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IDAHO PUBLIC
UTILITIES COMMISSION

BEFORE THE IDAHO PUBLIC UTILITIES COMMISSION

IN THE MATTER OF THE APPLICATION)	CASE NO. AVU-E-11-01
OF AVISTA CORPORATION FOR THE)	
AUTHORITY TO INCREASE ITS RATES)	
AND CHARGES FOR ELECTRIC AND)	
NATURAL GAS SERVICE TO ELECTRIC)	DIRECT TESTIMONY
AND NATURAL GAS CUSTOMERS IN THE)	OF
STATE OF IDAHO)	CLINT G. KALICH
)	

FOR AVISTA CORPORATION

(ELECTRIC ONLY)

1 I. INTRODUCTION

2 Q. Please state your name, the name of your
3 employer, and your business address.

4 A. My name is Clint Kalich. I am employed by Avista
5 Corporation at 1411 East Mission Avenue, Spokane,
6 Washington.

7 Q. In what capacity are you employed?

8 A. I am the Manager of Resource Planning & Power
9 Supply Analyses in the Energy Resources Department of
10 Avista Utilities.

11 Q. Please state your educational background and
12 professional experience.

13 A. I graduated from Central Washington University in
14 1991 with a Bachelor of Science Degree in Business
15 Economics. Shortly after graduation, I accepted an analyst
16 position with Economic and Engineering Services, Inc. (now
17 EES Consulting, Inc.), a Northwest management-consulting
18 firm located in Bellevue, Washington. While employed by
19 EES, I worked primarily for municipalities, public utility
20 districts, and cooperatives in the area of electric utility
21 management. My specific areas of focus were economic
22 analyses of new resource development, rate case proceedings
23 involving the Bonneville Power Administration, integrated
24 (least-cost) resource planning, and demand-side management
25 program development.

26 In late 1995, I left Economic and Engineering
27 Services, Inc. to join Tacoma Power in Tacoma, Washington.

1 I provided key analytical and policy support in the areas
2 of resource development, procurement, and optimization,
3 hydroelectric operations and re-licensing, unbundled power
4 supply rate-making, contract negotiations, and system
5 operations. I helped develop, and ultimately managed,
6 Tacoma Power's industrial market access program serving
7 one-quarter of the company's retail load.

8 In mid-2000 I joined Avista Utilities and accepted my
9 current position assisting the Company in resource
10 analysis, dispatch modeling, resource procurement,
11 integrated resource planning, and rate case proceedings.
12 Much of my career has involved resource dispatch modeling
13 of the nature described in this testimony.

14 **Q. What is the scope of your testimony in this**
15 **proceeding?**

16 A. My testimony will describe the Company's use of
17 the AURORA_{XMP} dispatch model, or "Dispatch Model." I will
18 explain the key assumptions driving the Dispatch Model's
19 market forecast of electricity prices. The discussion
20 includes the variables of natural gas, Western Interconnect
21 loads and resources, and hydroelectric conditions. I will
22 describe how the model dispatches its resources and
23 contracts to maximize customer benefit and tracks their
24 values for use in pro forma calculations. Finally, I will
25 present the modeling results provided to Company witness
26 Mr. Johnson for his power supply pro forma adjustment
27 calculations.

1 basis the Dispatch Model develops an available resource
2 stack, sorting resources from lowest to highest cost. It
3 then compares this resource stack with load obligations in
4 the same hour to arrive at the least-cost market-clearing
5 price for the hour. Once resources are dispatched and
6 market prices are determined, the Dispatch Model singles
7 out Avista resources and loads and values them against the
8 marketplace.

9 **Q. What experience does the Company have using**
10 **AURORA_{XMP}?**

11 A. The Company purchased a license to use the
12 Dispatch Model in April 2002. AURORA_{XMP} has been used for
13 numerous studies, including each of its integrated resource
14 plans and rate filings after 2001. The tool is also used
15 for various resource evaluations, market forecasting, and
16 requests-for-proposal evaluations.

17 **Q. Who else uses AURORA_{XMP}?**

18 A. AURORA_{XMP} is used all across North America and in
19 Europe. In the Northwest specifically, AURORA_{XMP} is used by
20 the Bonneville Power Administration, the Northwest Power
21 and Conservation Council, Puget Sound Energy, Idaho Power,
22 Portland General Electric, Seattle City Light, Grant County
23 PUD, Snohomish County PUD, and Tacoma Power.

