and put into service in its current
14 configuration.

15 **Q. BASED ON YOUR REVIEW OF MR. MARKELL’S ASSESSMENT OR THE**
16 **TESTIMONY OF MR. CAMP, DOES PUBLIC SERVICE BELIEVE IT IS**
17 **APPROPRIATE FOR THE COMMISSION TO IMPOSE A USEFUL LIFE ON**
18 **THESE FACILITIES THAT IS SHORTER THAN THE 45 YEARS SELECTED**
19 **BY THE COMPANY?**

20 A. No. First, I am not aware of the Commission imposing a useful life on any of
21 Public Service’s generating equipment as short as the “20 to 30” years that Mr.
22 Markell states for new equipment. Second, the “10 to 15 years” Mr. Markell
23 recommends for Brush units is unreasonably short for a number of reasons that I

1 will get into in this testimony. Third, generating equipment of this vintage was
2 constructed to highly robust standards and should sustain a longer useful life,
3 particularly considering that the Brush Units were reconditioned to new and clean
4 condition when installed at Brush. Fourth, the operating duty of power
5 generating equipment is more indicative of useful life than the age of the
6 equipment. The Brush Units are light duty peaking facilities that have historically
7 operated only a relatively few hours of the year and for which we anticipate will
8 operate in the 1 to 3 percent of the time. These operational characteristics
9 further support a longer useful life than recommended by Mr. Markell.

10 **Q. HOW DO YOU PROPOSE TO RESPOND TO THE CRITICISMS OF MR.**
11 **MARKELL AND MR. CAMP?**

12 A. I will discuss some of the factors that I used in concluding that the useful life of
13 this equipment is longer than proposed by Mr. Markell. For simplicity, I will
14 discuss the combustion turbines and the steam turbine separately.

15 **Q. LET'S START WITH THE STEAM TURBINE. DOES THE COMPANY HAVE**
16 **EXPERIENCE WITH REDEPLOYING STEAM TURBINES IN COMBINED**
17 **CYCLE OPERATION?**

18 A. Yes. A steam turbine is turned by steam and the turbine is indifferent as to how
19 the steam is produced, so long as it meets the pressure and quality needed for
20 the steam turbine. In 1994, the Company proposed to repower our former Fort
21 St. Vrain nuclear-powered steam turbine into a gas-fired combined cycle
22 operation. The manual for that turbine was written in 1969 and the turbine
23 generator was manufactured in the early 1970s and was first used as part of the

1 nuclear generating station in 1976. The unit was repowered and converted to
2 gas-fired combined cycle operation. It went into service in 1998. The Company
3 is currently depreciating this steam turbine asset over a new 45-year useful life
4 starting in 1998 as approved by the Commission.

5 Xcel Energy repowered a 1950s steam turbine at its Black Dog Station in
6 Minnesota. That turbine generator had previously been part of a coal-fired power
7 plant and was converted to gas-fired combined cycle in 2002. That unit remains
8 in service today. Xcel Energy has proposed the repowering of additional steam
9 turbines at Black Dog, but we put that proposal on hold do to changes in load
10 forecasts. We continue to operate Black Dog 3 and 4 on coal.

11 **Q. IS THE AGE OF THE FACILITY THE DETERMINING FACTOR IN HOW LONG**
12 **A STEAM TURBINE CAN OPERATE?**

13 A. No. In my experience it is not the age of the equipment that determines how long
14 a steam turbine can operate. Rather, the overall life of this type of equipment is
15 much more dependent upon the quality of the original equipment, how much the
16 unit has operated, how well it has been maintained, the planned operational
17 profile, the planned maintenance, and capital improvements for the equipment.
18 As Mr. Markell acknowledges, CEM, the operators of the Brush steam turbines,
19 have taken good care of the plant. CEM has taken the extra step of using a
20 thermo blanket to control the thermal stresses on the units during start-up and
21 shut-down. The purpose of the a thermo blanket is it keep the turbine
22 components and metal warm and not have cold starts on the unit that increase
23 thermal stresses. That added step influences my engineering estimate that the

1 plant can continue to operate well into the future, particularly when considering
 2 that we expect only to operate these units at the 1 to 3 percent capacity factor
 3 level. In sum, I feel comfortable that we have correctly estimated that operations
 4 and maintenance practices needed for this useful life in the budget that I
 5 provided in my Direct Testimony.

6 **Q. MOVING ON TO THE COMBUSTION TURBINES. DOES XCEL ENERGY**
 7 **HAVE EXPERIENCE OPERATING OLDER COMBUSTION TURBINES?**

