

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

DOCKET NO. 07S-521E

RE: IN THE MATTER OF ADVICE NO. 1495 - PUBLIC SERVICE COMPANY OF
COLORADO REVISION TO THE INTERRUPTIBLE SERVICE OPTION
CREDIT (ISOC) TARIFF - ELECTRIC.

**ANSWER TESTIMONY AND EXHIBITS OF LARRY Y. SHIAO
STAFF OF THE COLORADO PUBLIC UTILITIES COMMISSION**

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March 24, 2008

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I. IDENTIFICATION OF WITNESS AND PURPOSE OF TESTIMONY

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Larry Shiao. My address is 1560 Broadway, Suite 250, Denver, Colorado, 80202.

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

A. I am employed by the Colorado Public Utilities Commission (Commission or PUC) as a Professional Engineer.

Q. HAVE YOU PREPARED A STATEMENT OF YOUR EXPERIENCE AND QUALIFICATIONS?

A. Yes. A summary of my qualifications, experience and duties is attached as Appendix A to this testimony.

Q. ARE YOU GENERALLY FAMILIAR WITH THE FILINGS IN DOCKET NO. 07S-521E?

A. Yes.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. Public Service Company of Colorado (Public Service) has proposed a number of modifications to the Interruptible Service Optional Credit (ISOC) program. My testimony addresses Staff's concerns with the following aspects: (1) monthly credit rate

derivation, (2) the monthly credit and its relationship to Interruptible Demand, (3) the requested financial incentive, and (4) a few miscellaneous issues.

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS.

A. Staff recommends that the Commission order Public Service to:

- 1) Use seasonal capacity to compute the avoided capacity costs;
- 2) Use average MW to determine the Interruptible Demand;
- 3) Correct for errors in the equation that is used to calculate the monthly credit rates;
- 4) Use the current capacity availability factors to calculate the monthly credit rate;
- 5) Conduct additional studies to reflect the actual power system operation to evaluate the capacity availability factors;
- 6) Use all available interruptible hours absent a reasonable explanation for not doing so;
- 7) Address the cost-benefit analysis within the next six months.

II. PUBLIC SERVICE'S INTERRUPTIBLE SERVICE OPTIONAL CREDIT PROGRAM (ISOC) AND THE CHANGES THAT IT IS PROPOSING

Q. PLEASE DESCRIBE THE PRINCIPLES BEHIND PUBLIC SERVICE'S ISOC PROGRAM.

A. Public Service offers an ISOC program that consists of three elements: 1) capacity interruption, 2) contingency interruption, and 3) economic interruption. Public Service's

1 ISOC program allows program participants less than 10-minutes notice of an impending
2 interruption or one hour or eight hours of notice. Attracting interruptible load to the less
3 than 10-minute notice option is valuable to Public Service because such load counts
4 toward Public Service's operating reserves.

5 Public Service can call a capacity interruption at any time upon determining that
6 its generation or transmission capacity is insufficient to meet its load obligation. Public
7 Service can call a contingency interruption at any time when the Company believes that it
8 will be unable to meet its disturbance control standard (DCS) criteria mandated by the
9 Western Electricity Coordinating Council (WECC); however, a contingency interruption
10 is only applicable to the ISOC program participants that selected the less than 10-minute
11 notice option. Public Service can call an economic interruption upon determining that an
12 interruption will lower overall system costs when compared to overall system costs
13 without an interruption. Public Service pays a monthly bill credit to the program
14 participants. This credit is based on (1) a rate equation that calculates avoided capacity
15 cost and avoided energy cost and takes into account the options selected by the program
16 participant and (2) the program participant's interruptible load. The program participant
17 receives its credit irrespective of whether Public Service fails to call sufficient
18 interruptions to use up the interruptible hours that are subscribed to the ISOC program.

19
20 **Q. WHY DOES PUBLIC SERVICE OFFER THE ISOC PROGRAM?**

21 **A.** The ISOC program is a demand side management program that is designed to reduce load
22 during the peak demand periods. The program does not necessarily reduce overall energy
23 consumption. The capacity and contingency interruption elements of the ISOC program

1 provide additional capacity resources to support and enhance the reliability of the Public
2 Service power system operations without forcing the construction of another peaking
3 plant or incurring fuel costs. These types of interruptions represent the real value of the
4 ISOC program. The economic interruptions, on the other hand, are designed to lower the
5 overall cost of providing energy to meet the energy demand of Public Service's power
6 system. As compared to the value of a capacity or contingency interruption, economic
7 interruptions represent a substantially lower value. The ISOC program is beneficial to
8 Public Service's power system; however, the program needs to be designed correctly and
9 be implemented properly in order to realize the expected benefit for all rate payers.

10
11 **Q. WHY HAS PUBLIC SERVICE PROPOSED TO CHANGE THE EXISTING ISOC**
12 **PROGRAM?**

13 **A.** Public Service appears to have proposed changes to the ISOC program in an attempt to
14 attract additional load to the program. Public Service hopes to expand the program from
15 its present subscription of 120 MW to 234 MW by 2020. Public Service also proposes to
16 attract additional load by introducing additional options, such as permitting use of an
17 ISOC program participant's energy management system (EMS) to effect an interruption,
18 that it perceives as reducing barriers to participation. Finally, Public Service believes that
19 it should be entitled to a financial incentive if it can market and administer the program
20 effectively.

