INDEX

REBUTTAL TESTIMONY OF

ROBERT W. ANDERSON, ROBERT J. PETTY, AUDREY M. PERINO,

AND JEFF KING

Witnesses for Bonneville Power Administration

SUBJECT: Rebuttal Testimony for the Marginal Cost Analysis Study

1	REBUTTAL TESTIMONY OF
2	ROBERT W. ANDERSON, ROBERT J. PETTY, AUDREY M. PERINO,
3	AND JEFF KING
4	Witnesses for Bonneville Power Administration
5	
6	**SUBJECT: REBUTTAL TESTIMONY FOR MARGINAL COST ANALYSIS STUDY**
7	**Section 1. Introduction and Purpose of Testimony**
8	*Q. Please state your names and qualifications.*
9	A. My name is Robert W. Anderson. My qualifications are contained in WP-02-Q-BPA-01.
10	A. My name is Robert J. Petty. My qualifications are contained in WP-02-Q-BPA-58.
11	A. My name is Audrey M. Perino. My qualifications are contained in WP-02-Q-BPA-57.
12	A. My name is Jeff King. My qualifications are contained in WP-02-Q-BPA-35.
13	*Q. Have you previously filed testimony in this proceeding?*
14	A. Yes. We previously sponsored direct testimony on the Marginal Cost Analysis (MCA).
15	*See* Anderson, *et al.,* WP-02-E-BPA-16.
16	*Q. Please state the purpose of your testimony.*
17	A. The purpose of this testimony is to respond to the direct testimony filed by three parties:
18	the direct service industries (DSI) regarding "The AURORA Electric Price Forecasting
19	Model," *see* Schoenbeck and Bliven, WP-02-E-DS/AL/VN/-02; the High Load Factor
20	Group (HLFG) regarding Rate Design, *see* Koehler, *et al.,* WP-02-E-HL-01; and the
21	Northwest Energy Coalition (NWEC), *see* Weiss, WP-02-E-NA-01.
22	*Q. How is your testimony organized?*
23	A. This testimony is in four sections (plus subsections) including this introductory section.
24	The second section responds to the DSIs. The third section responds to the HLFG. The
25	fourth section responds to the NWEC.
26	

Section 2.   Responses to the Direct Service Industries

Summary of the DSIs' Testimony and BPA's Response

Q.   What was the purpose of the DSIs' testimony?

A.   As stated by the DSIs (Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02, at 1,
lines 16-17) the purpose is to "… recommend a change of the version of the AURORA
used in the rate case and to recommend changes to the input data set."

*Q.   Do you accept the recommendation to change the version of AURORA used in the rate
case?*

A.   Bonneville Power Administration (BPA) cannot accept the recommendation as given in
the DSIs' testimony (Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02, at 1-60).
BPA's use of AURORA version 3.2.7 (AURORA-v3) in its initial rate proposal
(WP-02-BPA-E-04) was, and still is, reasonable. At the time the initial proposal was
being developed, it was neither necessary nor practical to use versions later than
AURORA-v3. The Hearing Officer, in her order denying Alcoa and Vanalco's motion
to strike BPA's testimony based on AURORA-v3, stated, "What is relevant here is not
the software, but the user's <u>data</u> that was fed into the program." *See* WP-02-O-08, at 4,
Attachment 1. She also noted that, "It is possible that AURORA will change again
before this proceeding is tried next year. If Companies' position is taken seriously, this
case might never be tried because a change in circumstances could then be raised every
time new software is created." WP-02-O-08, at 5.

In addition, as discussed later in this testimony, the proposal for BPA to use
AURORA version 4.6.4 (AURORA-v4) as given in the DSIs' testimony is not
reasonable. The DSIs had numerous problems executing model runs that verified their
direct testimony, as stated in their responses to BPA data requests.

*Q.   Do you accept the recommendation to change the input data set used in the initial
proposal? Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02, at 1-60*