8 A. Yes, Table GEH-1 below is a listing of older combustion turbines operated by the
 9 Xcel Energy today.

Table GEH-1
Older Gas-fired combustion turbines
in operation today for Xcel Energy

| Station | Unit# | Utility | State | In-service Year |
|-----------------|--------|-------------------------------------|-------|-----------------|
| Maddox CT | Unit 3 | Southwestern Public Service Company | NM | 1963 |
| Flambeau CT | Unit 1 | Northern States Power Company | WI | 1969 |
| Granite City CT | Unit 1 | Northern States Power Company | MN | 1969 |
| Granite City CT | Unit 2 | Northern States Power Company | MN | 1969 |
| Granite City CT | Unit 3 | Northern States Power Company | MN | 1969 |
| Granite City CT | Unit 4 | Northern States Power Company | MN | 1969 |
| Key City CT | Unit 1 | Northern States Power Company | MN | 1970 |
| Key City CT | Unit 3 | Northern States Power Company | MN | 1970 |
| Key City CT | Unit 4 | Northern States Power Company | MN | 1970 |
| Fort Lupton CT | Unit 1 | Public Service Company of Colorado | CO | 1972 |
| Fort Lupton CT | Unit 2 | Public Service Company of Colorado | CO | 1972 |
| Inver Hills CT | Unit 1 | Northern States Power Company | MN | 1972 |
| Inver Hills CT | Unit 2 | Northern States Power Company | MN | 1972 |
| Inver Hills CT | Unit 3 | Northern States Power Company | MN | 1972 |
| Inver Hills CT | Unit 4 | Northern States Power Company | MN | 1972 |
| Inver Hills CT | Unit 5 | Northern States Power Company | MN | 1972 |
| Inver Hills CT | Unit 6 | Northern States Power Company | MN | 1972 |
| Alamosa CT | Unit 1 | Public Service Company of Colorado | CO | 1973 |
| Fruita CT | Unit 1 | Public Service Company of Colorado | CO | 1973 |

| Station | Unit# | Utility | State | In-service Year |
|------------------|--------|-------------------------------------|-------|-----------------|
| Valmont CT | Unit 6 | Public Service Company of Colorado | CO | 1973 |
| Wheaton CT | Unit 1 | Northern States Power Company | WI | 1973 |
| Wheaton CT | Unit 2 | Northern States Power Company | WI | 1973 |
| Wheaton CT | Unit 3 | Northern States Power Company | WI | 1973 |
| Wheaton CT | Unit 4 | Northern States Power Company | WI | 1973 |
| Wheaton CT | Unit 5 | Northern States Power Company | WI | 1973 |
| Wheaton CT | Unit 6 | Northern States Power Company | WI | 1973 |
| Blue Lake CT | Unit 1 | Northern States Power Company | MN | 1974 |
| Blue Lake CT | Unit 2 | Northern States Power Company | MN | 1974 |
| Blue Lake CT | Unit 3 | Northern States Power Company | MN | 1974 |
| Blue Lake CT | Unit 4 | Northern States Power Company | MN | 1974 |
| French Island CT | Unit 3 | Northern States Power Company | WI | 1974 |
| French Island CT | Unit 4 | Northern States Power Company | WI | 1974 |
| Riverview CT | Unit 6 | Southwestern Public Service Company | TX | 1974 |
| Maddox CT | Unit 2 | Southwestern Public Service Company | NM | 1976 |
| Alamosa CT | Unit 2 | Public Service Company of Colorado | CO | 1977 |
| Carlsbad CT | Unit 5 | Southwestern Public Service Company | NM | 1977 |

1 Xcel Energy continues to maintain and operate these facilities as peaking plants.
2 These units have been overhauled according to number of starts or service hours
3 in the normal course of business. We have no plans to retire these units.

4 **Q. DOES IT CONCERN YOU THAT THE BRUSH UNITS WERE MOVED FROM**
5 **ANOTHER LOCATION TO BRUSH WHEN THEY WERE INSTALLED IN THEIR**
6 **CURRENT CONFIGURATION?**

7 A. No. All of these units were then refurbished to new and clean condition and
8 installed at the Brush facility between 1990 and 2002. They have been run less
9 than many of our existing older combustion turbines and based on their projected
10 duty cycle going forward, they will continue to operate at low capacity factors in
11 the future.

1 **Q. HOW DOES XCEL ENERGY SUCCESSFULLY MAINTAIN AND OPERATE**
2 **OLDER UNITS?**

3 A. Xcel Energy is organized such that we have engineers who are subject matter
4 experts on all of the components of our generating fleet. For example, we have a
5 subject matter expert on combustion turbine technologies employed across our
6 fleet and across the industry. We have partnerships with turbine manufacturers
7 and companies who specialize in turbine overhauls. Our subject matter expert
8 works with our plant engineering personnel to understand specific concerns at
9 each plant and serves as a resource to the plant. In this way Xcel Energy has
10 the “best minds” working on each technology and ensures that we are operating
11 and maintaining using best practices and properly assessing the risks of
12 operating and maintaining combustion turbines.

13 **Q. IN GENERAL, DO YOU SHARE MR. MARKELL’S CONCERNS OVER THE**
14 **CONDITION OF THE BRUSH COMBUSTION TURBINES OR THE BASES**
15 **FOR HIS CONCLUSION THAT THE OVERALL USEFUL LIFE OF THESE**
16 **UNITS SHOULD BE 10 TO 15 YEARS FROM NOW?**

17 A. No. Based on Xcel Energy’s experience with older equipment, our review of the
18 CEM operating and maintenance history of the Brush units as part of the
19 Company’s overall due diligence review, and the expected light duty these units
20 are anticipated to experience, my opinion is that the useful life of the Brush Units
21 is much longer than 10 to 15 years. My opinion is that the Company’s original
22 assessment of 45 years from these units’ refurbishment and installation at Brush

1 (1990 and 2002) is the appropriate useful life to be applied to them for
2 ratemaking purposes.