21
22 **Q. IS STAFF CONCERNED ABOUT PUBLIC SERVICE'S PROPOSED**
23 **EXPANSION OF THE ISOC PROGRAM?**

1 **A.** No. The revisions to the ISOC program proposed by Public Service should provide a net
2 benefit to non-participants. Currently, Public Service’s interruptible load program
3 participants have a combined contract interruptible load (CIL) of about 120 MW.
4 Approximately 107 MW of the interruptible load is contributed by the less than 10-
5 minute notice option participants. The remaining interruptible load, about 13 MW, is the
6 total CIL for the one-hour notice program participants. Public Service witness Scott
7 Brockett discussed Public Service’s plan for an interruptible load of about 243 MW in
8 2020. This would be an increase of about 123 MW from the current interruptible load of
9 120 MW (See Scott Brockett Direct Testimony, page 16, line 23). One can only
10 speculate which options the new ISOC participants will select. Likewise, it is a
11 supposition that Public Service will be successful in its marketing of the program to
12 achieve an increase of 123 MW by 2020. Staff will continue to monitor the level of
13 benefit to non-participants that is achieved from the anticipated attraction of interruptible
14 load, including monitoring the level of the monthly credits paid to the ISOC program
15 participants to achieve such load attraction.

16
17 **Q. WHAT CHANGES DOES PUBLIC SERVICE PROPOSE?**

18 **A.** Public Service’s proposed changes are:
19 (1) Reducing the eligible interruptible customer peak demand to 300 kW,
20 (2) Elimination of the 200-hour option,
21 (3) Elimination of the 8-hour notice option,
22 (4) Allowing participants to select from several more options,
23 a) Limiting interruptible hours to no more than 4 hours in 24 hours period;

1 b) No minimum 4-hours requirements;

2 c) Managing interruptions for participants, who select less than 10 minutes notice,

3 by direct control of customer EMS,

4 (5) Allowing greater flexibility within the ISOC program (*e.g.*, the use of a customer's
5 EMS to effect interruptions,

6 (6) Updating the monthly credit rates,

7 (7) Setting the ISOC credit to 80 percent of total avoided costs,

8 (8) Proposing that it retain about 12.5% of total ISOC credits as an incentive, and

9 (9) Miscellaneous changes to the Schedule ISOC tariff sheets.

10
11 **Q. DOES STAFF AGREE WITH PUBLIC SERVICE'S PROPOSED CHANGES?**

12 **A.** Staff agrees with some of the proposed changes but not all. Staff agrees with changes
13 that will make the ISOC program more efficient and that will provide benefit to
14 ratepayers at reasonable costs. In general, Staff agrees with the proposed changes that
15 will reduce the minimum load requirement to 300 kW and eliminating options not
16 selected by current ISOC participants and unnecessary tariff language.

17 Staff has concerns with the changes that Public Service proposes to make to the
18 monthly credit rate (MCR) equation, including the avoided cost derivation, and the
19 proposed EMS option.

20 Staff strongly objects to Public Service's proposed incentive. In the following
21 sections I will discuss Staff's concerns and reasons why Staff does not believe Public
22 Service is entitled to an incentive.

23

III. MONTHLY CREDIT RATE (MCR)

Q. PLEASE DESCRIBE THE MONTHLY CREDIT RATE (MCR) CALCULATION?

A. The MCR equation is used to calculate the monthly credit rate Public Service is willing to pay to ISOC program participants. While Public Service and Staff propose different equations, both parties use the same essential components. The equation consists of two basic components: (1) the avoided capacity rate and (2) the avoided energy rate. The avoided capacity rate component is the estimated, derived avoided capacity cost multiplied by a capacity availability factor (Ca). The avoided energy rate is computed using a generic heat rate, a generic delivered gas price adjusted by the “energy rate paid by customers” and the variable operating and maintenance (VOM) rate to develop a energy rate in \$/kWh. The “energy rate paid by customers” is the sum of the base energy rate with general rate schedule adjustment (GRSA), the electric commodity rate (ECA) and the renewable energy standard adjustment (RESA).

A. THE AVOIDED CAPACITY COST DERIVATION

Q. WHAT ARE THE ELEMENTS OF PUBLIC SERVICE’S PROPOSED AVOIDED CAPACITY COST DERIVATION?

A. Public Service has assumed that the interruption of a customer’s load within a short time after it gives notice would provide its electric system with characteristics similar to that of a combustion turbine (CT). In general, a CT is a generation unit typically used to provide capacity to meet operating reserve and peaking demand requirements. It is normally operated less than 400 hours or 5% of time in a given year.

1 Public Service assumes that the interruptible load would be able to (1) replace a
2 CT for the purpose of maintaining the operating reserve; (2) defer the Company's
3 expenses of either constructing or purchasing a CT; and (3) reduce the Company's costs
4 of providing operating reserve. In this filing, Public Service argues that the estimated
5 costs of constructing a conventional frame CT, with a nameplate capacity of 160 MW, is
6 a reasonable proxy for calculating the avoided capacity costs associated with the 1-hour
7 notice option of the ISOC program.¹ For customers that select the less than 10 minutes
8 notice option, Public Service proposes to use a different type of CT, a GE LMS100 with a
9 nameplate capacity of 100 MW, as its proxy for calculating the avoided capacity costs.
10 Then for both notice options, Public Service uses the respective derived avoided capacity
11 costs as the base cost to determine the monthly credit rate that it will pay to the ISOC
12 program participants.

13
14 **Q. DOES STAFF HAVE ANY CONCERNS WITH THE ESTIMATED CT**
15 **CONSTRUCTION COSTS USED IN PUBLIC SERVICE'S ANALYSIS OF THE**
16 **AVOIDED CAPACITY COSTS?**

17 **A. No.**

18
19 **Q. CAN STAFF ADOPT THE OTHER ASSUMPTIONS CONTAINED IN PUBLIC**
20 **SERVICE'S AVOIDED CAPACITY COST DERIVATION?**

21 **A. No.**

¹ The estimated avoided costs data was from Table 39, Cost and Performance Characteristics of New Central Station Electricity Generating Technologies in 2007 annual report published by Energy Information Administration.