24 **Q. What benefits does the Dispatch Model offer for**
25 **this type of analysis?**

26 A. The Dispatch Model generates hourly electricity
27 prices across the Western Interconnect, accounting for its

1 specific mix of resources and loads. The Dispatch Model
2 reflects the impact of regions outside the Northwest on
3 Northwest market prices, limited by known transfer
4 (transmission) capabilities. Ultimately, the Dispatch
5 Model allows the Company to generate price forecasts in-
6 house instead of relying on exogenous forecasts.

7 The Company owns a number of resources, including
8 hydroelectric plants and natural gas-fired peaking units,
9 which serve customer loads during more valuable on-peak
10 hours. By optimizing resource operation on an hourly
11 basis, the Dispatch Model is able to appropriately value
12 the capabilities of these assets. For example, actual 2008
13 and 2009 on-peak prices were 23% higher than off-peak
14 prices. 2010 on-peak prices were 22% higher. Forward
15 prices for the proforma 2012 period were 30% higher in the
16 on-peak hours at the time this case was prepared. The
17 Dispatch Model forecasts on-peak prices for the pro forma
18 period to average 30% higher than off-peak prices. A
19 graphical representation of the differences in on- and off-
20 peak prices over the proforma period is shown below in
21 Illustration 1.

1 loads. As the Dispatch Model progresses from hour to hour,
2 it "operates" those least-cost resources necessary to meet
3 load. With respect to the Company's portfolio, the
4 Dispatch Model tracks the hourly output and fuel costs
5 associated with portfolio generation. It also calculates
6 hourly energy quantities and values for the Company's
7 contractual rights and obligations. In every hour the
8 Company's loads and obligations are compared to available
9 resources to determine a net position. This net position
10 is balanced using the simulated wholesale electricity
11 market. The cost of energy purchased from or sold into the
12 market is determined based on the electric market-clearing
13 price for the specified hour and the amount of energy
14 necessary to balance loads and resources.

15 **Q. How does the Dispatch Model determine electricity**
16 **market prices, and how are the prices used to calculate**
17 **market purchases and sales?**

18 A. The Dispatch Model calculates electricity prices
19 for the entire Western Interconnect, separated into various
20 geographical areas such as the Northwest and Northern and
21 Southern California. The load in each area is compared to
22 available resources, including resources available from
23 other areas that are linked by transmission connections, to
24 determine the electricity price in each hour. Ultimately,
25 the market price for an hour is set based on the last
26 resource in the stack to be dispatched. This resource is
27 referred to as the "marginal resource." Given the

1 prominence of natural gas-fired resources on the margin,
2 this fuel is a key variable in the determination of
3 wholesale electricity prices.

4 **Q. How does the Dispatch Model operate regional**
5 **hydroelectric projects?**

6 A. The model begins by "peak shaving" loads using
7 system hydro resources. When peak shaving, the Dispatch
8 Model determines which hours contain the highest loads and
9 allocates to them as much hydroelectric energy as possible.
10 Remaining loads are then met with other available
11 resources.

12 **Q. Has the Company made any modifications to the**
13 **EPIS database for this case?**

14 A. Yes. The EPIS database was modified to include
15 various assumptions used in the Company's Integrated
16 Resource Plan. For example, Avista's resource portfolio is
17 modified to reflect actual project operating
18 characteristics. Natural gas prices are modified to match
19 projected forward prices over the pro-forma period,
20 regional resources and loads are modified where better
21 information is known, and Northwest hydro data are replaced
22 with Bonneville Power Administration data.

23

24

III. HYDRO MODELING ASSUMPTIONS

25 **Q. Please provide additional detail on how the**
26 **Company has modeled hydroelectric generation for this case.**

1 A. Avista is modeling the Clark Fork, the Mid-
2 Columbia (Mid-C) projects, and the lower two Spokane River
3 projects (Long Lake and Little Falls) identically as we did
4 in the last rate case. For the four upriver (Post Falls,
5 Upper Falls, Monroe Street, and Nine Mile) Spokane River
6 projects, the Company is now using its Avista Hydro
7 Optimization model; the same model was adopted for use in
8 the last case for the Clark Fork system.

9 Avista uses historical streamflow data from the
10 Bonneville Power Administration ("BPA") for the Clark Fork
11 and the four up-stream Spokane River projects. For the
12 Mid-C and two lower Spokane River projects, where the
13 Company does not have adequate data to model them, NWPP
14 generation values are used just as in previous rate cases.
15 As in previous cases, the NWPP data are modified slightly
16 to address the NWPP model's tendency to overstate
17 generation in high-flow periods, to maintain year-to-year
18 consistency in project operations, to account for
19 encroachment on our Mid-C project shares, and to allow for
20 year-2000 irrigation depletion levels. These
21 modifications, taken from the 2004 BorisMetrics study, were
22 accepted by the Commission in previous filings.

