Exhibit D-9 DSM Lost Margin and Deferrals

Estimated Lost Margin due to Company DSM for 101 customers during 2007 2008 compared to — From C.3
Estimated annual lost margin under the mechanism — From D.1
Additional margin revenues provided by Schedule 101 as a result of new rates taking effect

New Rates were Effective 1/1/2008
No Rate Case - Compute Mechanism as if 1/1/06 rates were in effect in 2008

		100%			90%		
Month		Existing	No Rate Case	Difference	Existing	No Rate Case	Difference
	Jan-07	($126,606)	($126,606)	$0	($113,945)	($113,945)	$0
	Feb-07	$31,372	$31,372	$0	$28,235	$28,235	$0
	Mar-07	($193,671)	($193,671)	$0	($174,304)	($174,304)	$0
	Apr-07	($93,518)	($93,518)	$0	($84,166)	($84,166)	$0
	May-07	($76,847)	($76,847)	$0	($69,162)	($69,162)	$0
	Jun-07	$77,174	$77,174	$0	$69,456	$69,456	$0
	Jul-07	($38,507)	($38,507)	$0	($34,656)	($34,656)	$0
	Aug-07	($33,953)	($33,953)	$0	($30,558)	($30,558)	$0
	Sep-07	$88,875	$88,875	$0	$79,988	$79,988	$0
	Oct-07	($264,463)	($264,463)	$0	($238,016)	($238,016)	$0
	Nov-07	($278,510)	($278,510)	$0	($250,659)	($250,659)	$0
	Dec-07	($133,934)	($133,934)	$0	($120,541)	($120,541)	$0
2007 Total		($1,042,587)	($1,042,587)	$0	($938,329)	($938,329)	$0
	Jan-08	($136,242)	($410,268)	($274,026)	($122,617)	($369,241)	($246,624)
	Feb-08	$369,207	$44,671	($324,536)	$332,286	$40,204	($292,082)
	Mar-08	($405,409)	($434,165)	($28,756)	($364,868)	($390,749)	($25,881)
	Apr-08	($20,877)	$130,404	$151,281	($18,789)	$117,363	$136,152
	May-08	$107,591	($21,133)	($128,724)	$96,832	($19,019)	($115,852)
	Jun-08	($7,128)	$70,111	$77,239	($6,415)	$63,100	$69,515
	Jul-08	$50,996	$5,032	($45,964)	$45,896	$4,529	($41,367)
	Aug-08	$32,464	($25,950)	($58,414)	$29,218	($23,355)	($52,573)
	Sep-08	($43,362)	($3,431)	$39,931	($39,026)	($3,088)	$35,937
	Oct-08	($90,656)	($138,968)	($48,312)	($81,590)	($125,072)	($43,481)
	Nov-08	($225,463)	($310,682)	($85,219)	($202,917)	($279,614)	($76,697)
	Dec-08	($379,465)	($344,334)	$35,131	($341,519)	($309,900)	$31,618
2008 Total		($748,344)	($1,438,714)	($690,371)	($673,509)	($1,294,843)	($621,334)
2007 Annual Total		($1,042,587)	($1,042,587)	$0			
2008 Annual Total		($748,344)	($1,438,714)	($690,371)			

Modifed 1/07 to 6/07 to reflect no GRC change per Avista response to DR# 10-16.

With Revised New Customer Report this would have been ($108,860) which changes the 90% value to ($97,974)

2008 values captures additional deferrals that would have been made if the GRC rates had not become effective 1/1/08

BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

DOCKET NO. UE-07______

DOCKET NO. UG-07______

DIRECT TESTIMONY OF

TARA L. KNOX

REPRESENTING AVISTA CORPORATION

I. INTRODUCTION

Q. Please state your name, business address and present position with Avista Corporation?

A. My name is Tara L. Knox and my business address is 1411 East Mission Avenue, Spokane, Washington. I am employed as a Rate Analyst in the State and Federal Regulation Department.

Q. Would you briefly describe your duties?

A. I am responsible for preparing the regulatory cost of service models for the Company, as well as providing support for the preparation of results of operations reports.

Q. Would you describe your educational background and professional experience?

A. I am a 1982 graduate of Washington State University with a Bachelor of Arts degree in General Humanities, and a Master of Accounting degree in 1990. As an employee in the Rate Department at Avista since 1991, I have attended several ratemaking classes, including the EEI Electric Rates Advanced Course that specializes in cost allocation and cost of service issues. I have also been a member of the Cost of Service Working Group since 1999, which is a discussion group made up of technical professionals from utilities throughout the United States and Canada concerned with cost of service issues.

Q. What is the scope of your testimony in these proceedings?

A. My testimony and exhibits will cover the Company's electric and natural gas cost of service studies performed for this proceeding and the weather normalization adjustments to retail usage. I also address the issue of common costs in the retail revenue credit.

II. WEATHER NORMALIZATION

Q. Would you please briefly summarize your testimony related to electric weather normalization?

A. Yes. The Company's weather normalization adjustment calculates the change in kWh usage required to adjust actual loads during the 2006 test period to the amount expected if weather had been normal. This adjustment incorporates the effect of both heating and cooling on weather-sensitive customer groups. The weather adjustment is developed from regression analysis of ten years of billed usage per customer and billing period heating and cooling degree-day data. The resulting seasonal weather sensitivity factors are applied to monthly test period customers and the difference between normal heating/cooling degree-days and monthly test period observed heating/cooling degree-days.

Company witness Mr. Hirschkorn includes the Washington adjustment to normal usage as part of the Revenue Adjustment for pro forma results of operations. Company witness Mr. Kalich includes the combined Washington and Idaho adjustment to reflect the normal load shape for 2008 pro forma loads in the modeling for the Pro Forma Power Supply costs.

Q. Would you please briefly summarize your natural gas weather normalization testimony?

A. Yes. The natural gas weather adjustment is developed from a regression analysis of ten years of billed usage per customer and billing period heating degree-day data. The resulting seasonal weather sensitivity factors are applied to monthly test period customers and the difference between normal heating degree-days and monthly test period observed heating degree-days. This calculation produces the change in therm usage required to adjust existing loads to the amount expected if weather had been normal. Mr. Hirschkorn includes the adjustment to normalize usage as part of the Revenue/Gas Supply Adjustment for pro forma results of operations.

Q. What does the Company use for "normal" degree days?

A. The NOAA (National Oceanographic and Atmospheric Administration) publishes Monthly Station Normals for the Spokane airport weather station. The current published normals are based on the years 1971 to 2000 and are updated every ten years.

Q. Are these processes different from the methods employed in the Company's prior cases?

A. Yes. This process includes a number of changes from the prior method related to the data included in the regression analysis. These changes address issues raised by the parties to the last general rate case.

Q. How is this process different from prior cases?

A. In prior cases, the Company utilized five years of data to develop the weather sensitivity factors. Commission Staff was concerned that five years did not include enough data points, and recommended using ten years of data. The Company was concerned that data from that long ago would be influenced by changes in customer usage from appliance consumption, heating source mix, air conditioning saturation, etc. A test of the results using five years vs ten years of data revealed that the sensitiviy factors produced were very similar and we were therefore comfortable accepting the ten year recommendation.

In the past, annual average sensitivity factors were derived and applied uniformly to all heating and cooling degree days throughout the year. In this new process the definition of the independent variables has been adjusted to produce seasonal sensitivity factors. Seasonal sensitivity factors change depending on the time of year, therefore under the new method it is important to determine when the deviations from normal heating and cooling degree days occurred, which is why we now use a monthly calculation to determine the adjustment volumes. This modification addressed both Company concerns that applying the annual factors on a monthly basis produced some counter-intuitive results during shoulder and summer months, and Staff concerns (particularly for natural gas) that the baseload value should approximate observed summer usage.