Q. WITH WHICH ASSUMPTIONS DOES STAFF DISAGREE?

A. Staff believes that in estimating the avoided capacity costs, Public Service should consider seasonal differences in the capacity rating of a combustion turbine. While Public Service did use a seasonal ratio in its calculations, Public Service used only the summer capacity rating for its modeled CTs. Staff believes that a more proper calculation would use the ISO-adjusted seasonally differentiated capacity ratings. For example, the GE LMS100 CT has an estimated summer capacity of about 77 MW; however, the same GE LMS100 CT has an estimated winter capacity of about 91.6 MW. Public Service's method fails to accurately capture this approximately 20% seasonal differential in capacity in the calculation of avoided capacity cost.

Q. WHAT AVOIDED CAPACITY COST CALCULATION DOES STAFF PROPOSE?

A. Staff proposes the avoided capacity cost calculation set forth on Exhibit LYS-1. Exhibit LYS-1 presents a comparison of Public Service's existing and proposed avoided capacity cost (\$/kW) calculations alongside Staff's proposed avoided cost calculations. These avoided capacity costs are presented for both the less than 10 minutes notice option (GE LM6000 CT for Public Service existing and GE LMS100 CT for Public Service proposed and Staff proposed) and the one-hour notice option (frame CT), respectively. Staff's recommendations eliminate the notification factor (Nf) and the seasonal ratio multiplier (115% or 90%) in the equation that Public Service proposes to use to calculate the monthly credit rate.

B. THE CAPACITY AVAILABILITY FACTOR (CA)

Q. IS STAFF PRESENTING A NEW METHOD TO DETERMINE THE CAPACITY AVAILABILITY FACTOR?

A. No. Staff has been unable to develop a method to recommend to the Commission; however, through its investigation into the new method proposed by Public Service, Staff has determined that Public Service's new method has significant flaws. These flaws are described below. Staff believes that the nature of these flaws should result in Commission rejection of the method proposed by Public Service. Staff also recommends that the Commission reject the "4 hours in any 24-hour period" option.

Q. HOW DID PUBLIC SERVICE DERIVE THE CAPACITY AVAILABILITY FACTOR?

A. Public Service uses a production cost simulation model called PROSYM and the forecasted load shapes and generation for 2007-2011 to develop marginal cost data for the 2007-2011 period. Public Service also uses a separate PROSYM module to derive the loss of load probability (LOLP) using the same forecasted generation mix data and load shapes for 2007-2011. Public Service then combines the marginal cost data and the LOLP values to derive a set of marginal and reliability cost data that it applies to the five-year historical period 2002-2006.

1 **Q. HAS STAFF IDENTIFIED ANY PROBLEMS WITH THE PROSYM INPUTS**
2 **USED IN PUBLIC SERVICE’S PROPOSED METHOD TO CALCULATE THE**
3 **CAPACITY AVAILABILITY FACTOR?**

4 **A.** Yes. First, Staff could not verify the capacity of the CT and the interruptible load used in
5 the PROSYM study. Public Service witness Alan Taylor described that he made a
6 request to the Company to remove the interruptible load program from the base case;
7 however, Staff could not verify the interruptible load in MW used in the PROSYM study.
8 Public Service’s discovery response on this subject shows that the interruptible load used
9 in the PROSYM was a sum of “CFI Arc furnace and other interruptible load – including
10 the Saver’s Switch load”. (See Exhibit LYS–2) The data in the Attachment to CPUC 12-
11 3, however, shows that the total size of the CT used in the PROSYM for 2007 was about
12 115.29 MW including the Saver’s Switch load, which is about 4.7 MW less than the
13 existing CIL amount of 120 MW.

14 Second, Public Service did not use the correct CT in the PROSYM study. The
15 CT used in the PROSYM study to derive capacity availability factors is an “appropriately
16 sized” frame CT and not the GE LMS100 CT. Public Service should have used the GE
17 LMS100 CT because the vast majority of the interruptible load, about 90%, is contributed
18 by the less than 10-minute notice option participants. Staff raises this issue because the
19 GE LMS100 CT has a much lower heat rate than a frame CT. While Staff does not know
20 whether a different type of CT in the PROSYM study will make a material difference to
21 the resulted capacity availability factors, Staff believes in any event that the use of the
22 “appropriately sized” frame CT was in error.

1 **Q. HAS STAFF IDENTIFIED ANY ADDITIONAL PROBLEMS WITH THE**
2 **PROSYM ANALYSIS USED IN PUBLIC SERVICE’S PROPOSED METHOD TO**
3 **DERIVE THE CAPACITY AVAILABILITY FACTOR?**

4 **A.** Yes. Public Service has introduced a lot of uncertainty into the derivation of the capacity
5 availability factor. Public Service uses forecasted load shapes from the five-year period
6 2007-2011 to derive marginal costs and LOLP values and then mixes this data with
7 historical load shapes from the five-year period 2002-2006 to derive the various capacity
8 availability factors it proposes. Such mixing of data sets can produce skewed results,
9 especially when the analysis focuses only on system demand the top 40, 80 or 160 hours
10 in a year.