3 **IV. MR. MARKELL'S SPECIFIC CONCERNS**

4 **Q. MR. MARKELL STATES IN "CONDITION ASSESSMENT FOR BRUSH**
5 **FACILITIES" DATED 9/17/12 THAT "THE COMPANY WILL MOST LIKELY**
6 **HAVE TO HIRE A THIRD PARTY TO PERFORM THE MAJOR MAINTENANCE**
7 **ON THESE UNITS". IS THIS TRUE?**

8 A. Yes. Xcel Energy does plan to have major maintenance on the combustion
9 turbines performed by a third party. This is a normal practice for Xcel Energy
10 and should not be viewed as a negative factor. Xcel Energy has a significant
11 amount of experience with third party vendors and has found that utilizing
12 personnel who routinely perform major combustion turbine maintenance is both
13 more cost-effective and more efficient than having our own personnel specialize
14 in performing this work.

15 **Q. MR. MARKELL FURTHER STATES THAT XCEL ENERGY DOES "NOT HAVE**
16 **EXPERIENCE WORKING WITH THESE UNITS LIKE CEM". IS THIS TRUE?**

17 A. No Mr. Markell suggests that, because these units are older, Xcel Energy would
18 not have the knowledge-base to take care of the equipment. I strongly disagree
19 with that implication. Xcel Energy has first class resources and subject matter
20 experts who have broad experience over a wide range of technologies and
21 equipment from many vintages. Xcel Energy has the resources (internal and
22 external) to take proper care of this equipment. While Xcel Energy does not
23 have specific experience with the specific model W251AA, these units do not

1 represent a new technology and as I noted above, the Company has extensive
 2 experience operating and maintaining similar technology units. In addition to the
 3 older turbines that I listed in Table GEH-1, Xcel Energy also operates many other
 4 combustion turbines. I have listed the remaining combustion turbines in our fleet
 5 in Table GEH-2.

**Table GEH-2
 Remaining Gas-fired combustion turbines
 in operation today for Xcel Energy**

| Station | Unit# | Utility | State | In-service Year |
|------------------------------------|------------|--|-------|--------------------|
| Angus Anson CT | Unit 1 | Northern States Power Company | SD | 1994 |
| Angus Anson CT | Unit 2 | Northern States Power Company | SD | 1994 |
| Fort St Vrain CT | Unit 2 | Public Service Company of Colorado | CO | 1996 |
| Cunningham CT | Unit 3 | Southwestern Public Service Company | NM | 1998 |
| Cunningham CT | Unit 4 | Southwestern Public Service Company | NM | 1998 |
| Fort St Vrain CT | Unit 3 | Public Service Company of Colorado | CO | 1999 |
| Fort St Vrain CT | Unit 4 | Public Service Company of Colorado | CO | 2001 |
| Black Dog | Unit 5 | Northern States Power Company | MN | 2002 |
| Blue Spruce Energy Center CT | Unit 1 | Public Service Company of Colorado | CO | 2003 |
| Blue Spruce Energy Center CT | Unit 2 | Public Service Company of Colorado | CO | 2003 |
| Rocky Mountain Energy Center CT | Unit 1 | Public Service Company of Colorado | CO | 2004 |
| Rocky Mountain Energy Center CT | Unit 2 | Public Service Company of Colorado | CO | 2004 |
| Angus Anson CT | Unit 4 | Northern States Power Company | SD | 2005 |
| Blue Lake CT | Unit 7 | Northern States Power Company | MN | 2005 |
| Blue Lake CT | Unit 8 | Northern States Power Company | MN | 2005 |
| High Bridge CT | Unit 7 | Northern States Power Company | MN | 2008 |
| High Bridge CT | Unit 8 | Northern States Power Company | MN | 2008 |
| Fort St Vrain CT | Unit 5 | Public Service Company of Colorado | CO | 2009 |
| Fort St Vrain CT | Unit 6 | Public Service Company of Colorado | CO | 2009 |
| Riverside CT | Unit 9 | Northern States Power Company | MN | 2009 |
| Riverside CT | Unit 10 | Northern States Power Company | MN | 2009 |
| Jones CT | Unit 3 | Southwestern Public Service Company | TX | 2011 |

1 Also, Mr. Markell makes special note of the fact that gas turbines are maintained
2 on “equivalent” starts and hours. This fact is very well known by Xcel Energy as
3 we operate several combustion turbines in both base load operation using “hours
4 based” maintenance programs (that is maintenance programs that trigger off of
5 hours operated because unit starts are few) and peak load operation using
6 “starts based” maintenance programs (that is maintenance that trigger off of
7 equivalent unit starts because hours of operation are few).