Finally, in the prior process, two statistical tests were used to determine whether a regression result was acceptable. Namely, the t-statistic for all independent variables must be greater than the absolute value of two, and the adjusted R-square statistic must be greater than sixty percent. For the new method we have added a third test to satisfy concerns that auto-correlation of error terms may have been present in the data. Now, in addition to the first two tests the regression result must also pass the Durbin-Watson test for auto-correlation at five percent significance.

Q. What was the impact of electric weather normalization on the 2006 test year?

A. Weather was warmer than normal during the 2006 test year both in the summer and in the winter with offsetting impacts. The adjustment to normal required the addition of 488 heating degree-days and the deduction of 221 cooling degree-days. The net adjustment to Washington sales volumes was an addition of 1,308,972 kWhs which is approximately two hundredths of one percent of billed usage.

Q. What was the impact of natural gas weather normalization on the 2006 test year?

A. Weather was warmer than normal during the 2006 test year. The adjustment to normal required the addition of 488 heating degree-days. The adjustment to sales volumes was an addition of 7,751,383 therms which is approximately three percent of billed usage.

III. ELECTRIC COST OF SERVICE

Q. Please briefly summarize your testimony related to the electric cost of service study.

A. I believe the Base Case cost of service study presented in this case is a fair representation of the costs to serve each customer group. The Base Case study shows Residential Service Schedule 1 and Extra Large General Service Schedule 25 earn substantially less than the overall rate of return under present rates. Pumping Service Schedule 31 earns somewhat less than the overall rate of return under present rates. General Service Schedule 11 and Large General Service Schedule 21 and Street and Area Lights earn substantially more than the overall rate of return under present rates.

Q. Are you sponsoring any exhibits related to the electric cost of service study?

A. Yes. I am sponsoring Exhibit No.__(TLK-2), electric cost of service study process description; and Exhibit No. ___(TLK-3), electric cost of service study model output.

Q. Were these exhibits prepared by you?

A. Yes.

Q. Please identify the Company's electric cost studies presented to this Commission in the last five years.

A. An Electric cost of service study was presented to this Commission in Docket No. UE-050482.

Q. What is an electric cost of service study and what is its purpose?

A. An electric cost of service study is an engineering-economic study, which separates the revenue, expenses, and rate base associated with providing electric service to designated groups of customers. The groups are made up of customers with similar load characteristics and facilities requirements. Costs are assigned in relation to each group's characteristics, resulting in an evaluation of the cost of the service provided to each group. The rate of return by customer group indicates whether the revenue provided by the customers in each group recovers the cost to serve those customers. The study results are used as a guide in determining the appropriate rate spread among the groups of customers. Exhibit No. ___(TLK-2) explains the basic concepts involved in performing an electric cost of service study. It also details the specific methodology and assumptions utilized in the Company's Base Case cost of service study.

Q. What is the basis for the electric cost of service study provided in this case?

A. The electric cost of service study provided by the Company as Exhibit No.___(TLK-3) is based on the 2006 test year pro forma results of operations presented by Company witness Ms. Andrews in Exhibit No.___(EMA-2).

Q. Would you please explain the cost of service study presented in Exhibit No. ___(TLK-3)?

A. Yes. Exhibit No. ___(TLK-3) includes the Excel spreadsheet model calculation of the cost of service results. This detail has been divided into three distinct segments.

Part 1 is composed of a series of summaries of the study results. The summary on page 1 shows the results of the study by FERC account category. The rate of return by rate schedule and the ratio of each schedule's return to the overall return are shown on Lines 39 and 40. This summary was provided to Mr. Hirschkorn for his work on rate spread and rate design. The results will be discussed in more detail later in my testimony.

Pages 2 and 3 are both summaries that show the revenue to cost relationship at current and proposed revenue. Costs by category are shown first at the existing schedule returns (revenue); next the costs are shown as if all schedules were providing equal recovery (cost). These comparisons show how far current and proposed rates are, from rates that would be in alignment with the cost study. Page 2 shows the costs segregated into production, transmission, distribution, and common functional categories. Page 3 segregates the costs into demand, energy, and customer classifications.

Part 2 is the cost of service calculations from the spreadsheet called "Assign" showing the functionalization, classification, and allocation of each line item in the study. The supporting schedules required to run the model, made up of the allocation and classification factors used in the study, are shown on pages 31 through 35.

Finally, Part 3 is the spreadsheet called "Proforma." This worksheet shows the segregation of Ms. Andrew's pro forma results of operations into the detailed accounting data used in this study.

Q. Does the Company's electric Base Case cost of service study follow the methodology filed in the Company's last electric general rate case in Washington?

A. Yes. The Base Case cost of service study was prepared using the same methodology applied to the study presented in Docket No. UE-050482.

Q. Given that the specific details of this methodology are described in Exhibit No.___(TLK-2), would you please give a brief overview of the key elements and the history associated with those elements?

A. In general the cost study follows the methodology established in Docket No. UE-920499 for Puget Sound Power and Light (now PSE). Production and transmission costs are classified to energy and demand by a peak credit analysis. The definition of peaks and peak credit are specific to Avista and were accepted by the

Commission for Avista in Docket No. UE-991606 and confirmed in Docket No. UE-050482. Distribution costs are classified and allocated by the basic customer theory[1] that was derived directly from the methodology approved for Puget in Docket No. UE-920499. Administrative and general costs are first directly assigned to production, transmission, distribution, or customer relations functions. The Commission found this process acceptable in Avista's Docket No. UE-991606. The remaining administrative and general costs are categorized as common costs and have been allocated by a variety of factors as approved by this Commission for Puget in Docket No. UE-920499. The specific factors and items they are applied to are described in detail in Exhibit No. ___(TLK-2), see pages 5 and 9.

Q. What are the results of the Company's Base Case cost of service study?

A. The following table shows the rate of return and the relationship of the customer class return to the overall return (relative return ratio) at present rates for each rate schedule:

[1] Basic customer theory classifies only meters, services and street lights as customer-related plant; all other distribution facilities are considered demand-related.

Table 1

Customer Class	Rate of Return	Return Ratio
Residential Service Schedule 1	3.87%	0.66
General Service Schedule 11	11.13%	1.90
Large General Service Schedule 21	8.41%	1.44
Extra Large General Service Schedule 25	3.79%	0.65
Pumping Service Schedule 31	4.71%	0.81
Lighting Service Schedules 41 - 49	8.79%	1.50
Total Washington Electric System	5.85%	1.00

As can be observed from the above table, residential and extra large general service schedules (1 and 25) show significant under-recovery of the costs to serve them, the pumping service schedule (31) shows moderate under-recovery, while the general, large general, and lighting service schedules (11, 21, and 41 - 49) show over-recovery of the costs to serve them. However, only general service schedule 11 currently provides a rate of return higher than the rate of return requested in this case. The summary results of this study were provided to Mr. Hirschkorn as an input into development of the proposed rates.

Q Is there something else that should be noted with regards to the cost study results?

A. Yes. As shown on page 1, lines 38 and 41 of Exhibit No.___(TLK-3) both Schedule 1 and Schedule 25 do not provide enough net income to cover the interest expense (debt cost) associated with their rate base. Consequently, these two groups receive income tax benefits that improve their respective net income and rate of return results. Simply comparing the relative return ratios in Table 1 fails to acknowledge that these schedules do not cover their debt cost at present rates.