11
12 **Q. IS IT APPROPRIATE TO RELY ON MARGINAL COST DATA TO DEVELOP A**
13 **CAPACITY AVAILABILITY FACTOR FOR PUBLIC SERVICE’S**
14 **INTERRUPTIBLE PROGRAM?**

15 **A.** No. Staff believes that Public Service’s complex and data intensive approach is
16 inappropriately biased toward high demand hours because on-peak hours will always
17 have a higher marginal cost. An inappropriate bias exists because the capacity or
18 contingency interruptions called by Public Service have not historically occurred during
19 the highest demand hours of the year. Examining actual interruptible events in the last
20 three years, 2005, 2006, 2007, it is undisputed that neither a capacity interruption nor a
21 contingency interruption was called on the peak day, which day has the highest marginal
22 cost during the course of a year. Moreover, Exhibit LYS-3 demonstrates that capacity or
23 contingency interruptions have occurred randomly throughout the year. Importantly,, the

1 marginal and reliability costs developed by Public Service witness Taylor show a
2 marginal cost of zero on certain dates of actual interruptions (for example February 18,
3 2006 and October 27, 2006). The existence of a marginal cost of zero on these dates is
4 not surprising as it reflects the fact that, during the shoulder and off peak months, Public
5 Service's power system has excess capacity available and has no need to run a CT.
6 Marginal costs, therefore, should not be a factor in determining the capacity availability
7 factor.

8
9 **Q. DOES STAFF HAVE A SEPARATE BASIS FOR RECOMMENDING**
10 **REJECTION OF THE "4 HOURS IN ANY 24-HOUR PERIOD" OPTION?**

11 **A.** Public Service's proposed option to limit interruption to no more than 4 hours in any 24-
12 hour period will limit the ability to call capacity and contingency interruptions as
13 necessary. It also reduces the value of the ISOC program because, if Public Service must
14 end a capacity interruption as to certain ISOC program participants prematurely, then
15 Public Service will either need to schedule rolling black outs or import expensive power.
16 Given that Public Service has frequently called capacity interruptions for longer than 4
17 hours, Staff views the no more than 4 hours in any 24-hour period as such a significant
18 constraint that it should not be offered.²

² In the event the Commission rejects Staff's recommendation and retains the no more than 4 hours in any 24-hour period option, the Schedule ISOC tariff sections entitled Capacity Interruptions and Contingency Interruptions both need to be amended to include the following language (probably as the second sentence): "The Company's ability to call a Capacity [Contingency] Interruption shall not exceed 4 hours in any 24-hour period if Customer has elected that option."

**Q. WHAT IS STAFF'S RECOMMENDATION REGARDING THE CAPACITY
AVAILABILITY FACTOR?**

A. Staff is troubled that Public Service is attempting to derive the capacity availability factor using marginal cost analysis when the historical interruption data demonstrates no correlation to marginal costs and is therefore not representative of Public Service's actual power system operations. Therefore, Staff recommends that Public Service continue to use the capacity availability structure and factors set forth in the existing Schedule ISOC tariff as the best available derivation of the appropriate capacity availability factors. Staff recognizes that Public Service would want to update these factors from time to time to reflect the actual power system operations and would likely recognize the need for such updates.

C. THE AVOIDED ENERGY RATE

**Q. IS STAFF CONCERNED ABOUT THE EQUATION TO COMPUTE THE
AVOIDED ENERGY RATE?**

A. Staff is concerned that a load factor of 50% used by Public Service to convert the avoided energy cost in \$/kWh into capacity cost in \$/kW is unreasonably high for a CT. Staff examined the monthly generation of CTs either owned by Public Service or under contract with Public service for the last three years (2005, 2006, and 2007). The data obtained from this examination is set forth on Exhibit LYS-4. The results show that the weighted average load factor for CTs that can generate electricity on less than 10 minutes notice is 3.11%. CTs that need more than 10-minute notice had an average weighted load factor of 13.65%. The highest load factor for a CT was about 25%. The historical load

1 factors are better inputs into the avoided energy rate component of the monthly credit rate
2 equation and should therefore be used. However, because of the minimal impact on the
3 total monthly credit rate to be paid to an ISOC customer, Staff recommends rounding the
4 load factors up a little. Staff recommends using a load factor of 5% for the less than 10-
5 minute notice customers (based on the GE LMS100 CT) and a load factor of 15% for the
6 one hour notice customers (based on the frame CT).

7 Another concern is the generic heat rate used in the calculation of the avoided
8 energy cost. Public Service proposes to use a generic heat rate of 10450 Btu/kWh for
9 both the frame and the GE LMS100 CT. In response to Staff's discovery, Public Service
10 indicated that the estimated heat rate for GE LMS100 CT is about 8862 Btu/kWh. Staff
11 believes that this heat rate should be used to calculate the avoided energy costs.

12 In summary, because the avoided energy, which is the benefit to non-participants,
13 is very small as compared to the avoided capacity costs, the suggested changes will have
14 insignificant impact to the monthly credit rate. However, even though small, Staff
15 recommends Public Service use the correct data to calculate the avoided energy costs.
16

17 **D. CONCLUSION REGARDING THE MCR**

18 **Q. PLEASE SUMMARIZE YOUR DISCUSSION ON THE MCR**

19 **A.** Staff has put forth a number of suggested modifications to the MCR equation as well as
20 some criticisms that might lay the groundwork for future additional modifications to the
21 inputs to the MCR equation. As a result of the modifications proposed here, Staff has
22 developed the MCR equation that it believes should be used in the Schedule ISOC tariff.

Exhibit LYS-5 presents Staff's proposed MCR equation alongside the equation presently in effect and the equation proposed by Public Service in this proceeding.

IV. THE MONTHLY CREDIT AND ITS RELATIONSHIP TO INTERRUPTIBLE DEMAND

Q. HOW MUCH CREDIT DID PUBLIC SERVICE PAY TO ISOC PROGRAM PARTICIPANTS IN 2006 AND 2007?

A. Exhibit LYS-6 shows the actual percentage of each ISOC program participant's bill attributable to its monthly interruptible credit for 2006 and 2007. The percentages range from a low of about 3% to a high of about 33%. As expected, the less than 10-minute notice ISOC program participants generally had a higher credit ratio than the one-hour notice participants.