8 **Q. PLEASE ELABORATE ON THE IMPORTANCE OF EQUIVALENT STARTS**
9 **AND HOURS IN THIS CIRCUMSTANCE.**

10 A. Mr. Markell states that “a single failed start could actually count for 20 equivalent
11 starts towards the major maintenance requirements.” While Mr. Markell correctly
12 identifies the concept of equivalent starts or hours, Mr. Markell exaggerates the
13 situation. For example, a General Electric 7FA gas turbines per GER-3620L
14 count a “failed start” as zero (0) starts if the machine never fired off. In fact, with
15 the GE 7FA gas turbines the worst count towards a factored start would be a trip
16 from full load, and in that case General Electric per GER-3620L on page 13,
17 Figure 21 would count it as 8 equivalent starts.

1 **Q. BASED ON MR. MARKELL'S DISCUSSION, IS THERE ANYTHING ABOUT**
2 **THE EQUIVALENT START CONCEPT THAT CAUSES YOU TO THINK THAT**
3 **THE USEFUL LIFE OF THE BRUSH UNITS SHOULD BE SHORTER THAN**
4 **PUBLIC SERVICE'S PROPOSED 45 YEARS?**

5 A. No. We had access to the operating history of the units and took that into
6 account when we made our assessment. Mr. Markell's discussion does not add
7 to that analysis.

8 **Q. MR. MARKELL ALSO DISCUSSES MAJOR MAINTENANCE**
9 **REQUIREMENTS FOR STEAM TURBINES AND STATES THAT IT IS**
10 **"COMMON PRACTICE IN THE INDUSTRY TO OPERATE A STEAM TURBINE**
11 **FOR 7 TO 10 YEARS" BETWEEN MAJOR MAINTENANCE CYCLES. DO**
12 **YOU AGREE?**

13 A. I first note that throughout his report, Mr. Markell is careful to qualify various
14 assessments by including the caveat that conditions or circumstances depend
15 upon the actual operating history of a unit. While Mr. Markell does not elaborate
16 on what that means, this particular statement is a good example of how important
17 actual operating history is to the determination of maintenance schedules. Mr.
18 Markell's statement of 7 to 10 years between major maintenance cycles is
19 correct, assuming that the machines were operated as base loaded machines.
20 For peaking units, Xcel Energy does not agree the same frequency would apply.
21 Xcel Energy bases major maintenance on many factors including inspections and
22 has found that for peaking steam units, an approach similar to the "equivalent"
23 starts and hours methodology for combustion turbines serves us well.

1 **Q. THE PF ENGINEERS REPORT ALSO LAYS OUT SEVERAL CONCERNS FOR**
2 **OPERATIONS GOING INTO THE FUTURE. FIRST THERE IS MENTION OF**
3 **ISSUES WITH ST1'S 19TH STAGE BUCKETS AND WATER IMPINGEMENT IN**
4 **THIS GENERAL AREA. CAN YOU EXPLAIN THE ISSUE AND YOUR**
5 **ASSESSMENT?**

6 A. A turbine is essentially a piece of equipment designed to capture the energy in
7 the steam moving through it and transfer that energy into rotation of a shaft,
8 which is then used to turn a generator and produce electricity. In this case Mr.
9 Markell's concern is regarding one of the steam turbines. The buckets and
10 blades in a steam turbine work on the same principle as a wind turbine. When
11 the wind blows the energy of the wind is transferred to the turbine blades causing
12 it to rotate and turn a generator creating electricity. You want the wind to touch
13 the blades smoothly, for as long as it can, so it gives up as much energy as
14 possible.

15 In the case of a steam turbine, the same principles apply. The energy of
16 the steam is transferred to the buckets and blades. They are designed to
17 capture the energy in the steam and use that energy to turn a shaft that runs
18 through the turbine and into the generator, where the rotation will be used to
19 generate electricity.

20 Mr. Markell is concerned that some of the later stages of the turbine
21 blades and buckets are not as efficient in transferring that energy as they were
22 originally designed to be and that some of the inefficiency is resulting in erosion
23 of the last state.

1 The Company is aware of this issue and we have experienced it at other
2 steam turbines and in fact this does slightly reduce efficiency of the machine.
3 However, these units are peaking power units that are expected to be operated
4 seldom and then only for short periods of time. Mr. Markell states that “at some
5 point in time, repairs to the 19th stage bucket[s] and last stage diaphragm should
6 be performed”. In our practice, as with CEM before us, the Company would base
7 the decision regarding when or if to perform this maintenance on inspections and
8 performance testing to ensure that the peak capacity is still attainable.

9 Furthermore because of the due diligence that was performed it was
10 identified that the 19th stage buckets and diaphragm have erosion from the
11 inspections that have been performed by CEM, demonstrating full disclosure by
12 CEM. For this reason it was not prudent to disassemble the turbine for further
13 inspections. This is not consistent with industry practices. It is a known issue and
14 will be monitored and repaired if and when necessary.

15 **Q. DOES MR. MARKELL’S CONCERN OVER THE 19TH STAGE CAUSE YOU TO**
16 **CHANGE YOUR OPINION ABOUT THE USEFUL LIFE OF THE BRUSH UNITS**
17 **TO BE USED AS PEAKING UNITS AS PART OF PUBLIC SERVICE’S FLEET?**

18 A. Not at all. I want to emphasize that these are peaking units that will be operated
19 very few hours of the year. While optimal turbine efficiency is of course
20 desirable, in light of the acknowledged overall good condition of these units, our
21 projected operating plan, and the price we are paying for the units, this issue
22 does not impact on my opinion.