23 **Q. Why is the Company not using the Avista Hydro**
24 **Optimization Model and is instead continuing to rely on the**
25 **methodology of the last rate case for Long Lake and Little**
26 **Falls?**

1 A. The BPA daily hydrological record prior to 1986
2 appears to be subject to data errors with regard to the
3 daily shaping of the monthly record. The Spokane River
4 projects above Long Lake are "run-of-river" and simpler to
5 model hydraulically; therefore, the BPA data still does
6 provide valid results. However, given the concerns with
7 the BPA data for the two lower projects, the Company has
8 elected to continue with using NWPP generation results in
9 this case for Long Lake and Little Falls. Once better data
10 are available on a daily granularity level, the Company
11 will include these projects in the Avista Hydro
12 Optimization Model.

13 **Q. What hydroelectric record is being used in this**
14 **case?**

15 A. 1929-1998.

16 **Q. How is the generation then used for ratemaking**
17 **purposes?**

18 A. The monthly generation levels for each project
19 (Mid-C, Spokane River, and Clark Fork) are input into the
20 dispatch model (AURORAxmp) where Avista's portfolio value
21 is quantified for ratemaking purposes.

22 **Q. Please describe the Avista Hydro Optimization**
23 **Package.**

24 A. The Avista Hydro Optimization Package is a mixed-
25 integer linear programming-based system emulating the
26 operation of the Company's projects. It was developed in
27 support of system operations, financial forecasting, and

1 hydro upgrade efforts. Operating on an hourly time-step,
2 they accurately represent individual turbine and reservoir
3 operations. License constraints (e.g., minimum flows,
4 elevation limits) are honored in all periods. The
5 optimization package is comprised of four components.

6 **Q. What is the first component of the Avista Hydro**
7 **Optimization Package?**

8 A. The first component is the Avista Hydro Water
9 Budget Model. The most important aspect of looking over
10 the longer record of water flow optimization is to ensure
11 that storage water is released during the most valuable
12 times of the year. As with other third-party hydro
13 optimization routines, water flow is determined over the
14 longer record by simplifying the optimization. Each
15 project is represented by one power curve instead of
16 multiple curves representing individual turbines. Tailrace
17 impacts are ignored. Model granularity is reduced to daily
18 rather than hourly time steps. Project elevation and flow
19 constraints are retained.

20 Outputs are weekly beginning and ending project
21 elevations for each storage project. These elevations are
22 exported to the second module of the Avista Hydro
23 Optimization Package—the Avista Hydro Optimization Model
24 Input Database.

25 **Q. What is the source for hydroelectric flows in the**
26 **Avista Hydro Water Budget Model?**

1 A. The model uses BPA daily flow data derived from
2 the U.S. Army Corp of Engineers monthly flow study. This
3 work re-creates historical flows on Avista hydro projects
4 back to 1929 based on today's river system.² This data is
5 housed in the Avista Hydro Optimization Model Input
6 Database, the second element of the Avista Hydro
7 Optimization package.

8 **Q. What is the third element of the Avista Hydro**
9 **Optimization Package?**

10 A. The third element is the Avista Hydro Optimization
11 Model itself. This hourly model uses a mixed-integer
12 optimization routine to maximize the value of the
13 hydroelectric projects over time. Each project is
14 represented in detail, including individual turbine
15 efficiency curves, physical and license-constrained
16 reservoir elevations, tailrace elevations, and minimum and
17 maximum flow constraints.

18 The Avista Hydro Optimization Model shapes generation
19 into the most beneficial (i.e., most economic) time periods
20 using the projects' storage reservoirs. It also maximizes
21 the value of the generation by flowing water through the
22 turbines at their most economically efficient points on the
23 power curves.

24 **Q. What is the fourth element of the Avista Hydro**
25 **Optimization Package?**

² Accounting for additional irrigation depletion, new in-river developments, and present regulation requirements due to environmental requirements.

1 A. The fourth element is the Avista Hydro
2 Optimization Model Output Database. This database contains
3 the results from the Avista Hydro Optimization Model,
4 including hourly turbine discharge and spill flows, hourly
5 generation levels, hourly generation values, and hourly
6 reservoir elevations.

7 **Q. How did the Company ensure that the Avista Hydro**
8 **Optimization Package accurately reflects the operations and**
9 **value of Company-owned projects?**

10 A. The Avista Hydro Optimization Package is
11 benchmarked against the Company's 2000-2009 actual results
12 at the projects to ensure its accuracy.