Q. HOW DOES PUBLIC SERVICE CALCULATE THE MONTHLY CREDIT?

A. As stated in the tariff, the Monthly Credit is calculated by multiplying the monthly credit rate (MCR) by the lesser of the customer's Contract Interruptible Load or the actual Interruptible Demand during the billing month. Typically, the lesser amount is the Interruptible Demand.

Q. HOW INFLUENTIAL IS THE INTERRUPTIBLE DEMAND COMPONENT TO THE AMOUNT OF THE BILL CREDIT PAID TO THE ISOC PROGRAM PARTICIPANTS?

1 **A.** This component carries is very influential because it is probably the most individualized
2 component of the monthly credit that is paid to ISOC program participants. The actual
3 Interruptible Demand carries a lot of weight because the program participant's load curve
4 forms the basis for this component. Presently, the monthly credit paid out pursuant to the
5 Schedule ISOC tariff looks only to the maximum 15-minute point in each peak hour to
6 determine the actual Interruptible Demand. By setting the Interruptible Demand in this
7 manner, the ISOC program from a demand response perspective, values program
8 participants with flat and fluctuating load curves equally even though a program
9 participant with a flat load curve is much more valuable to the ISOC program. It is
10 because the ISOC tariff values customers with flat and fluctuating load curves equally
11 that there is such a wide range in the percentage of the participant's bill attributable to the
12 monthly interruptible credit.

13
14 **Q. HOW DOES PUBLIC SERVICE PROPOSE TO DERIVE THE INTERRUPTIBLE**
15 **DEMAND?**

16 **A.** In this filing, Public Service proposes to use the maximum daily one-hour integrated kW
17 demands occurring between the hours of 12:00 noon to 8:00 pm Monday through Friday,
18 excluding federal holidays. By averaging the four data points obtained during the hour
19 from the demand meter, Public Service is deemphasizing the program participant's peak
20 demand within each hour. The proposed modification to the method for deriving
21 Interruptible Demand (and, similarly, Contract Interruptible Load) is an improvement of
22 the existing method, albeit a very modest improvement.

23

1 **Q. DOES PUBLIC SERVICE’S PROPOSED MODIFICATION TO THE METHOD**
2 **BY WHICH IT DERIVES INTERRUPTIBLE DEMAND MAKE THE**
3 **CALCULATION COMPORT WITH THE PUBLIC INTEREST?**

4 **A.** No.

6 **Q. WHY DOES STAFF BELIEVE ADDITIONAL CHANGES TO THE**
7 **DERIVATION OF INTERRUPTIBLE DEMAND SHOULD BE MADE TO**
8 **COMPORT WITH THE PUBLIC INTEREST?**

9 **A.** Staff has begun examining the load curves of the ISOC program participants to try to
10 assess the relationship between the demand associated with the derivation of the
11 Interruptible Demand and the actual demand. Highly Confidential Exhibit LYS-7 shows
12 the demand variation of six customers on July 24, 2006, a date when Public Service
13 called a capacity interruption. For customers with a very high load factor, the 15-minute
14 demand meters provide adequate information about the demand to derive an actual
15 Interruptible Demand that is reasonably representative of the customer’s actual loads.
16 However, for customers that have a low load factor and large demand swings in a
17 relatively short period of time, the 15-minute demand meter cannot capture the load
18 variation accurately enough. If one then uses incorrect demand information, it is not
19 possible to derive an actual Interruptible Demand that reasonably represents the
20 customer’s actual loads. For such customers, the actual Interruptible Demand component
21 of the Monthly Credit is likely to be higher than the actual demand that can be relied upon
22 in the event of an interruption. Similarly, the ISOC program participant could be paid a

1 Monthly Credit that significantly exceeds the value of that program participant to a
2 demand response program like ISOC.
3

4 **Q. WHAT ADDITIONAL CHANGES TO THE DERIVATION OF THE**
5 **INTERRUPTIBLE DEMAND COMPONENT SHOULD PUBLIC SERVICE**
6 **MAKE?**

7 **A.** Staff recognizes that there are numerous ways to derive a reasonable interruptible
8 demand. Such methods could include performing a probability analysis to determine
9 how much demand a program participant is likely to have when an interruption event
10 commences or assessing a penalty if the customer has less load than predicted by the
11 actual Interruptible Demand component of the monthly credit. At this time and based on
12 the information reviewed to date, Staff recommends deriving actual Interruptible Demand
13 on the basis of the average kW for the billing month, which average kW is the total
14 energy consumed in a month divided by the total number of hours in the month.

15 In conjunction with this proposal, Staff has examined the effect of this proposal
16 on the current ISOC program participants. The results of Staff's analysis are depicted on
17 Exhibit LYS-8. To arrive at the percentages, Staff averaged the 2006 and 2007 data for
18 each of the four months presented. Further, for ease of presentation Staff has used each
19 ISOC program participants Contract Interruptible Load as a proxy for its actual
20 Interruptible Demand.

21 Staff believes that this is a fair method to determine how much demand reduction
22 an ISOC program participant can be expected to actually provide in the event an
23 interruption is called.