1 **Q. SECOND, MR. MARKELL ADDRESSES EXHAUST PLENUM CRACKING ON**
2 **THE COMBUSTION TURBINES AND THAT THIS COULD BE PROBLEMATIC**
3 **BECAUSE THE PLENUMS HOLD THE BEARINGS. CAN YOU EXPLAIN THE**
4 **ISSUE AND YOUR ASSESSMENT?**

5 A. Yes. The size, location, depth and number of cracks are aspects that are
6 important to monitor to determine what, if any, affect these cracks are having on
7 the bearings. The nearby Fort St. Vrain combustion turbines (FSV 2, 3, and 4)
8 have similar cracking in the exhaust plenum. As with the Brush units we will
9 monitor the exhaust frame cracking on a routine basis. We have not experienced
10 an alignment problem in our existing units due to this cracking issue.

11 **Q. DOES THE PLENUM CRACKING IDENTIFIED BY MR. MARKELL CAUSE**
12 **YOU TO CHANGE YOUR OPINION ABOUT THE USEFUL LIFE OF THE**
13 **BRUSH UNITS TO BE USED AS PEAKING UNITS AS PART OF PUBLIC**
14 **SERVICE'S FLEET?**

15 A. No.

16 **Q. MR. MARKELL NEXT ADDRESSES IN GENERAL THE THERMAL STRESSES**
17 **ON CASING AND THE IMPACT THAT COULD HAVE DURING FUTURE**
18 **MAINTENANCE WHERE THE CASINGS NEED TO BE DISASSEMBLED AND**
19 **THEN REASSEMBLED. CAN YOU EXPLAIN THE ISSUE AND YOUR**
20 **ASSESSMENT?**

21 A. The issue of combustion turbine casings going out of round due to age and
22 thermal stress and cycling is something that we deal with on all of our thermal
23 generating units. Mr. Markell states that the performance degradation of the

1 units is of secondary concern as compared to the “potential of not being able to
2 reassemble the casing after an outage”. While this could be a problem, there are
3 methods to fix these issues which would be evaluated for repair and/or
4 replacement either with used or new parts.

5 Mr. Markell is suggesting that the Company, as part of the due diligence,
6 should disassemble the combustion turbine to determine if the casings are out of
7 round. This is not a good practice because if the casings are out of round the
8 disassembly and reassembly could cause repairs to be made that are not
9 needed at this time because the units are currently in good operating condition.
10 As stated above, the issue would be address during a normal overhaul or
11 inspection of the unit and I believe that is the prudent course of action.

12 **Q. DOES THE CONCERN ABOUT THE TURBINE CASING GOING OUT OF**
13 **ROUND IDENTIFIED BY MR. MARKELL CAUSE YOU TO CHANGE YOU**
14 **OPINION ABOUT THE USEFUL LIFE OF THE BRUSH UNITS TO BE USED**
15 **AS PEAKING UNITS AS PART OF PUBLIC SERVICE’S FLEET?**

16 A. No.

17 **Q. MR. MARKELL ALSO DISCUSSES THAT THE COMBUSTION TURBINES’**
18 **CONTROL SYSTEM IS WELL AGED AND PARTS ARE HARD TO COME BY**
19 **AND THAT THE STEAM TURBINES ARE MECHANICAL HYDRAULIC**
20 **CONTROLS. CAN YOU EXPLAIN THE ISSUE AND YOUR ASSESSMENT?**

21 A. Xcel Energy has extensive experience with retrofitting control systems on
22 combustion turbine and steam turbine units. One example is, Cherokee unit one
23 was initially commissioned in 1958 with mechanical hydraulic controls. Since the

1 commissioning of the unit the controls were upgraded to digital control or
2 electrical hydraulic control.

3 **Q. IN A FOLLOW-UP CONCERN, MR. MARKELL ALSO STATES THAT “YOU**
4 **NEED THE RIGHT MAINTENANCE PEOPLE TO KEEP THESE UNITS**
5 **[STEAM TURBINES WITH MECHANICAL HYDRAULIC CONTROLS]**
6 **RUNNING. CAN YOU EXPLAIN THE ISSUE AND YOUR ASSESSMENT?**

7 A. The Company currently owns and operates machines in the Colorado region that
8 have mechanical hydraulic control systems and therefore we have expertise and
9 the skills to maintain the units. However, it is the intent of the Company to retrofit
10 the controls on the units with more automated and remote control capabilities
11 and I included the cost of those upgrades in the estimates in my Direct
12 Testimony

13 **Q. DOES THE AGE OF THE EQUIPMENT AND CURRENT MECHANICAL**
14 **CONTROLS CAUSE YOU TO CHANGE YOU OPINION ABOUT THE USEFUL**
15 **LIFE OF THE BRUSH UNITS TO BE USED AS PEAKING UNITS AS PART OF**
16 **PUBLIC SERVICE’S FLEET?**

17 A. No.

18 **Q. NEXT, MR. MARKELL DISCUSSES THE NEED TO REWIND THE**
19 **GENERATORS. CAN YOU EXPLAIN THE ISSUE AND YOUR**
20 **ASSESSMENT?**

21 A. Yes. Mr. Markell correctly acknowledges that the generators are being tested
22 regularly and then makes an assumption without support, analysis or citation,
23 that the generators will all require a rewind in the future and that these rewinds

1 are not scheduled. Based on our experience, it is possible to run a generator
2 from new construction to decommissioning without having to rewind the
3 generator. Regular testing is the appropriate approach and allows the operator
4 to know when and if to schedule a generator rewind. The testing of the Brush
5 facilities was made available to Commission Staff as part of discovery in this
6 proceeding but it appears that Mr. Markell simply make a general statement that
7 the generators will need a rewind during their life. I view his statement as
8 speculation.