1	A.	BPA cannot accept these recommendations as a whole because the DSIs cannot produce
2		their analysis in a manner such that BPA, or other parties, can verify the computations.
3	Q.	*Have you asked the DSIs to produce the analysis in a manner that BPA could verify?*
4	A.	Yes, in BPA-DS:010 (Attachment 2), BPA asked for the input used to generate the DSIs'
5		results and for the complete output data base supporting the summary results given in the
6		DSIs' testimony.
7	Q.	*What was the DSIs' response?*
8	A.	The DSIs first produced only an input data base. After this was received, the DSIs
9		informed BPA that this input data base was incorrect. In a supplemental response
10		(BPA-DS:010S, Attachment 3), the DSIs produced a second input data base. The DSIs
11		still have not provided an output data base.
12	Q.	*Did you ask for an explanation as to why an output data base was not provided?*
13	A.	Yes, BPA asked this in BPA-DS/AL/VN:039, Attachment 4.
14	Q.	*What was the DSIs' response?*
15	A.	The DSIs responded that, "The requested output file is not available, due to technical
16		problems with AURORA. We have been having problems completing full hourly output
17		runs due to an incompatibility problem within the AURORA code. EPIS attempted to fix
18		the bug, hence our use of Version 4.6.4, which is a sole release to us of Version 4.6."
19	Q.	*Is the output data base important?*
20	A.	Yes. The output data base is important for three reasons. First, it enables BPA to verify
21		the resulting prices from the DSIs' testimony. By not providing a consistent input and
22		output data base, BPA cannot verify that the inputs the DSIs use actually do produce the
23		outputs given in their testimony. Second, the output data base can be used to verify that
24		the DSIs' use of AURORA-v4 was executed successfully. Without the output data base,
25		BPA cannot determine if AURORA-v4 was properly set up and ran without errors.
26		Third, the output data base can also be used to examine a greater breadth of results than

1		the simple summary given in the DSIs' testimony. AURORA models in general have the
2		ability to output a wide variety of specific data such as area loads (annual, monthly, and
3		hourly), transmission flows from area to area, resource output, etc. Without the output
4		data base, BPA cannot verify that the whole of the DSIs' results are internally consistent
5		and reasonable.
6	*Q.*	*Were there other problems in your attempt to verify the DSIs' analysis?*
7	A.	Yes. The DSIs critiqued BPA's estimate of the AURORA-v3 hydro shape factor in their
8		testimony (WP-02-E-DS/AL/VN-02, at 29). BPA requested the DSIs' data and analysis
9		used to derive their recommended hydro shape factor (BPA-DS:009, Attachment 5).
10		When the DSIs responded, they provided only one of the 12 months (December) required
11		to complete an AURORA-v4 (or AURORA-v3) analysis. BPA followed up with a data
12		request for all of the months (BPA-DS/AL/VN:044, Attachment 6).
13	*Q.*	*What was the DSIs' response to the request for a complete set of months?*
14	A.	The DSIs offered a description of their methodology in calculating the hydro shape
15		factors. The DSIs stated (BPA-DS/AL/VN:044), "Because of the way in which the
16		analysis was performed, we did not preserve any interim results, only the template of the
17		analysis, as laid out in the provided spreadsheet. Because December was the last month
18		done, and the last trial performed was the final resulting hydro shape factor, only that
19		data was preserved. We cannot replicate our results because our data base upon which
20		the calculations were performed has changed as a result of error uncovered in preparing
21		earlier data responses. The details and effect of those corrections was provided to you
22		both in data responses and errata. Although the resulting impacts of the corrections on
23		the hydro shape factors would be small, we did not redo our calculations, nor can we
24		replicate the results of our testimony."
25	*Q.*	*What do you conclude from these data requests and responses described in the*
26		*proceeding questions?*

1	A.	BPA is not able to verify or properly review the analysis that the DSIs prepared for their
2		testimony (Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02, at 1-60). We cannot verify
3		the reliability of their results since they were unable to reliably execute AURORA-v4 and
4		the DSIs did not use AURORA-v3 which was made available to all rate case participants.
5		We cannot verify their final conclusions due to lack of an output data set. We cannot
6		verify the calculation of the hydro shape factors. Therefore BPA cannot accept the DSIs'
7		recommendations.
8		*Individual DSI Proposals Accepted By BPA*
9	Q.	*Were there any individual recommendations offered by the DSIs in their testimony that*
10		*BPA agrees with?*
11	A.	Yes. BPA agrees with some of the DSIs' individual recommendations and will
12		incorporate these changes in the final study.
13	Q.	*Please describe the individual recommendations.*
14	A.	The DSIs state that some resources were included in BPA's input data base twice
15		(Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02, at 42, lines 8-12). BPA will delete
16		redundant resources in the final study.
17		The DSIs argue that BPA understates the amount of hydroelectric generation in
18		Canada (Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02, at 33, lines 1-15). BPA will
19		incorporate this change in the final study.
20		The DSIs argue that BPA's MCA used an inflation rate assumption that is
21		inconsistent with BPA's Revenue Requirement Study (WP-02-E-BPA-02A). The DSIs
22		also argue that the inflation rate for 1997 should be set equal to 0 (Schoenbeck and
23		Bliven, WP-02-E-DS/AL/VN-02, at 53, lines 9-16). BPA acknowledges that there was a
24		minor misspecification of the inflation assumption. BPA's inflation assumption in the
25		MCA came from the same source as the Revenue Requirements Study, as shown in
26		Column A, WP-02-E-BPA-02A, at 132. These are also the same annual values used by