1
2 **Q. IN CONJUNCTION WITH YOUR CRITICISM OF THE INTERRUPTIBLE**
3 **DEMAND COMPONENT OF THE MONTHLY CREDIT, DOES STAFF HAVE**
4 **ANY RELATED RECOMMENDATIONS?**

5 **A.** Yes. It appears that the 15-minute demand meter may not be able to record peak demand
6 in an effective manner for purposes of the ISOC program bill credits. While the existing
7 15-minute demand meter may provide good data for billing purposes, it limits Public
8 Service's ability to accurately record the ISOC program participant's load when an
9 interruption event occurs. Staff suggests that Public Service explore the possibility of
10 replacing all 15-minute demand meters for ISOC program participants that select the less
11 than 10-minute notice option to a meter that will have the capability to accurately record
12 demand in less than 10-minute intervals and will provide "granularity" of demand
13 information for Public Service to manage the ISOC program effectively.

14
15 **V. INCENTIVE**
16

17 **Q. WHAT IS THE INCENTIVE PROPOSED BY PUBLIC SERVICE?**

18 **A.** Public Service proposes to retain 12.5 % of the ISOC credit as an incentive if it can
19 successfully market the ISOC program.
20

21 **Q. DID PUBLIC SERVICE PROPOSE ANY CRITERIA TO OBTAIN THE**
22 **INCENTIVE OF 12.5 %?**

1 **A.** No. Public Service does not propose a method or criteria to calculate the proposed
2 incentive of 12.5% of the ISOC monthly credit. Furthermore, Public Service does not
3 propose any way to determine or measure the success of the ISOC program.

4
5 **Q. IS THE 12.5% INCENTIVE TO PUBLIC SERVICE FAIR AND REASONABLE**
6 **TO RATE PAYERS?**

7 **A.** Staff is very concerned about this self serving assumption. Rate payer funds, not
8 shareholder funds, are used to provide the credits paid to the ISOC program participants.
9 The payment to the ISOC program participants is based on the estimated costs of the
10 ISOC program. There should not be any excess funding of this program. Any artificial
11 increase in the evaluation of ISOC credit payment is wrong and will increase the
12 DSMCA rate paid by ratepayers.

13
14 **Q. WHAT OTHER REASONS EXIST FOR STAFF’S OPPOSITION TO THE**
15 **INCENTIVE PROPOSED BY PUBLIC SERVICE?**

16 **A.** Staff believes that Public Service is mistakenly considering the ISOC as another DSM
17 program that would reduce the peak demand permanently. Unlike DSM programs such
18 as the energy efficiency program, which may cause a long-term load reduction in
19 customer’s demand, the ISOC program is utilized when the power system is under stress
20 or in an unexpected contingency situation. Staff agrees that DSM programs that produce
21 permanent reduction in demand should have some mechanism or provision to provide
22 incentive to Public Service in return for promoting efforts to reduce load and in turn
23 revenue. However, the interruptible load program is not a program that reduces load

1 permanently. The ISOC program essentially causes program participants to use power at
2 a different time period or during a period when the power system is not under stress or
3 under a capacity shortage situation. As compensation for the occasional and infrequent
4 inconvenience, Public Service is offering to pay a monthly credit, using funds collected
5 from ratepayers, to commercial and industrial customers that choose to participant in the
6 ISOC program. The customer's peak load and energy consumption will remain
7 unchanged unless customers change existing equipment.

8
9 **Q. DOES PUBLIC SERVICE RECEIVE ANY BENEFIT FROM OFFERING THE**
10 **ISOC PROGRAM EVEN IN THE ABSENCE OF AN INCENTIVE?**

11 **A.** Yes. Public Service will benefit by reducing its operating reserve requirements and by
12 having additional flexibility to operate its power system. By leveling power usage,
13 Public Service increases its load factor and system efficiency. In addition, it will cost
14 Public Service less to serve the ISOC program participants' load because most of the load
15 will shift to light load or off peak periods. Further, Public Service will either not have to
16 serve the load during peak periods or, if a buy-through is elected, will be able to charge
17 the ISOC program participant for the highest cost block of electricity consumed in each
18 buy-through hour.

19
20 **VI. MISCELLANEOUS ISSUES**

21
22 **Q. WHAT OTHER ISSUES CAUSE CONCERN TO STAFF?**

1 **A.** The Commission, in Decision No. C07-0559, ordered the ISOC workshop participants to
2 address the following issues: (1) optimizing the use of available interruptible hours, and
3 (2) the cost and benefit of the ISOC program.
4

5 **Q. PLEASE DISCUSS THE OPTIMIZATION OF AVAILABLE INTERRUPTIBLE**
6 **HOURS.**

7 **A.** Public Service proposes that if the Company uses at least 80 % of the ISOC program
8 participant's potential annual hours of interruption then such usage of hours will be
9 automatically deemed prudent and entitle Public Service, all other things being equal, to
10 fully recover the monthly credit payments through the DSMCA it will not require the
11 Company to justify its action. Staff does not believe this is a reasonable expectation.
12 Staff believes that Public Service should make every effort to use all available
13 interruptible hours within the year. An 80% utilization of interruptible hours without
14 further justification is an unacceptably low target. Staff, however, does not demand
15 perfection; Staff believes that Public Service should however be required to provide a
16 justification to the Commission each year that it does not use up all available interruptible
17 hours. The Commission would then determine whether Public Service should be entitled
18 to full recovery of the monthly credit payments on the facts presented.
19

20 **Q. PLEASE DISCUSS PUBLIC SERVICE'S TESTIMONY REGARDING THE**
21 **COST AND BENEFIT OF THE ISOC PROGRAM.**

22 **A.** Public Service did not "evaluate the usefulness and purpose of preparing a cost-benefit
23 analysis relating to the ISOC program and methodology to be used in preparing such an

1 analysis” as ordered by the Commission in Docket No. 06S-642E. In Public Service’s
2 2005 ISOC cost and benefit analysis report, Public Service stated that “intermittent
3 generation resources will play a principal role in the valuation process for the ISOC
4 program as they have a direct impact on the system reserve dynamic.” Public Service has
5 acknowledged that the addition of wind resources have highlighted the need to have
6 resources that can respond to load drops in 10 minute and even one hour time frames.
7 But it is unclear how much of these load drops can be reliably covered by ISOC
8 subscriptions. Staff recommends that Public Service conduct a study within the next six
9 months to evaluate and quantify the benefit contributed by the ISOC program to the
10 operation of the Company’s power system and determine correctly the responsiveness of
11 this demand to a request for reduction.