9 **Q. DOES MR. MARKELL'S DISCUSSION OF GENERATOR REWINDING CAUSE**
10 **YOU TO CHANGE YOU OPINION ABOUT THE USEFUL LIFE OF THE**
11 **BRUSH UNITS TO BE USED AS PEAKING UNITS AS PART OF PUBLIC**
12 **SERVICE'S FLEET?**

13 A. No.

14 **Q. LASTLY, MR. MARKELL REFERENCES THE FACT THAT "FOR**
15 **PERFORMANCE OR EMISSIONS PURPOSES, THE PERSONNEL [CEM]**
16 **HAVE ADJUSTED THE OPERATING PARAMETERS" AND GOES ON TO**
17 **STATE THAT THIS COULD "ADVERSELY IMPACT THE LIFE OF THE**
18 **ROTORS" AND THAT A ROTOR LIFE ASSESSMENT SHOULD BE DONE.**
19 **CAN YOU EXPLAIN THE ISSUE AND YOUR ASSESSMENT?**

20 A. Yes. The Company is aware of the fact that all four of the combustion turbines
21 are fired at a higher than design temperature, otherwise known as "over firing" as
22 a means of controlling air emissions. Over firing is the practice of introducing
23 more heat (energy) into the system than necessary to achieve the same energy

1 output. The Company is also aware of the potential life cycle issues that type of
2 operation can present. The Company factors this parameter as well as others in
3 determining the life of our current fleet of machines.

4 **Q. DO YOU AGREE THAT A ROTOR ASSESSMENT SHOULD HAVE BEEN**
5 **CONDUCTED PRIOR TO PUBLIC SERVICE'S PURCHASE OF THESE**
6 **UNITS?**

7 A. No. A rotor life assessment should be determined on the number of hours\starts
8 on the unit or if there was an event that occurred causing suspicion of rotor
9 damage. Based on our assessment of the equipment and our review of the due
10 diligence materials provided to us, I do not believe it would have been
11 appropriate to take the time or incur the expense of doing that assessment at this
12 time.

13 **Q. DOES THE LACK OF A ROTOR ASSESSMENT PRIOR TO THE**
14 **ACQUISITION CAUSE YOU TO CHANGE YOU OPINION ABOUT THE**
15 **USEFUL LIFE OF THE BRUSH UNITS TO BE USED AS PEAKING UNITS AS**
16 **PART OF PUBLIC SERVICE'S FLEET?**

17 A. No.

18 **Q. IN THE REPORT MR. MARKELL ALSO DISCUSSES MAJOR MAINTENANCE**
19 **OF THE HEAT RECOVERY STEAM GENERATORS (HRSGS) AND**
20 **SPECIFICALLY THE DRUMS AND INSPECTIONS OF THE SAME. CAN YOU**
21 **EXPLAIN THE ISSUE AND YOUR ASSESSMENT?**

22 A. Yes. Xcel Energy owns and operates several large boilers and HRSGs and has
23 developed a maintenance inspection schedule that is followed regularly; we

1 intend to put in place such a schedule for these units. Xcel Energy's experience
2 is that tube leaks in HRSGs are either minimal or nonexistent.

3 Mr. Markell also raises concern about the life of the superheat tubes due
4 to the duct burning capabilities of these HRSGs. Xcel Energy owns and operates
5 several other HRSGs that are capable of duct burning. The HRSGs that have
6 duct burning capability are designed to have this additional heat input that
7 causes temperatures that are above the normal exhaust temperatures of the
8 combustion turbines to be present and the materials are selected based the
9 elevated temperatures.

10 **Q. DO THE ISSUES ABOUT THE HRSG IDENTIFIED BY MR. MARKELL CAUSE**
11 **YOU TO CHANGE YOU OPINION ABOUT THE USEFUL LIFE OF THE**
12 **BRUSH UNITS TO BE USED AS PEAKING UNITS AS PART OF PUBLIC**
13 **SERVICE'S FLEET?**

14 A. No.

15 **Q. HAVE YOU REVIEWED MR. MARKELL'S OPINION ON THE COSTS HE**
16 **EXPECTS WILL NEED TO BE INCURRED FROM THE BRUSH UNITS FOR**
17 **THEM TO LAST AS LONG AS PUBLIC SERVICE PROJECTS?**

18 A. Yes. Mr. Markell has an extremely pessimistic view of what will need to be done
19 to keep these units in service for the duration of Public Service's projected 45
20 year useful life. Mr. Markell's opinion does not reflect Xcel Energy's experience.