Witnesses: Robert W. Anderson, Robert J. Petty, Audrey M. Perino, and Jeff King

1		the DSIs (WP-02-E-DS/AL/VN-02). However, AURORA requires inflation values to be
2		entered into the previous year's input cell. For example, the value for 1998 inflation
3		should be entered in 1997 input cell. BPA entered inflation values in the coincident year
4		cell. Therefore, the inflation values for any year were off by one year. BPA will correct
5		this in the final study. BPA does not agree that the inflation level for 1997 should be set
6		equal to zero.
7		The DSIs argue that the forced outage rate for wind resources should be set at
8		70 percent and the fuel cost should be set to 0 (Schoenbeck and Bliven,
9		WP-02-E-DS/AL/VN-02, at 52, lines 19-22, and at 53, lines 1-2). BPA agrees with this
10		and will incorporate this change in the final study.
11		The DSIs argue that the forced outage rate for solar resources should be set at
12		43 percent and the fuel cost should be set to 0 (Schoenbeck and Bliven,
13		WP-02-E-DS/AL/VN-02, at 53, lines 3-7). BPA agrees with this and will incorporate
14		this change in the final study.

15 ***Discussion on Modeling a Forecast of Cyclical Factors***

16	*Q.*	*The DSIs argue cyclical generation development patterns are ignored by AURORA's*
17		*modeling of resource development. Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02,*
18		*at 44-47. Do you agree?*
19	A.	No. Cyclical generation development patterns are not ignored by AURORA's modeling
20		of resource development. Part of the reason for the existence of cycles is that generation
21		is 'lumpy,' it comes in unit sizes not perfectly matched to the needs of the market at any
22		one moment. AURORA captures this effect. AURORA uses generation unit sizes
23		actually seen in the power generation market. Therefore, the part of any cyclical pattern
24		due to 'lumpy' generation will be captured by AURORA.
25	*Q.*	*The DSIs explain that because AURORA builds and retires resources based on its*
26		*forecast of market prices, AURORA uses 'perfect knowledge' to model resource changes.*

1   *Schoenbeck and Bliven, WP-02-E-DS/AL/VN-02, at 44-50. The DSIs also argue that*

2   *generation developers will follow a pattern that exacerbates a cyclical pattern.*

3   *Therefore, new generation should be exogenously included in AURORA to force the*

4   *model into an over-build cycle. Do you agree?*

5 A. BPA does not agree that an exogenous forecast which causes the model to over-build

6   should be input to AURORA for the purposes of the MCA forecast.

7 Q. *Please explain your reasons.*

8 A. BPA understands that some variables, including perhaps generation development, may

9   exhibit cyclical patterns. However, BPA believes it would be unwise to explicitly

10   forecast one particular cyclical pattern for the specific purpose of the MCA. There are

11   several reasons for this.

12   First, the rate case is for a specific five-year period. If a cyclical forecast is used

13   for the MCA, it could significantly skew the results depending on the exact timing of the

14   cyclical pattern. Forecasting the timing of cycles is a notoriously difficult task in

15   economics. BPA believes a much better method to obtain accurate overall results for the

16   five-year rate period is to use a long-term structural approach. The structural approach

17   will produce reliable estimates, but will not be susceptible to the risk of not accurately

18   forecasting the timing of the cyclical pattern.

19   In addition, to accurately implement a cyclical forecast, BPA would need to

20   include the effects of other cycles that may affect electricity prices. For example,

21   economic cycles may affect loads, natural gas price cycles may affect fuel costs, and

22   weather cycles may also affect loads. The risk of accurately forecasting the timing of

23   these cyclical variables also increases the risk of skewing the results for the rate case

24   period. The DSIs have offered no testimony as to the timing of any other cyclical

25   variables, so their recommendation ignores the complexity of the issue.

26

Witnesses: Robert W. Anderson, Robert J. Petty, Audrey M. Perino, and Jeff King

1	The DSIs have offered no substantive evidence to describe the timing, duration, or
2	amplitude of the generation development cycle they assume. The DSIs also have not
3	offered any evidence on how a cyclical pattern will evolve in the future under electricity
4	deregulation. The DSIs have simply made a judgement as to the amount of future
5	generation development, and then input this into AURORA (Schoenbeck and Bliven,
6	WP-02-E-DS/AL/VN-02, at 47-48). The DSIs have based this judgement on the amount
7	of generation development currently planned and contrasted this to historical patterns.
8	The DSIs' assumption that generation development is at the peak of a cycle is not a
9	necessary conclusion of this data. The current amount of planned generation may well be
10	a response to expectations of future long-term opportunities now opening up in the
11	electric industry due to restructuring, rather than a simple response to short-term cyclical
12	prices.
13	The DSIs argue that AURORA uses 'perfect knowledge' to guide the amount of
14	new resource development. It is true that AURORA uses a market forecast and builds
15	generation corresponding to this forecast. However, the DSIs have merely substituted an
16	exogenous forecast of generation development, based on the DSIs' judgement and
17	knowledge. BPA does not agree that the perfect knowledge of an exogenous forecast is
18	preferable to a forecast developed internally in AURORA.