IV. COMMON COSTS AND THE RETAIL REVENUE CREDIT

Q. Would you please address the issue of the allocation of common costs related to the retail revenue credit?

A. Yes. Item 7(3) of the Settlement Stipulation approved by Order No. 3 in Docket No. UE-060181 dated June 16, 2006 approving modifications to the ERM states:

> "(3) Consideration of the allocation of common costs related to the retail revenue credit will be addressed in the next GRC;"

The Company is not proposing that common costs be included in the retail revenue credit rate of $0.04415 per kilowatt-hour.

Q. Why should common costs be excluded from the production property adjustment and the retail revenue credit?

A. The proposed retail revenue credit rate in this case is calculated directly from the same production and transmission related costs used to calculate the pro forma production property adjustment. Production and transmission rate base, revenues and expenses have been pro formed to 2008 rate year levels. The production property adjustment was applied to these pro forma fixed and variable costs in order to spread the costs to 2006 test year billing determinants. It follows that the same costs that have been adjusted by the production property adjustment should also be the costs used to determine the retail revenue credit.

An under-collection of costs could occur if these common costs are included in the retail revenue credit. Other than labor, no attempt has been made to reflect inflation or other changes that will affect distribution or administrative and general costs between the 2006 test year and the 2008 rate year, although it is highly likely that these costs will increase. Furthermore, as new customers are added, the portion of their revenue from the embedded rates to recover administrative and general costs as well as distribution costs are used to recover the costs associated with line extension allowances. Therefore, if a portion of the common (administrative and general) costs are included in the retail revenue credit and the same common cost revenue is intended to defray incremental distribution investment, a shortfall in cost recovery will occur.

Common costs were inadvertantly picked up in the first retail revenue credit rate derived from the cost of service study presented in Docket No. UE-011595 since that study combined common costs into the other functional categories of costs, i.e. production, transmission, and distribution. The cost of service studies in the last general rate case and in this case do not combine common costs with other cost categories, rather the common costs have their own separate category.

Q. Do you have an exhibit that shows the calculation of the proposed retail revenue credit rate showing how it ties to the production property adjustment?

A. Yes. Exhibit No. ___(TLK-4) begins with the identification of the production and transmission revenue, expense and rate base amounts included in each of Ms. Andrews actual, restating, and pro forma adjustments to 2006 results of operations (not including the production property adjustment). The values on line 36, labeled Pro Forma Total, reflect production and transmission revenues, expenses, and rate base necessary to serve 2008 retail loads. The values on line 40, labeled 2006 Production/Transmission Costs, are the amounts on line 36 multiplied by the production property factor in order to reflect the proportion of those costs required to serve 2006 retail loads. The difference between the 2006 and 2008 values is the production property adjustment Ms. Andrews included in her calculation of revenue requirement in this case.

The proposed retail revenue credit rate is the revenue requirement on the total production and transmission components of pro forma results of operations divided by retail load. Page 2 of Exhibit No.___(TLK-4) shows the calculation of the proposed revenue requirement associated with production and transmission costs in this case. The rate of return and debt cost percentages on line 2 are inputs from the proposed cost of capital. The rate base and net expense values are the same costs calculated on page 1 to determine the production property adjustment. Revenue related expenses have been specifically excluded from the production/transmission revenue requirement for the retail revenue credit. The proposed retail revenue credit rate is $0.04415 per kWh. There are two columns showing that the retail revenue credit rate produced by this revenue requirement calculation is the same whether you look at the costs before or after the production property adjustment. The calculation of the retail revenue credit rate will need to be revised based on the final production and transmission costs and rate of return that are approved by the Commission.

V. NATURAL GAS COST OF SERVICE

Q. Are you sponsoring any exhibits related to the natural gas cost of service study?

A. Yes. I am sponsoring Exhibit No.___(TLK-5), natural gas cost of service study process description; and Exhibit No. ___(TLK-6), natural gas cost of service study model output.

Q. Were these exhibits prepared by you?

A. Yes.

Q. Please identify the natural gas cost studies presented to this Commission in the last five years.

A. Natural gas cost of service studies were filed with this Commission in Docket No. UG-050483 and Docket No. UG-041515.

Q. Please describe the natural gas cost of service study and its purpose.

A. A natural gas cost of service study is an engineering-economic study which separates the revenue, expenses, and rate base associated with providing natural gas service to designated groups of customers. The groups are made up of customers with similar usage characteristics and facility requirements. Costs are assigned in relation to each groups' characteristics, resulting in an evaluation of the cost of the service provided to each group. The rate of return by customer group indicates whether the revenue provided by the customers in each group recovers the cost to serve those customers. The study results are used as a guide in determining the appropriate rate spread among the groups of customers. Exhibit No.__(TLK-5) explains the basic concepts involved in performing a natural gas cost of service study. It also details the specific methodology and assumptions utilized in the Company's Base Case cost of service study.

Q. What is the basis for the natural gas cost of service study provided in this case?

A. The cost of service study provided by the Company as Exhibit No.__(TLK-6) is based on the 2006 test year pro forma results of operations presented by Ms. Andrews in Exhibit No.__(EMA-3).

Q. Would you please explain the cost of service study presented in Exhibit No.__(TLK-6)?

A. Yes. Exhibit No. __(TLK-6) includes the Excel spreadsheet model calculation of the cost of service results. This detail has been divided into three distinct segments.

Part 1 is composed of a series of summaries of the study results. Page 1 shows the results of the study by FERC account category. The rate of return and the ratio of each schedule's return to the overall return are shown on lines 38 and 39. This summary is provided to Mr. Hirschkorn for his work on rate spread and rate design. The results will be discussed in more detail later in my testimony. The additional summaries show the costs organized by functional category (page 2) and classification (page 3), including margin and unit cost analysis at current and proposed rates.

Part 2 is the cost of service calculation from the spreadsheet called "Assign" showing the functionalization, classification, and allocation of each line item in the study. The supporting schedules required to run the model are shown on pages 28 through 44.

Finally, Part 3 is the spreadsheet called "Proforma." This worksheet shows the segregation of Ms. Andrew's pro forma results of operations into the detailed accounting data used in this study.

Q. Does the Natural Gas Base Case cost of service study utilize the methodology from the Company's last natural gas case in Washington?

A. Yes. The Base Case cost of service study was prepared using the same methodology applied to the study presented in Docket No. UG-050483.

Q. What are the key elements that define the cost of service methodology?

A. Gas costs and underground storage costs are tied to the current purchased gas tracker methodology. Natural gas main investment has been segregated into large and small mains. Large usage customers that take service from large mains do not receive an allocation of small mains. Meter installation and services investment is allocated by number of customers weighted by the relative current cost of those items. System facilities that serve all customers are classified by the peak and average ratio that reflects the system load factor, then allocated by coincident peak demand and throughput, respectively. Demand side management costs are treated in the same way as system facilities. General plant is allocated by the sum of all other plant. Administrative & general expenses are segregated into labor related, plant related, revenue related, and "other". The costs are then allocated by factors associated with labor, plant in service, or revenue, respectively. The "other" A&G amounts get a combined allocation that is one-half based on O&M expenses and one-half based on throughput. A detailed description of the methodology is included in Exhibit No.__(TLK-5).

Q. Does this methodology follow previously approved methods?

A. Yes, with the exception of Company-specific purchased gas and related items, the methodology I have presented here, and in prior cases before this Commission, replicates the methodology established in Docket No. UG-940814 for Washington Natural (now PSE).