12 13 **VII. RECOMMENDATIONS**

14 15 **Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS**

16 **A.** Staff recommends the Commission order Public Service to:

- 17 1) Use seasonal capacity to compute the avoided capacity costs;
- 18 2) Use average MW to determine the Interruptible Demand;
- 19 3) Correct for errors in the equation that is used to calculate the monthly credit
20 rates;
- 21 4) Use the current capacity availability factors to calculate the monthly credit rate;
- 22 5) Conduct additional studies to reflect the actual power system operation to
23 evaluate the capacity availability factors;

1 6) Use all available interruptible hours absent a reasonable explanation for not

2 doing so;

3 7) Address the cost-benefit analysis within the next six months.

4

5 **Q. DOES THIS CONCLUDE YOUR TESTIMONY AT THIS TIME?**

6 **A. Yes.**

APPENDIX A

STATEMENT OF QUALIFICATIONS

OF

Larry Y. Shiao

I began my employment with the Commission in August 2001 as a staff engineer in the Fixed Utilities section. In my current position, I have the responsibility to review and evaluate the engineering portion of the regulated utilities filings before the Commission to ensure their compliance with the Commission's rules and that regulated utilities use sound engineering judgment and good utility practices.

I have a MS degree in Civil Engineering from the University of Missouri at Rolla and a PhD degree in Civil Engineering from the Colorado State University. I have also completed graduate level Electrical Engineering classes from the University of Colorado and the University of Idaho. In addition, I have taken short courses on power system planning and production simulation and regional transmission planning. I am a registered professional engineer in Colorado.

Prior to joining the Commission, I have worked as a professional engineer in consulting companies as well as at a Federal power marketing agency and as a research associate in an academic environment for more than 25 years in various phases of water and power resource development, feasibility, utilization and operational studies.

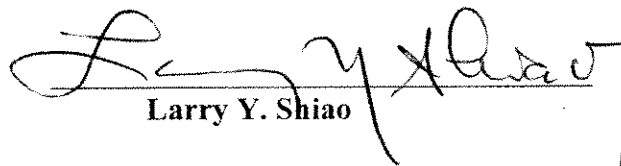
**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO**

DOCKET NO. 07S-521E

IN THE MATTER OF ADVICE NO. 1495 - PUBLIC SERVICE COMPANY OF
COLORADO REVISION TO THE INTERRUPTIBLE SERVICE OPTION CREDIT
(ISOC) TARIFF - ELECTRIC.

**AFFIDAVIT OF LARRY Y. SHIAO
STAFF OF THE COLORADO PUBLIC UTILITIES COMMISSION**

I, Larry Y. Shiao, being duly sworn, state that the attached testimony and exhibits were prepared by me or under my supervision, control, and direction; that the testimony and exhibits are true and correct to the best of my information, knowledge and belief; and that I would give the same testimony orally and would present the same exhibits if asked under oath.


Larry Y. Shiao

Subscribed and sworn to before me in the County of Denver, State of Colorado,
this 24th day of March 2008.


NOTARY PUBLIC

My Commission expires:

6/30/09

Calculation of Avoided Capacity Cost

	PSCo Existing				PSCo Proposed				Staff Proposal			
	<10 minute Notice		One -hour Notice		<10 minute Notice		One -hour Notice		<10 minute Notice		One -hour Notice	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Generic Capacity Payment ('C)	\$5.17	\$5.17	\$5.17	\$5.17	\$6.91	\$6.91	\$6.91	\$6.91	\$13.47	\$11.26	\$6.91	\$5.77
AGC Adjustment (A)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
Reactive Power Adjustment ('R)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
Transmission Loss Factor-(Tlf)	1.0256	1.0256	1.0256	1.0256	1.0256	1.0256	1.0256	1.0256	1.0256	1.0256	1.0256	1.0256
Net Costs (See ATS-1 for Row Title)	\$4.79	\$4.79	\$4.79	\$4.79	\$6.57	\$6.57	\$6.57	\$6.57	\$13.30	\$11.04	\$6.57	\$5.40
Reserve margin (Rm)					16%	16%	16%	16%	16%	16%	16%	16%
Rm Adjusted-Net Cost					\$7.63	\$7.63	\$7.63	\$7.63	\$15.43	\$12.80	\$7.63	\$6.27
Notification Factor (Nf)	182%	182%	100%	100%	202%	202%	100%	100%				
Rm+Nf Adjusted Net Cost					\$15.43	\$15.43	\$7.63	\$7.63	\$15.43	\$12.80	\$7.63	\$6.63
Seasonal Ratio Adjustment	130%	85%	130%	85%	115%	90%	115%	90%				
Rm+Nf+Sr Adjusted Net Cost					\$17.75	\$13.89	\$8.77	\$6.86	\$15.43	\$12.80	\$7.63	\$6.63
Credit Adjustment Factor-CAF					80%	80%	80%	80%	80%	80%	80%	80%
Fully Adjusted Net Cost	\$11.33	\$7.41	\$6.23	\$4.07	\$14.20	\$11.11	\$7.02	\$5.49	\$12.34	\$10.24	\$6.10	\$5.02

In the Matter of Advice Letter 1495-Electric)	Twelfth Set of Discovery Requests
Public Service Company of Colorado - Revision)	Of the CPUC Staff - Beckett
To Interruptible Service Option Credit Tariff)	Served On Public Service Company
Docket No. 07S-521E)	March 5, 2008

DISCOVERY REQUEST NO. CPUC12-3:

Referring to Mr. Alan Taylor's direct testimony at page 10, lines 9-13, please define the "interruptible load program" and provide supporting materials to show the PROSYM model input data before and after removing "the interruptible load program."