1 **Q. DO YOU HAVE AN UNDERSTANDING WHY MR. MARKELL HAS SUCH A**
2 **PESSIMISTIC VIEW OF COSTS?**

3 A. Not based on his report or testimony. The materials he provided into the record
4 were very general and did not provide much by way of basis for his opinions.
5 However, in discovery, we asked him to explain what actions and factors he took
6 into account in developing his cost estimate. In response to Discovery Request
7 PSCo4-21 (see Exhibit No. GEH-3), Mr. Markell states:

8 “Based on the age of these units and operational profile, it was assumed
9 that the following will need to be performed to continue to operate these units for
10 another 22 to 34 years:

- 11 1. Steam turbine rotor replacements
- 12 2. Gas turbine rotor replacements
- 13 3. Generator rotor replacements
- 14 4. Generator rewind
- 15 5. Steam turbine steam path refurbishment
- 16 6. Gas turbine exhaust plenums
- 17 7. Gas turbine casings.”

18 **Q. DO YOU AGREE THAT ALL SEVEN OF THESE ITEMS MUST BE DONE IN**
19 **ORDER TO KEEP THE UNITS IN OPERATION FOR THE FULL PROJECTED**
20 **USEFUL LIFE?**

21 A. Absolutely not. Mr. Markell must have approached his work with the assumption
22 that ‘anything that can go wrong, will go wrong.’ That sort of pessimistic
23 approach is not the right frame of reference for utility assets, particularly units

1 such as these that can be acquired at a low price compared to new generation,
2 that provide valuable capacity to the system without upgrading infrastructure, and
3 which will be operated at very low capacity factors.

4 **Q. PLEASE DESCRIBE EACH OF THE SEVEN ITEMS SET FORTH IN MR.**
5 **MARKELL'S DISCOVERY RESPONSE AND PROVIDE YOUR OPINION**
6 **ABOUT THE LIKELIHOOD SUCH AN ACTIVITY WOULD BE REQUIRED**
7 **DURING THE USEFUL LIFE OF THE BRUSH FACILITIES.**

8 A. My description follows:

9 1. Steam turbine rotor replacements: Mr. Markell is speculating and
10 making assumptions that due to the age of the steam turbines that a rotor
11 replacement will be necessary in order for the turbine to be available for the
12 Company's projected useful life. The purpose of turbine overhauls, inspections,
13 and Non-destructive examination (NDE) is to make repairs, and refurbishments
14 to increase efficiencies and life of the turbine. The overhauls, inspections, testing
15 and operating hours provide the information needed to make engineering
16 decision to replace or repair the turbine components. We do not believe it is
17 appropriate to assume that such rotor replacements will automatically be needed
18 when buying a piece of equipment.

19 2. Gas turbine rotor replacement: Gas turbines are similar to steam
20 turbines with the decisions to replace rotors. However more emphasis is placed
21 on the operating hours and starts on whether or not a rotor life assessments or
22 replacement should be completed. We do not believe it is appropriate to assume

1 that such rotor replacements will automatically be needed when buying a piece of
2 equipment.

3 3. Generator rotor replacement: Generator rotor replacements are
4 rare and usually coincide with catastrophic failure. Mr. Markell again is making a
5 broad statement without any supporting documentation that would necessitate
6 the need to replace the rotor in a generator. This should clearly not be assumed
7 in making a purchase decision.

8 4. Generator rewind: Rewinds are preformed on generators based on
9 inspections and testing. It is not uncommon for a generator to operate its entire
10 life without a rewind. Inspections and testing of generators is a standard practice
11 of the company. Rewinds have been performed at PSCo based on the
12 inspections and testing. The Company does not support assuming the need for
13 a rewind as a precursor of the purchase.

14 5. Steam turbine steam path: As stated in above, item 1, Overhaul,
15 inspections and NDE of steam turbines are to improve efficiencies and life of the
16 turbine. Monitoring, inspecting, and testing will dictate the need for repairs of the
17 turbine steam path. We do not believe it is appropriate to assume that steam
18 path replacement will automatically be needed.

19 6. Gas Turbine Exhaust Plenums: The cracking in the exhaust
20 plenums will be monitored to determine if the cracks are worsening. Currently
21 the cracking the plenums is not affecting the operation of the units. Repairs
22 and/or replacement of the plenums will be made based on inspections and
23 testing. This is normal operating procedure for equipment of this type.

1 7. Gas Turbine Casings: Mr. .Markell states that the gas turbine
2 casings can become out of round inhibiting the reassembly on the unit. This can
3 be the case; however, this again is speculation, he does not know or would not
4 know the casings are out of round until a unit overhaul when measurements
5 would be taken to determine if they are out of round. If they are found to be out
6 round then the Company would take the necessary steps to repair or replace the
7 casing.

8 In sum, the Company performs overhauls, inspections and testing on a
9 routine basis on all the PSCo generating units. They are performed to maintain
10 the efficiencies and extend the life of the units. Dealing with these types of issues
11 is not something new in the industry or the company. The Brush units are not so
12 different from the Company's existing units that they would warrant the company
13 replace rotors and other equipment based on what could happen with out any
14 justification. It would not be economically feasible for the company and
15 customers to start replacing high dollar equipment on speculations or
16 assumptions.