Q. What are the results of the Company's natural gas cost of service study?

A. I believe the Base Case cost of service study presented in this filing is a fair representation of the costs to serve each customer group. The study indicates that Residential Service Schedule 101 is earning slightly less than the overall return, Large Firm Service Schedule 121 is earning considerably less than the overall return, and all other schedules are earning more than the overall return to varying degrees. Small Firm and Interruptiible Service schedules are slightly above unity, but below the requested return, whereas Transportation Service is earning slightly over the requested return.

The following table shows the rate of return and the relative return ratio at <u>present</u> <u>rates</u> for each rate schedule:

Table 2

Customer Class	Rate of Return	Return Ratio
Residential Service Schedule 101	7.36%	0.98
Small Firm Service Schedule 111	8.08%	1.08
Large Firm Service Schedule 121	5.20%	0.69
Interruptible Service Schedule 131	8.77%	1.17
Transportation Service Schedule 146	9.65%	1.29
Total Washington Natural Gas System	7.50%	1.00

The summary results of this study were provided to Mr. Hirschkorn as an input into development of the proposed rates.

Q. Does this conclude your pre-filed direct testimony?

A. Yes.

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AVISTA Corp.

August 29, 2008

State of Washington
Washington Utilities & Transportation Commission
1300 S. Evergreen Park Drive
Olympia, Washington 98504-8002

Attention: Mr. David Danner, Executive Director and Secretary

RE: WN U-29 – Natural Gas Service
Avista's Proposed Natural Gas Decoupling Rate Adjustment

Enclosed for filing with the Commission is a copy of the following proposed tariff sheets:

Second Revision Sheet 159 canceling Substitute First Revision Sheet 159
Second Revision Sheet 159B canceling First Revision Sheet 159B

These tariff sheets reflect the proposed Natural Gas Decoupling Rate Adjustment, filed in compliance with the Commission's Order No. 04 in Docket No. UG-060518. This Order approved a natural gas decoupling mechanism for Avista for a three-year pilot period. The decoupling mechanism allows the Company to: 1) defer 90% of the margin lost due to lower customer gas usage since the Company's last general case, and 2) file a tariff to recover up to the total deferred amount through a surcharge under the proposed tariff. These tariff sheets reflect a surcharge of 0.593 cents per therm, which is an increase of 0.336 cents per therm over the present decoupling rate adjustment of 0.257 cents per therm, or an increase of 0.30% applicable to natural gas customers taking service under rate Schedule 101. These tariff sheets are proposed to become effective November 1, 2008, coincident with the proposed effective date of the Company's Purchased Gas Adjustment, which will be filed by mid-September.

The proposed surcharge rate of 0.593 cents per therm is designed to recover approximately $721,000 from the Company's residential and small commercial natural gas customers served under rate Schedule 101. This amount is comprised of $678,014, which is the recorded deferred revenue for the period July 2008 – June 2009 (90% of the lost margin), and associated interest and revenue-related expenses. The workpapers supporting the lost margin and deferred revenue are provided in Exhibit 1. If the proposed surcharge is approved by the Commission, the deferred amount of $678,014 will be transferred to a balancing account, and will begin accruing interest in November at the quarterly rate published by the FERC (5.30% effective July 1 / new rate will be effective October 1). The balance in the account will be reduced each month by the revenue collected under the tariff. Exhibit 2 shows the derivation of the proposed surcharge rate to recover the deferred balance of $678,014 plus interest and revenue-related expenses, based on projected sales volumes for Schedule 101 customers during the surcharge/amortization period (Nov. '08 – Oct. '09).

Effective January 1, 2008, the Company had revised base rates and an updated test year (2006) as a result of Docket UG-070805 which affected the calculation of the monthly decoupling deferral from that date forward. These revisions are reflected in Exhibit 1 (monthly deferral calculation) as well as the present decoupling tariff. The Company presently has a natural gas general filing pending before the Commission (Docket UG-080417); upon the effective date of new rates resulting from that filing, the Company would again revise the decoupling tariff and the deferral calculation to reflect the affected items.

<u>2% Surcharge Limitation</u>
One of the conditions of the decoupling rate adjustment is that the surcharge cannot exceed a rate increase of 2%. The proposed surcharge of $0.00593 per therm represents an *incremental* increase of 0.366 cents per therm, or 0.30% for Schedule 101 customers, based on weather-normalized revenue for the period July 2006-June 2007. The workpapers supporting this information are provided as Exhibit 3.

<u>Earnings Test</u>
Another condition of the rate adjustment is that the rate of return for the Company's Washington gas operations not exceed the level authorized by the Commission. This "test" is based on the Commission Basis Report filed by the Company each spring for the prior calendar year. If the Company's actual rate of return exceeds the authorized level, then the amount of the surcharge is reduced, as described on Schedule 159A of the proposed tariff. Attached as Exhibit 4 is the Company's Gas Commission Basis Report for 2006, filed with the Commission by letter dated April 22, 2008. As shown in the summary, the rate of return for 2007 (including restating adjustments) was 8.29%, however, this level *included* the annual revenue increase of $3.2 million effective January 1, 2008 as a result of Docket UG-070805. Including this revenue increase in the 2007 Commission Basis results is inappropriate and the Company has calculated a revised (Commission Basis) rate of return excluding the increase. As shown on page 1 of Exhibit 4, the revised Commission Basis rate of return is 6.97%, which is considerably below the Commission authorized level of 8.20% (Order 05 in Docket UG-070805). Therefore, there is no adjustment to the deferred revenue as a result of the earnings test.

<u>DSM Test</u>
The DSM test is based on the Company's actual level of completed programmatic gas DSM savings (verified by independent audit) for the prior calendar year compared to its targeted level of savings set forth in its acknowledged 2006 Integrated Resource Plan (IRP). That target level of annual DSM savings is 1,062,000 therms for calendar years 2006 and 2007. For this filing, the actual level of verified savings for calendar year 2007

is compared to the target level. If the Company's actual level of DSM savings is less than the target, then the amount of the surcharge is reduced, as shown on Schedule 159A of the proposed tariff.

In order to verify the Company's reported level of DSM savings for decoupling, the Company retains an independent third party to verify the results. The Company retained the consulting firm of Research Into Action, Inc. to verify its 2007 DSM results for this filing. A summary of the audit results is provided in Exhibit 5, and the full report is provided as Attachment A. As shown on page 1 of Exhibit 5, the verified level of DSM savings for 2007 is 1,455,678 therms, which is 137.1% of the target level of 1,062,000 therms. Therefore, the full 90% of the lost margin for the July 2007 – June 2008 period is recoverable, as shown in the table on sheet 159A of the proposed tariff.

A new section has been added to the proposed tariff under sheet 159B. This new section addresses the Company's proposed DSM target to be used for the DSM test in the 2009 filing. The proposed DSM target reflects the Company's natural gas DSM goal for 2008 (and 2009), as reflected in the Company's most recent Integrated Resource Plan, which was acknowledged by the Commission in July (2008). On page 6 of the (decoupling) settlement agreement in Docket No. UG-060518, it states: "…the target savings level included in the Company's 2008 IRP will be used for the 2009 surcharge. The Company will file its 2008 gas DSM goal as a tariff revision to its decoupling tariff, which will provide an opportunity for review and comment from all interested parties." This annual DSM target/goal for 2008 and 2009 is 1,424,070 therms, which is 34% higher than the Company's 2006 and 2007 annual goal of 1,062,000 therms.