RESPONSE:

The interruptible load program was defined in the ProSYM Model as that amount of interruptible load from the CFI Arc furnace and other interruptible load – including the Saver's Switch load.

Attachment CPUC12-3 is a ProSYM data file that identifies the interruptible input data. When removing the interruptible load program the modeler simply removes the entire file from the program call list and models the interruptible capacity as explained in the above referenced testimony of Alan Taylor.

Sponsor: Art Warren

Response Date: March 20, 2008

Capacity & Contingency Interruptions

Year	2005	2006	2007
Peak Day	7/21	7/19	7/24
Capacity/contingency Interruptions	7/12	2/18	2/14
	7/13	7/24	4/6
	7/14	10/27	4/7
			4/8
			5/10
			9/18
			12/11

Historical Load Factor of Combution Turbine

	<10-minutes Notice					
	Alamosa 1	Alamosa 2	Ft. Lupton 1	Ft. Lupton 2	Plains End	Valmont 6
	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH
2005	145	161	1656	1680	50309	301
2006	0	0	1515	1778	39556	643
2007	263	297	4325	3933	113627	5985
AVG	136	153	2499	2464	67831	2310
Total		288		4962	67831	2310
Capacity		36		90	108	43
Load Factor		0.09%		0.63%	7.17%	0.61%
Total Capacity	277					
Weighted Avg	3.11%					

	One Hour Notice							
	Fountain Valley	Valmont 7&8	BlueSpruce 1&2	Spindle Hill 1&2	Manchief 11&12	Fruita	Brighton 1& 2	Brush 1& 3
	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH	Energy in MWH
2005	265249	4942	244331		83908	500	24971	8825
2006	342053	9350	229254		119616	138	18570	9694
2007	449305	17292	489331	505316	338716	4268	238688	37832
AVG	352202	10528	320972	505316	180747	1635	94076	18784
Capacity	246	88	280	300	267	19	150	30
Load Factor	16.34%	1.37%	13.09%	25.52%	7.73%	0.98%	7.16%	7.15%
Total Capacity	1380							
Weight Avg	13.65%							

Note:

1. Did not use Brush 2 & 4
2. Use 6600 hour to calculate the load factor for the Spindle Hill 1 & 2
3. Refer to CPUC 2-4 for combustion turbines.

Monthly Credit Rate (MCR) Comparison

PSCo Existing MCR	
Summer	$MCR = [(\$4.79 * Ca_{Existing} * Nf) + (Av * Ha)] * Slf * 130\%$
Winter	$MCR = [(\$4.79 * Ca_{Existing} * Nf) + (Av * Ha)] * Slf * 85\%$
PSCo Proposed MCR (Including the 80% Credit Adjustment Factor)	
Summer	$MCR = [(\$6.10 * Ca_{Proposed} * Nf) + (Av * Ha)] * Slf * 115\%$
Winter	$MCR = [(\$6.10 * Ca_{Proposed} * Nf) + (Av * Ha)] * Slf * 90\%$
Staff Proposed MCR (Including the 80% Credit Adjustment Factor)	
Summer <10 minute Notice	$MCR = [(\$12.34 * Ca_{Existing}) + (Av_{Staff} * Ha)] * Slf$
Winter < 10 minute Notice	$MCR = [(\$10.24 * Ca_{Existing}) + (Av_{Staff} * Ha)] * Slf$
Summer One Hour Notice	$MCR = [(\$6.10 * Ca_{Existing}) + (Av_{Staff} * Ha)] * Slf$
Winter One Hour Notice	$MCR = [(\$5.02 * Ca_{Existing}) + (Av_{Staff} * Ha)] * Slf$

Percentage of Program Participant's Bill Attributable to Monthly Interruptible Credit

Customer	2006	2007
1	19.48%	32.65%
2	25.82%	32.04%
3	30.29%	28.64%
4	27.71%	24.85%
5	15.02%	15.59%
6	13.04%	14.95%
7	13.70%	14.21%
8	9.48%	8.66%
9		7.79%
10	7.79%	7.77%
11	6.88%	7.56%
12	6.53%	6.97%
13	6.20%	6.54%
14	5.74%	5.74%
15	6.02%	5.53%
16	12.57%	4.16%
17	5.90%	3.71%
18	5.44%	3.38%
19	4.00%	2.90%

Note: Original data from CPUC 8-20 and CPUC 8-37

HIGHLY
CONFIDENTIAL
EXHIBIT LYS-7

Percentage of Average kW to CIL

Customer	July	August	January	December
1	163%	170%	130%	142%
2	132%	130%	51%	67%
3	109%	91%	27%	42%
4	97%	93%	82%	98%
5	95%	101%	87%	90%
6	88%	91%	97%	93%
7	87%	89%	79%	76%
8	85%	88%	90%	89%
9	71%	74%	65%	66%
10	67%	68%	61%	62%
11	62%	53%	21%	46%
12	60%	63%	40%	46%
13	55%	57%	48%	52%
14	50%	46%	30%	38%
15	27%	21%	23%	31%
16	19%	18%	13%	15%
17	15%	16%	10%	9%
18	14%	14%	16%	16%