Section 3.   Responses to the High Load Factor Group

19

20 *Q. HLFG compares the volatility in the MCA forecast to the volatility in the California*

21 *Power Exchange (California PX). Koehler, et al., WP-02-E-HL-01, at 2-6. Is this a*

22 *valid comparison?*

23 A. The comparison may offer a simple starting point for further review, but the comparison

24   also suffers serious weaknesses.

25 *Q. Please describe these weaknesses.*

26

1 A.   The comparison is calculated from actual California PX prices from April 1998 to

2   September 1999. This is not in the rate case time period. The time period for this

3   comparison may be interesting to electricity analysts, but is not directly relevant to the

4   rate case.

5   The HLFG uses the first one and one-half years of operation of the California PX.

6   This is an experimental and unsettled time for the California PX. Electricity traders are

7   still learning how to optimize their use of the California PX. Experimentation is

8   necessary because the California PX is the first market of this kind in the United States.

9   The rules under which the California PX operates are still evolving. The companies

10   involved in the California PX are changing. Legislation affecting the California PX is

11   under review. In summary, the current conditions seen in the California PX are unsettled

12   and may change dramatically in the future. Therefore extrapolating the historical amount

13   of volatility to the future is spurious.

14   The HLFG compares a BPA forecast of Pacific Northwest (PNW) prices and

15   California prices (Koehler, *et al.,* WP-02-E-HL-01, at 2-6). The PNW price responds to

16   different supply and demand conditions than does the California price. For example,

17   California loads peak in the summer while PNW loads peak in the winter. This clearly

18   leads to differences in price volatility for the two regions as one may be experiencing

19   peak loads while the other is not. In addition, California has much more generation from

20   natural gas, while the PNW has much more hydroelectric generation. Therefore,

21   California prices will follow the volatility in gas prices more closely, while the Northwest

22   will follow the volatility of water availability more closely.

23   The historical California PX prices are responses to specific, actual conditions in

24   California. For example, short-term heat waves, generation outages, transmission

25   restrictions, or rainfall may have a strong effect on historical short-term volatility. In

26   contrast, the forecasted MCA prices are aimed at the rate period and use normal

1	conditions for variables such as weather or outages. Therefore, the MCA estimates do
2	not include short-term anomalies that may skew volatility to either a greater or lesser
3	amount.
4	*Q. Does the HLFG offer any concrete suggestions to change the MCA?*
5	A. No. The HLFG does not offer any alternatives. No critique is offered for the data inputs,
6	the methodology, or any aspect of the MCA other than the comparison already noted.
7	**Section 4. Responses to the Northwest Energy Coalition**
8	*Q. NWEC states that the AURORA model as used in MCA is inaccurate because it does not*
9	*model conservation, peak shifting, and interruptibility responses to rate signals. Weiss,*
10	*WP-02-E-NA-01, at 11-12. Do you agree?*
11	A. No. AURORA accounts for these factors in the forecast of load growth. All the
12	responses mentioned affect loads. These load responses to rate signals have existed in
13	the past and will continue in the future. The level and growth rate of BPA's MCA load
14	forecast is consistent with a continuation of these factors.
15	*Q. NWEC states that the AURORA model as used in the MCA is inaccurate because it*
16	*assumes all new generation will be privately financed and that some amount of public*
17	*financing of new generation would result in lower generation costs. Weiss,*
18	*WP-02-E-NA-01, at 11-12. Do you agree?*
19	A. No. BPA believes that only a small amount of new generation may be publicly financed.
20	The small amount of publicly financed generation may have slightly lower costs, but
21	these units are not likely to be on the margin and therefore will not affect marginal costs.
22	*Q. The NWEC states that the AURORA model as used in MCA is inaccurate because it uses*
23	*market-driven prices, including price spikes, to economically trigger new resources. The*
24	*NWEC asserts that in reality some initial price spikes may trigger political action to*
25	*"incent" new resources, conservation, load shifting programs, and new transmission.*
26	

1		*This would lower market prices beyond what they would have been. Weiss,*
2		*WP-02-E-NA-01, at 11-12. Do you agree?*
3	A.	No. BPA believes that the future of electric power bulk marketing in the WSCC will be
4		driven by market forces. BPA believes that a market-driven methodology is the best
5		method to forecast electric power market prices.
6	*Q.*	*Does this conclude your testimony?*
7	A.	Yes.
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		