The decoupling rate adjustment is proposed to become effective November 1, 2008 simultaneous with the Company's proposed Purchase Gas Adjustment (PGA). Notice to customers regarding the proposed decoupling rate adjustment, as well as the proposed PGA adjustment, will be provided in a bill insert.

If you have any questions regarding this filing, please call Brian Hirschkorn at 509-495-4723.

Sincerely,

Kelly Norwood

Kelly O. Norwood, Vice President
State & Federal Regulation

Enc.

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that I have this day served Avista Utilities', a division of Avista Corp, Proposed Natural Gas Decoupling Rate Adjustment, upon the parties listed below by mailing a copy thereof, postage prepaid and by electronic mail or CD.

Nancy Hirsh
The Northwest Energy Coalition
219 1st Avenue South, Suite 100
Seattle, WA 98104

Ms. Paula Pyron
Executive Director
Northwest Industrial Gas Users
4113 Wolfberry Court
Lake Oswego, OR 97035

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Deborah Reynolds
Washington Utilities & Trans. Comm.
1300 S. Evergreen Park Dr. SW
Olympia, WA 98504-7250

Chuck Eberdt
The Energy Project
1322 N. State St.
Bellingham, WA 98225

I declare under penalty of perjury that the foregoing is true and correct.

Dated at Spokane, Washington this 29th day of August 2008.

Patty Olsness

Patty Olsness
Rates Coordinator

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WN U-29

Second Revision Sheet 159
Canceling
Substitute First Revision Sheet 159

AVISTA CORPORATION
dba Avista Utilities

SCHEDULE 159

NATURAL GAS DECOUPLING RATE ADJUSTMENT

PURPOSE:

This Schedule is a pilot program to allow the Company to recover costs associated with providing Natural Gas distribution service as authorized by the Commission in the Company's last general rate filing.

APPLICABLE:

To Natural Gas Customers served under General Service Schedule 101.

MONTHLY RATE:

$0.00593 per therm (I)

The monthly rate set forth above reflects the recovery of 90% of the lost margin (I) realized by the Company from July 2007 through June 2008 for Schedule 101, as (C) described in more detail below. This lost margin results from lower customer usage due to the implementation of natural gas conservation measures.

SPECIAL TERMS AND CONDITIONS:

This Schedule is a three-year pilot program, effective November 1, 2007 and will expire on October 31, 2010. On or before March 31, 2009, the Company may file a request to extend the term of this tariff beyond the expiration date.

Monthly Revenue Deferral Calculation

Following the end of each month, the Company will compute a deferred revenue amount to be recorded in a special account. This deferred revenue amount can be either a debit or credit and will be determined as follows:

(1) The difference in weather-corrected therm sales for the current month (Current Therm Sales) and the weather-corrected therm sales for the corresponding month (June to June) of 2006 (Base Therm Sales) will be calculated for Schedule 101. The usage for new customers added since 2006 will first be subtracted from Current Therm Sales. Base Therm Sales is then subtracted from Current Therm Sales.

(2) The difference in usage determined in (1) will be multiplied by $0.21748. This rate represents the margin (rate less gas costs) under Schedule 101.

(3) If the result calculated in (2) above is a negative amount, 90% of that amount will be recorded as a debit to the deferred revenue account, representing a potential surcharge. If the result is a positive amount, 90% of that amount will be recorded as a credit to the deferred revenue account, representing a potential rebate.

Issued August 29, 2008 Effective November 1, 2008

Issued by Avista Corporation
By Kelly Norwood — Kelly Norwood, Vice President, State & Federal Regulation

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SCHEDULE 159B

NATURAL GAS DECOUPLING RATE ADJUSTMENT

<u>2% Annual Rate Increase Limitation</u>

Following the application of the Earnings and DSM tests described above, the amount of the incremental proposed rate adjustment under this Schedule cannot reflect more than a 2% rate increase (cumulative of 6% over the pilot term). This will be determined by dividing the incremental annual revenue to be collected (proposed surcharge revenue less present surcharge revenue) under this Schedule by the total "normalized" revenue for Schedule 101 for the most recent July – June period. Normalized revenue is determined by multiplying the weather-corrected usage for the period by the present rates in effect. If the incremental amount of the proposed surcharge exceeds 2%, only a 2% incremental rate increase will be proposed and any remaining deferred revenue will be carried over to the following year.

After determining the amount of deferred revenue that can be recovered through a surcharge (or refunded through a rebate), the proposed rate under this Schedule will be determined by dividing the deferred revenue to be recovered by the estimated therms sales for Schedule 101 during the twelve month recovery period. The deferred revenue amount to be recovered will be transferred to a Decoupling Balancing Account and the actual revenue received under this Schedule will be applied to the Account to reduce (amortize) the balance. Interest will be accrued on the unamortized balance in the Decoupling Balancing Account at the quarterly rate published by the FERC.

<u>DSM Target for September 2009 Rate Adjustment</u> (N)

The DSM Target to be used for the DSM Test in the September 2009 rate adjustment filing is 1,424,070 therms. This amount is the annual DSM goal for 2008 and 2009 reflected in the Company's most recent Integrated Resource Plan, acknowledged by the Commission in July 2008. (N)

Avista Corp.
1411 East Mission PO Box 3727
Spokane, Washington 99220-3727
Telephone 509-489-0500
Toll Free 800-727-9170

AVISTA Corp.

October 8, 2008

State of Washington
Washington Utilities & Transportation Commission
1300 S. Evergreen Park Drive
Olympia, Washington 98504-8002

Attention: Mr. David Danner, Executive Director and Secretary

Docket No. UG-081601 - Supplemental Filing
Avista's Proposed Natural Gas Decoupling Rate Adjustment

By advice letter dated August 29. 2008, Avista filed for a revised Decoupling Rate Adjustment to be effective November 1, 2008 (Docket No. UG-081601). Exhibit 4 within that filing is Avista's 2007 Commission Basis Report (Report) for its Washington Gas Operations. In the Advice Letter, Avista described an adjustment which it made to the rate of return shown in the Report. This adjustment was to remove the annual revenue increase *effective Jan. 1, 2008*, approved by Commission Order No. 05 in Docket No. UG-070805. As it was inappropriate to include this revenue in the Report, page 1 of Exhibit 4 showed the adjusted rate of return after removal of this revenue.

On October 7, 2008, Avista filed a corrected Commission Basis Report for its 2007 gas operations. As described in the advice letter with the corrected Report, the originally filed Report included several *pro forma* adjustments, including the annual revenue associated with the Jan. 1, 2008 rate increase, that were not appropriate to include in the Report per WAC 480-090-257. Enclosed is a copy of the corrected Report that should replace the original Report (as well as the adjustment shown on page 1) included as Exhibit 4 in the August 29th Decoupling Rate Adjustment filing. The rate of return shown in the corrected Report is 7.79%, which is the (Commission Basis) rate of return that should be used in the Earnings Test associated with the Decoupling Rate Adjustment. As the Commission Basis rate of return of 7.79% is below Avista's most recently authorized rate of return of 8.20%, there should be no adjustment to the deferred revenue associated with the Decoupling Rate Adjustment in Docket No. UG-081601.

If you have any questions regarding this filing, please contact Brian Hirschkorn at 509-495-4723.

Sincerely,

Kelly Norwood

Kelly O. Norwood, Vice President
State & Federal Regulation

Enc.

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that I have this day served Avista Utilities', a division of Avista Corp, Docket No. UG-081601 Proposed Gas Decoupling Rate Adjustment – Supplemental Filing, upon the parties listed below by mailing a copy thereof, postage prepaid and by electronic mail or CD.