13 **Q. How did the initial results compare, and how was**
14 **the package adjusted to match with the 10-year record?**

15 A. The Avista Hydro Optimization Package initially
16 over-estimated generation relative to the 2000-2009 periods
17 by approximately 5.5 percent for the Noxon project. It
18 understated generation by 0.6 percent for the Cabinet Gorge
19 project. For the four upper Spokane River projects,
20 generation was overstated by between 5% and 18%. These
21 results were expected, as Avista does not operate its
22 projects in isolation. Instead the Company uses its hydro
23 projects to meet all of its needs, including operating
24 reserves. There are also times where units are out on
25 maintenance or forced outage. To synch the Avista Hydro
26 Optimization Package to history the power curves for each
27 project were therefore adjusted by the differences

1 described above. After the benchmarking process, the model
2 generated levels equal to actual generation during the
3 2000-2009 period. The adjustments are presented below in
4 Table No. 1.

5 **Table No. 1 - Avista Hydro Optimization Benchmarking**
6 **Adjustments**

Projects	Model Overestimating Percentage (%)	Model Underestimating Percentage (%)	Applied Benchmark Adjustment Percentage (%)
Noxon Rapid	5.5		105.5
Cabinet Gorge		0.6	99.4
Post Falls	16.8		116.8
Upper Falls	12.2		112.2
Monroe Street	4.7		104.7
Nine Mile	18.3		118.3

7

8 **Q. Are the hydro models included in the Company's**
9 **filing?**

10 A. Yes. All four components of the Avista Hydro
11 Optimization Package for each major Company hydro system
12 (Spokane River and Clark Fork River) are included in my
13 work papers, including all input and output data.

14 **Q. Does the Avista Hydro Optimization Package account**
15 **for recent upgrades at the Noxon Rapids project?**

16 A. Yes. Once the original model was benchmarked
17 against recent generation years that did not benefit from
18 upgrades at Noxon, the newly upgraded units (1, 2, 3, and
19 4) were input into the model to reflect the higher
20 anticipated generation levels. As Unit 4 will not enter
21 service until April 1, 2012, all proforma periods prior to
22 April 2012 include upgrades only to Units 1, 2 and 3.

1 **Q. How much additional generation did the new units**
2 **provide based on your modeling?**

3 A. The Company evaluated generation levels with the
4 old Noxon unit 4, and the newly upgraded unit 4 over the
5 70-year period for this case. Generation levels from the
6 Unit 4 upgrade increased the Clark Fork River generation
7 totals by 8,375 MWh.³

8 **Q. Please explain why the Company developed the**
9 **Avista Hydro Optimization Package.**

10 A. The Avista Hydro Optimization Package is the
11 culmination of ten years of work by the Company to bring
12 in-house a tool to enable true optimization of our hydro
13 facilities. In 2002 the Company acquired the Vista suite
14 from Synexus Global. This tool was used to evaluate system
15 operations and support upgrades at our Noxon and Cabinet
16 projects. It also was used to evaluate various Spokane
17 River upgrades. Because of some problems inherent to that
18 model, and its slow solution times, it was retired in the
19 middle of last decade. After evaluating other options in
20 the marketplace, the Company acquired Riverware from the
21 University of Colorado at Boulder. After working with this
22 tool over a number of years it became apparent that it
23 cannot meet our need for efficient unit-level dispatch
24 modeling.

25 Due to the apparent lack of a strong package for hydro
26 modeling in the marketplace, and the high costs of such

³ On a 12-month basis.

1 packages (the investment in Vista exceeded \$0.5 million and
2 the cost of Riverware has nearly approached that figure),
3 the Company began developing the Avista Hydro Optimization
4 Package in the middle of 2009.

5 **Q. How is the Company using the new Avista Hydro**
6 **Optimization Package in its business operations?**

7 A. The Avista Hydro Optimization Package is an
8 essential tool to assist the Company with optimizing its
9 system operations, both in short- and long-term planning.
10 Its results are also used for Company budgeting and hydro
11 project market valuation studies. It has been used to
12 support various upgrade option studies. Given its speed it
13 is possible to run large hydro-flow records through it, as
14 is necessary for rate filings such as the one before you
15 today. It was used by the Company in its last rate case
16 before the Commission.