1 **Q. MR. MARKELL STATES IN HIS REPORT THAT “CEM’S ALLOCATION OF**
2 **14.5 PEOPLE IS MORE IN THE RANGE [PF ENGINEERS] WOULD EXPECT**
3 **TO SUPPORT THIS OLDER TECHNOLOGY” AND ALSO SITES THAT CEM’S**
4 **BREAK DOWN OF EMPLOYEES FOR ALL OF THEIR OPERATIONS IN THE**
5 **BRUSH AREA (BRUSH AND MANCHIEF) IS 32 WITH NEARLY 1/3 OF THAT**
6 **STAFFING BEING “ADMINISTRATIVE AND SUPERVISORY PERSONNEL”.**
7 **CAN YOU EXPLAIN THE CONCERN AND YOUR ASSESSMENT?**

8 A. Yes. Mr. Markell seems to be concerned that the Company will actually need
9 more people to run the plant than I have included as the incremental number of
10 employees the Public Service would add to its staff to operate this facility. To
11 show that our assessment is reasonable, I would like to start with a little math.
12 Mr. Markell says that 1/3 of the staff is administrative and supervisory – so of the
13 14.5 equivalent employees that are allocated to the Brush units, 4.8 of them are
14 administrative and supervisory personnel, so 9.7 operating personnel. Public
15 Service’s plan initially calls for the addition of 8 to the current staff of Pawnee
16 Generating Station. We plan to have administrative support, maintenance,
17 electric, and instrument/controls personnel already in Pawnee’s current operating
18 staff to support the Brush units in these specialty areas. Xcel Energy has moved
19 to a “campus” approach across our fleet for these types of services and employs
20 this common support between plants that are geographically very close – like
21 Cunningham/Maddox in New Mexico, Harrington and Nichols in Texas. This has
22 proven to be a way to increase efficiency in these other facilities and it will work
23 at Pawnee/Brush as well.

1 Separately, it is the Company's intent to automate the Brush units more than
2 they currently are automated in order to reduce the initial staffing level from 8 to 6
3 over the course of the first three years. Mr. Markell does not take into account
4 the fact that the Brush units will not be a stand alone power plant, but will be a
5 satellite to our Pawnee plant.

6 Mr. Markell also addresses the use of non-union employees being able to do
7 multiple job functions and that the staffing level should have to go up based on
8 the fact that Public Service employs Union members for its operation staffs. The
9 Company does not see that this issue will be relevant as the modernization of the
10 control systems start being implemented. He also points to the "older equipment
11 requires a unique skill set" and states that it is "unlikely that [Xcel Energy's
12 experience] equals the experience the CEM personnel have in working with this
13 older equipment". Public Service Company of Colorado was established on
14 September 3, 1924 and has experience operating older equipment. Xcel Energy
15 has good experience operating equipment of this era as we still own and
16 operates the first (and therefore now oldest) generating facility to transmit
17 alternating current at high voltage in the world. That plant, Ames Hydro, started
18 operation in 1891. While the current CEM employees have vastly more
19 experience operating their equipment, our Company holds that we are fully
20 capable of the task of operating older equipment. We recognize there may be
21 some learning curve and we have been discussing staffing and the possibility of
22 employing people from CEM.

1 Q. DOES MR. MARKELL'S DISCUSSION ABOUT STAFFING CAUSE YOU TO
2 CHANGE YOUR OPINION ABOUT THE COMPANY'S PLAN FOR STAFFING
3 THE BRUSH UNITS TO BE USED AS PEAKING UNITS AS PART OF PUBLIC
4 SERVICE'S FLEET?

5 A. No.

6 Q. DID MR. MARKELL IDENTIFY IN HIS TESTIMONY ANYTHING ABOUT THE
7 BRUSH UNITS THAT THE COMPANY DID NOT KNOW?

8 A. No.

9 Q. DID THE COMPANY PERFORM THOROUGH DUE DILIGENCE ON THE
10 ASSETS PROPOSED TO BE ACQUIRED?

11 A. Yes. We had qualified personnel review the records and documents provided by
12 the owner and performed on site inspections. Over 120 person hours were spent
13 performing the due diligence of the Brush units. The combined experience of the
14 employees that performed the due diligence is over 50 years. Their experience
15 includes engineering, maintenance, and operation of power plants.

16 Q. IS THE COMPANY CONTINUING TO MONITOR THE BRUSH FACILITIES
17 WHILE THE ACQUISITION IS PENDING?

18 A. Yes. Since August 20, 2012, the Company has had Bruce Hogan, Plant
19 Supervisor at Pawnee Station assigned to the Brush transition team working out
20 of Brush station. He has observed plant start-up, operation and shut-down in
21 September when the units were dispatched due to a large unit trip. The units had
22 a normal start up and shut down without any issues.

1 **Q. HAS MR. MARKELL'S REPORT CHANGED YOUR OPINION OF THE LIKELY**
2 **USEFUL LIFE OF THE BRUSH FACILITIES?**

3 a. No.

4 **Q. DOES THIS CONCLUDE YOUR SUPPLEMENTAL REBUTTAL TESTIMONY?**

5 A. Yes.