Nancy Hirsh
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219 1st Avenue South, Suite 100
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Ms. Paula Pyron
Executive Director
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1300 S. Evergreen Park Dr. SW
Olympia, WA 98504-7250

Chuck Eberdt
The Energy Project
1322 N. State St.
Bellingham, WA 98225

I declare under penalty of perjury that the foregoing is true and correct.

Dated at Spokane, Washington this 8th day of October 2008.

Patty Olsness

Patty Olsness
Rates Coordinator

SCHEDULE 159B

NATURAL GAS DECOUPLING RATE ADJUSTMENT

2% Annual Rate Increase Limitation

Following the application of the Earnings and DSM tests described above, the amount of the incremental proposed rate adjustment under this Schedule cannot reflect more than a 2% rate increase (cumulative of 6% over the pilot term). This will be determined by dividing the incremental annual revenue to be collected (proposed surcharge revenue less present surcharge revenue) under this Schedule by the total "normalized" revenue for Schedule 101 for the most recent July – June period. Normalized revenue is determined by multiplying the weather-corrected usage for the period by the present rates in effect. If the incremental amount of the proposed surcharge exceeds 2%, only a 2% incremental rate increase will be proposed and any remaining deferred revenue will be carried over to the following year.

After determining the amount of deferred revenue that can be recovered through a surcharge (or refunded through a rebate), the proposed rate under this Schedule will be determined by dividing the deferred revenue to be recovered by the estimated therms sales for Schedule 101 during the twelve month recovery period. The deferred revenue amount to be recovered will be transferred to a Decoupling Balancing Account and the actual revenue received under this Schedule will be applied to the Account to reduce (amortize) the balance. Interest will be accrued on the unamortized balance in the Decoupling Balancing Account at the quarterly rate published by the FERC.

DSM Target for September 2009 Rate Adjustment (N)

The DSM Target to be used for the DSM Test in the September 2009 rate adjustment filing is 1,425,070 therms. This amount is the annual DSM goal for 2008 reflected in the Company's most recent Integrated Resource Plan, acknowledged by the Commission in July 2008. (N)

Agenda Date: October 30, 2008
Item Number: A2

Docket: **UG-081601**
Company: Avista Corporation

Staff: Deborah Reynolds, Regulatory Analyst
Danny Kermode, Regulatory Analyst

Recommendation

Take no action, thereby allowing Avista Corporation's (Avista or company) proposed natural gas decoupling rate adjustment tariff revisions filed in Docket UG-081601 to become effective November 1, 2008, by operation of law.

Background

In February of 2007, the Commission approved a multi-party settlement agreement establishing a three-year pilot program to allow Avista to test a natural gas decoupling mechanism.[1] The parties to the settlement included Avista, commission staff, The Northwest Energy Coalition, and the Northwest Industrial Gas Users. Public Counsel and The Energy Project were not parties to the settlement.

Decoupling is a ratemaking and regulatory tool intended to break the link between a utility's recovery of fixed costs and a consumer's energy consumption. Energy conservation advocates view decoupling as a tool to promote greater conservation efforts by utilities by removing financial disincentives.

Avista's pilot decoupling program applies to residential and small commercial customers receiving natural gas service under Schedule 101 of the company's tariff.

Under the terms of the pilot decoupling program, Avista may defer for later recovery 90 percent of fixed costs (margin) related to revenue reductions associated with conservation and price elasticity as calculated in the company's last general rate case. Recovery of the deferred margin occurs through a surcharge applied to customers served under Schedule 101. Recovery is subject to several tests and limitations, including:

- An earnings test to ensure that Avista does not earn more than its authorized rate of return through the decoupling mechanism (8.20 percent[2]).

- A demand side management (DSM) test that conditions the level of recovery of any deferral on Avista achieving specific conservation targets.

---

[1] Docket UG-060518, Order 04.
[2] Docket UG-070805, Order 05.

- DSM program third-party verification that corroborates Avista's annual program accomplishments.
- Annual rate changes are limited to a maximum of two percent.

Discussion

On August 29, 2008, Avista filed tariff sheets that would adjust the surcharge recovery rate for its natural gas decoupling mechanism effective November 1, 2008. The filing proposes an increase in the surcharge rate from 0.257 to 0.593 cents per therm. This would result in an increase of $0.24 (0.28 percent) in the bill of an average residential customer taking natural gas service under Schedule 101.

The proposed surcharge will recover $678,014 of deferred margin accrued in the period of July 2007 to June 2008 and the associated interest and revenue-driven expenses, or a total of approximately $721,000 additional revenue. This is approximately 0.26 percent of the company's annual revenue.

The company provided work papers supporting the above-mentioned tests and limitations as follows:

a) The two percent limitation test results in a 0.30 percent increase in the surcharge amount, well below the test criterion.

b) The company's Corrected Commission Basis Report filed August 30, 2008, indicates that its rate of return for 2007 (including restating adjustments) was 7.79 percent as compared to the present authorized level of 8.20 percent.

c) The company verified its 2007 natural gas DSM savings through retention of an independent evaluation contractor. Research into Action, Inc., independently verified that Avista acquired 1,455,678 therms of conservation through DSM programs in 2007 versus a target level of 1,062,000 therms (137.1 percent of target).

In addition to the rate adjustment, the filing establishes the company's 2008 DSM target of 1,425,070 therms, as found in the company's 2007 Natural Gas Integrated Resources Plan on page 3.9. The 2008 target is 34 percent higher than the company's 2007 target of 1,062,000 therms. The 2008 target will be used in the DSM test for the 2009 surcharge filing.

Conclusion

Staff reviewed the proposed tariff revisions filed by Avista in Docket UG-081601 and found them to be consistent with the requirements of Order 04 in Docket UG-060518. Staff concludes that the revised surcharge appropriately implements the pilot decoupling program as approved by the Commission and is reasonable. Therefore, Staff recommends the Commission take no action thereby allowing Avista's proposed natural gas decoupling rate adjustment in Docket UG-081601 to become effective November 1, 2008, by operation of law.

Exhibit G-1 New Customer Adjustment Impact

AVISTA UTILITIES
Washington - Gas
Approved Decoupling Mechanism
2007 compared to 2004 Test Year
Adjusted for Actual New Customer Usage
1st Year Pilot Period Jan - Jun 2007

	2007 January	2007 February	2007 March	2007 April	2007 May	2007 June	YTD Total
2007 Actual							
Schedule 101							
Schedule 101 Billed Therms	21,292,599	21,234,566	14,472,322	9,724,124	6,113,562	3,664,833	76,502,006
Deduct New Customer Usage(1)							-
Deduct Prior Month Unbilled Therms	(12,195,653)	(13,367,879)	(9,142,805)	(7,062,627)	(5,929,960)	(3,173,612)	(50,872,535)
Add Current Month Unbilled Therms	13,367,879	9,142,805	7,062,627	5,929,960	3,173,612	1,816,196	40,493,078
Add Weather Adjustment	(1,249,047)	881,219	1,792,880	152,306	1,150,125	219,680	2,947,162
Weather Adj Calendar Therms	21,215,778	17,890,711	14,185,023	8,743,763	4,507,338	2,527,097	69,069,710
Weather Adj Calendar Therms	21,215,778	17,890,711	14,185,023	8,743,763	4,507,338	2,527,097	69,069,710
Less Test Year Therms	20,224,840	16,393,846	14,157,246	8,557,146	4,587,478	1,965,936	65,886,492
Therm Difference	990,937	1,496,865	27,778	186,617	(80,140)	561,161	3,183,219
Times Current Margin Rate per Therm	0.20595	0.20595	0.20595	0.20595	0.20595	0.20595	
Revenue Excess (Shortfall)	$204,083	$308,279	$5,721	$38,434	($16,505)	$115,571	$655,584
90% Limitation	90%	90%	90%	90%	90%	90%	
Deferred Revenue Account Entry 407328 or (407428)	**$183,675**	**$277,452**	**$5,149**	**$34,590**	**($14,854)**	**$104,014**	**$590,025**