17 **Q. How does the AURORAxmp Dispatch Model Operate**
18 **Company-controlled hydroelectric generation resources?**

19 A. The Dispatch Model treats all hydroelectric
20 generation plants within a load area as a single large
21 plant. The Company's hydroelectric plants are on average,
22 however, more flexible than the average plant used in each
23 load area. To account for this additional flexibility, the
24 Company algebraically extracts its plants from the region
25 and develops individual hydro operations logic for them.
26 Company-controlled hydroelectric resources are separated
27 into three river systems: the Spokane River, the Clark

1 Fork River, and individually separate the Mid-Columbia
2 projects. This separation ensures that the flexibility
3 inherent in these resources is credited to customers in the
4 pro forma exercise.

5 **Q. Please compare the operating statistics from the**
6 **Dispatch Model to recent historical hydroelectric plant**
7 **operations.**

8 A. Over the pro forma period the Dispatch Model
9 generates 69% of Clark Fork hydro generation during on-peak
10 hours (based on average water). Since on-peak hours
11 represent only 57% of the year, this demonstrates a
12 substantial shift of hydro resources to the more expensive
13 on-peak hours. This is identical to the five-year average
14 of on-peak hydroelectric generation at the Clark Fork
15 through 2010. Similar relative performance is achieved for
16 the Spokane and Mid-Columbia projects

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18 **IV. OTHER KEY MODELING ASSUMPTIONS**

19 **Q. Please describe your update to pro forma period**
20 **natural gas prices.**

21 A. Natural gas prices for this filing are based on a
22 3-month average from November 9, 2010 to February 8, 2011
23 of calendar-year 2012 monthly forward prices.

24 Natural gas prices used in the Dispatch Model are
25 presented below in Table No 2.

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Table No. 2 - Pro Forma Natural Gas Prices

Basis	Price (\$/dth)	Basin	Price (\$/dth)
AECO	4.37	Stanfield	4.62
Malin	4.70	Sumas	4.69
Spokane	4.85	Henry Hub	5.02
Rockies	4.61	S. Calif.	4.83

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Q. What is the Company's assumption for rate period loads?

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A. Pro forma loads used in this case are weather-adjusted 2010 loads adjusted downward to reflect the energy efficiency load adjustment testified to by Company witness Mr. Ehrbar. Table No. 3 below details actual, weather-adjusted, and weather-adjusted plus energy- efficiency-reduced ("DSM Adjusted") 2010 loads by month and in total for the year.

12

Table No. 3 - Pro Forma Loads

Month	Actual	Weather Adjusted	DSM Adjusted	Month	Actual	Weather Adjusted	DSM Adjusted
Jan-10	1,176.8	1,231.0	1,198.5	Jul-10	1,067.2	1,067.2	1,045.4
Feb-10	1,131.6	1,182.3	1,151.8	Aug-10	1,068.9	1,067.8	1,046.0
Mar-10	1,042.9	1,054.8	1,026.0	Sep-10	972.4	986.4	963.3
Apr-10	1,024.9	1,027.1	1,002.1	Oct-10	1,018.9	1,036.8	1,011.8
May-10	973.7	952.1	929.0	Nov-10	1,188.8	1,172.8	1,146.6
Jun-10	965.1	970.9	949.5	Dec-10	1,270.1	1,291.3	1,260.4
				Average	1,075.1	1,086.4	1,060.9

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Q. How are Clearwater Paper's generation and load modeled in this filing?

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A. The Company modeled Clearwater Paper's generation and loads in line with our contracts. Clearwater's entire load is included in the proforma. Its generation is included as a portfolio resource. Generation is represented as 2010 actuals. This representation is a modest change from previous filings where only the net of

1 Clearwater Paper's load and generation was included in the
2 load forecast and no generation was included in the
3 Company's resource portfolio. This change in methodology
4 has no impact on the net power supply expenses being
5 requested in this case. It instead makes modeling simpler,
6 more transparent, and consistent with the Company's IRP
7 modeling.

8 **Q. Please discuss your outage assumptions for the**
9 **Colstrip units.**

10 A. As with our assumptions for other plants, we use
11 a 5-year average through 2010 to estimate long-run
12 performance at the Colstrip plant. The 8.7% forced outage
13 rate is based on this average and is below the 9.4% level
14 in present rates.

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VI. RESULTS

17 **Q. Please summarize the results from the Dispatch**
18 **Model that are used for ratemaking.**

19 A. The Dispatch Model tracks the Company's portfolio
20 during each hour of the pro forma study. Fuel costs and
21 generation for each resource are summarized by month.
22 Total market sales and purchases, and their revenues and
23 costs, are also determined and summarized by month. These
24 values are contained in Confidential Schedule 1C and were
25 provided to Mr. Johnson for use in his calculations. Mr.
26 Johnson adds resource and contract revenues and expenses