(1) Per monthly reports - current month usage for new services opened since that month of the test year (2004)

Unbilled Calculation

			Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07
Unbilled DDH			689.9	760.6	508.0	386.3	317.6	154.9	75.2
Unbilled Factor			62.23%	59.45%	59.81%	59.25%	62.20%	62.08%	61.25%
Sch. 101	2004 Baseload	Sensitivity							
Res 101	7	0.11	10,197,387	11,179,211	7,660,967	5,946,197	5,010,575	2,724,719	1,597,757
Com 101	0	0.249	1,971,062	2,160,933	1,460,730	1,101,361	906,996	442,785	215,410
Ind 101	0	0.424	27,204	27,735	21,108	15,069	12,389	6,108	3,029
			12,195,653	13,367,879	9,142,805	7,062,627	5,929,960	3,173,612	1,816,196

Weather Adjustment Calculation			Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	YTD Total
Normal DDH			1,169	916	790	557	338	149	3,919
Actual DDH			1,243	864	684	548	270	136	3,745
Normal - Actual DDH			(74)	52	106	9	68	13	174
Sch. 101	2004 Baseload	Sensitivity							
Res 101	7	0.11	(1,036,108)	729,535	1,486,533	126,253	953,064	181,917	2,441,194
Com 101	0	0.249	(210,241)	149,524	302,211	25,702	194,379	37,238	498,814
Ind 101	0	0.424	(2,698)	2,161	4,135	351	2,681	524	7,153
			(1,249,047)	881,219	1,792,880	152,306	1,150,125	219,680	2,947,162

Test Year Number of Customers by Class		Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07
101	01 RESIDENTIAL	127,078	127,286	127,541	127,490	127,528	127,415	127,215
	21 FIRM COMMERCIAL	11,474	11,410	11,548	11,450	11,469	11,480	11,504
	31 FIRM-MISCELLANEOUS INDU	93	86	98	92	92	93	95
	80 INTERDEPARTMENT REVEN	22	22	23	23	24	24	24
Total 101		138,667	138,804	139,210	139,055	139,113	139,012	138,838

Exhibit G-1 New Customer Adjustment Impact

AVISTA UTILITIES
Washington - Gas
Approved Decoupling Mechanism
2007/2008 with 2007 compared to 2004 Test Year and 2008 compared to 2006 Test Year
Adjusted for Actual New Customer Usage
2nd Year Pilot Period July 2007 - June 2008

	2007 July	2007 August	2007 September	2007 October	2007 November	2007 December	2008 January	2008 February	2008 March	2008 April	2008 May	2008 June	Period to Date Total
							New Base Rates January 1, 2008						
12 Months Ended June 2006 Actual													
Schedule 101													
Schedule 101 Billed Therms	2,462,636	2,010,203	2,332,936	4,484,817	9,398,517	18,392,852	20,755,627	22,514,347	14,859,076	13,629,159	8,714,627	4,232,714	123,787,511
Deduct New Customer Usage(1)													-
Deduct Prior Month Unbilled Therms	(1,816,196)	(551,658)	(926,010)	(3,295,322)	(6,996,845)	(11,616,348)	(12,425,356)	(13,253,869)	(10,084,034)	(9,402,054)	(7,125,880)	(3,236,457)	(80,730,029)
Add Current Month Unbilled Therms	551,658	926,010	3,295,322	6,996,845	11,616,348	12,623,367	13,253,869	10,084,034	9,402,054	7,125,880	3,236,457	1,804,135	80,915,979
Add Weather Adjustment	743,700	253,878	33,971	17,037	51,422	721,975	(1,183,011)	(112,020)	(1,440,543)	(1,724,926)	875,559	(369,087)	(2,132,047)
Weather Adj Calendar Therms	1,941,798	2,638,433	4,736,218	8,203,377	14,069,442	20,121,846	20,401,129	19,232,492	12,736,553	9,628,059	5,700,763	2,431,305	121,841,415
Weather Adj Calendar Therms	1,941,798	2,638,433	4,736,218	8,203,377	14,069,442	20,121,846	20,401,129	19,232,492	12,736,553	9,628,059	5,700,763	2,431,305	121,841,415
Less Test Year Therms	1,992,869	2,626,004	3,962,139	9,013,668	14,551,772	19,133,174	20,193,658	16,744,930	14,101,624	9,347,535	5,032,140	2,400,167	119,099,680
Therm Difference	(51,071)	12,429	774,079	(810,291)	(482,330)	988,672	207,471	2,487,562	(1,365,071)	280,524	668,623	31,138	2,741,734
Times Current Margin Rate per Therm ***(2)***	0.19822	0.19822	0.19822	0.19822	0.19822	0.19822	0.21748	0.21748	0.21748	0.21748	0.21748	0.21748	
Revenue Excess (Shortfall)	**($10,123)**	**$2,464**	**$153,438**	**($160,616)**	**($95,607)**	**$195,975**	**$45,121**	**$540,995**	**($296,876)**	**$61,008**	**$145,412**	**$6,772**	**$587,962**
90% Limitation	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	
Deferred Revenue Account Entry	($9,111)	$2,217	$138,094	($144,554)	($86,047)	$176,377	$40,609	$486,895	($267,188)	$54,908	$130,871	$6,095	**$529,166**
407328 or (407428)	Revised Oct ***(2)***	Revised Oct ***(2)***	Revised Oct ***(2)***										
Original Journal Entries	(36,007)	(31,750)	83,107										
Correction July through September	26,896	33,967	54,987	115,851									

(1) Per monthly reports - current month usage for new services opened since that month of the test year (2004 for July through December, 2006 for January through June
(2) Revised Margin Rate per Therm corrected in October per agreement with Staff and Public Counsel in Docket No. UG-071863, margin rate January through June from UG-070805 is exclusive of incremental revenue related cost items

	UG-070805 Margin Rate
Sch 101 Base Rate/therm	$1.12076
Times: 1 minus Revenue Related Items	0.956922
Revenue prior to gross up	$1.07248
Less: Weighted Average Gas Cost/therm	($0.85500)
Margin Rate/therm	**$0.21748**

Unbilled Calculation (2004 Test Year Factors)

			Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
Unbilled DDH			75.2	0.4	21.1	161.9	377.3	642.8	702.2
Unbilled Factor			61.25%	61.17%	63.75%	60.92%	63.31%	66.15%	61.00%
Sch. 101	2004 Baseload	Sensitivity							
Res 101	7	0.11	1,597,757	550,497	864,774	2,823,144	5,896,683	9,735,090	10,549,609
Com 101	0	0.249	215,410	1,146	60,404	465,657	1,085,284	1,856,183	2,046,069
Ind 101	0	0.424	3,029	16	832	6,521	14,878	25,074	27,689
			1,816,196	551,658	926,010	3,295,322	6,996,845	11,616,348	12,623,367

Weather Adjustment Calculation (2004 Test Year Factors)

			Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
Normal DDH			44	42	196	554	897	1,168
Actual DDH			-	27	194	553	894	1,126
Normal - Actual DDH			44	15	2	1	3	42
Sch. 101	2004 Baseload	Sensitivity						
Res 101	7	0.11	615,919	210,345	28,138	14,121	42,642	597,939
Com 101	0	0.249	126,027	42,941	5,752	2,876	8,663	122,380
Ind 101	0	0.424	1,754	591	81	39	117	1,656
			743,700	253,878	33,971	17,037	51,422	721,975

2004 Test Year Number of Customers by Class

		Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
101	01 RESIDENTIAL	127,215	127,256	127,482	127,898	128,371	129,218	129,424
	21 FIRM COMMERCIAL	11,504	11,503	11,497	11,551	11,552	11,597	11,702
	31 FIRM-MISCELLANEOUS INDUST	95	94	93	95	93	92	93
	80 INTERDEPARTMENT REVENUE	24	24	24	24	23	23	23
Total 101		138,838	138,877	139,096	139,568	140,039	140,930	141,242

2006 Test Year
Weather Normalization

		Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Total
Normal DDH		1,169	945	790	557	338	149	44	42	196	554	897	1,168	6,849
Actual DDH		1,243	952	880	683	274	176	44	42	196	554	897	1,168	7,109
Degree Day Adjustment		(74)	(7)	(90)	(126)	64	(27)	-	-	-	-	-	-	(260)
	Monthly													
Res 101	Use/DD/Cust(1)	0.101	0.101	0.101	0.090	0.090	0.090	0.000	0.000	0.000	0.090	0.090	0.101	
Com 101	Use/DD/Cust(1)	0.243	0.243	0.243	0.169	0.169	0.169	0.000	0.000	0.000	0.169	0.169	0.243	
Ind 101	Use/DD/Cust(1)	0.422	0.422	0.422	0.306	0.306	0.306	0.000	0.000	0.000	0.306	0.306	0.422	
Sch. 101														
Res 101		(969,946)	(91,868)	(1,181,246)	(1,472,624)	747,492	(314,879)	-	-	-	-	-	-	(3,283,071)
Com 101		(210,192)	(19,886)	(255,879)	(248,948)	126,363	(53,497)	-	-	-	-	-	-	(662,039)
Ind 101		(2,873)	(266)	(3,418)	(3,354)	1,704	(711)	-	-	-	-	-	-	(8,918)
Total 101		(1,183,011)	(112,020)	(1,440,543)	(1,724,926)	875,559	(369,087)	-	-	-	-	-	-	(3,954,028)

Monthly Unbilled Calculation

	06 Baseld(1)	Monthly	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Unbilled DDH			702.2	756.7	554.3	549.0	424.2	140.1	71.2	-	-	-	-	-	-
Unbilled Factor			61.00%	57.91%	59.90%	61.32%	64.25%	63.61%	63.30%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Res 101	15	se/DD/Cust(1)	0.1005	0.1005	0.1005	0.0951	0.0896	0.0896	0.0448	0.0000	0.0000	0.0448	0.0896	0.0951	0.1005
Com 101	12	se/DD/Cust(1)	0.2427	0.2427	0.2427	0.2058	0.1688	0.1688	0.0844	0.0000	0.0000	0.0844	0.1688	0.2058	0.2427
Ind 101	0	se/DD/Cust(1)	0.4222	0.4222	0.4222	0.3639	0.3055	0.3055	0.1528	0.0000	0.0000	0.1528	0.3055	0.3639	0.4222
Sch. 101															
Res 101			10,317,824	10,996,550	8,406,163	7,976,389	6,187,333	2,867,264	1,643,691	-	-	-	-	-	-
Com 101			2,079,960	2,227,927	1,656,809	1,407,687	927,272	365,469	159,509	-	-	-	-	-	-
Ind 101			27,572	29,392	21,062	17,978	11,275	3,724	935	-	-	-	-	-	-
Total			12,425,356	13,253,869	10,084,034	9,402,054	7,125,880	3,236,457	1,804,135	-	-	-	-	-	-

Revenue Run Customers (Meters Billed)

Class		Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08
Residential	01	129,424	129,776	129,941	129,950	129,861	129,773	129,580
Commercial	21	11,702	11,689	11,691	11,700	11,691	11,683	11,724
Industrial 10	31	93	92	90	90	87	87	86
Interdepartn	80	23	23	23	23	23	23	23
Total		141242	141,580	141,745	141,763	141,662	141,566	141,413

Exhibit G-1 New Customer Adjustment Impact

AVISTA UTILITIES
Washington - Gas
Approved Decoupling Mechanism
2008/2009 with 2008 compared to 2006 Test Year
Adjusted for Actual New Customer Usage
3rd Year Pilot Period July 2008 - June 2009

	2008 July	2008 August	2008 September	2008 October	2008 November	2008 December	2009 January	2009 February	2009 March	2009 April	2009 May	2009 June	Period to Date Total
12 Months Ended June 2009 Actual													
Schedule 101													
Schedule 101 Billed Therms	2,763,613	2,223,233	2,487,966	3,933,329	8,603,159	15,345,278							35,356,578
Deduct New Customer Usage(1)													-
Deduct Prior Month Unbilled Therms	(1,731,459)	(1,319,331)	(1,360,580)	(2,005,913)	(6,423,969)	(9,902,053)	(16,786,910)	-	-	-	-	-	(39,530,215)
Add Current Month Unbilled Therms	1,319,331	1,360,580	2,005,913	6,423,969	9,902,053	16,786,910	-	-	-	-	-	-	37,798,756
Add Weather Adjustment	-	-	-	343,326	1,544,935	(2,587,595)	-	-	-	-	-	-	(699,334)
Weather Adj Calendar Therms	2,351,485	2,264,482	3,133,299	8,694,711	13,626,178	19,642,540	(16,786,910)	-	-	-	-	-	32,925,785
Weather Adj Calendar Therms	2,351,485	2,264,482	3,133,299	8,694,711	13,626,178	19,642,540	(16,786,910)	-	-	-	-	-	32,925,785
Less Test Year Therms	1,983,193	2,049,321	3,228,950	8,830,784	14,228,112	20,663,191							50,983,551
Therm Difference	368,292	215,161	(95,651)	(136,073)	(601,934)	(1,020,651)							(1,270,856)
Times Current Margin Rate per Therm ***(2)***	0.21748	0.21748	0.21748	0.21748	0.21748	0.21748							
Revenue Excess (Shortfall)	**$80,096**	**$46,793**	**($20,802)**	**($29,593)**	**($130,909)**	**($221,971)**	$0	$0	$0	$0	$0	$0	($276,386)
90% Limitation	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	
Deferred Revenue Account Entry	**$72,087**	**$42,114**	**($18,722)**	**($26,634)**	**($117,818)**	**($199,774)**	$0	$0	$0	$0	$0	$0	**($248,747)**
407328 or (407428)													

(1) Per monthly reports - current month usage for new services opened since that month of the 2006 test year
(2) Margin Rate per Therm from UG-070805 is exclusive of incremental revenue related cost items.

2006 Test Year
Weather Normalization

		Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Total
Normal DDH		44	42	196	554	897	1,168	1,169	945	790	557	338	149	6,849
Actual DDH		8	52	142	529	785	1,328	1,169	945	790	557	338	149	6,792
Degree Day Adjustment		36	(10)	54	25	112	(160)	-	-	-	-	-	-	-
	Monthly													
Res 101	Use/DD/Cust(1)	0.000	0.000	0.000	0.090	0.090	0.101	0.101	0.101	0.101	0.090	0.090	0.090	
Com 101	Use/DD/Cust(1)	0.000	0.000	0.000	0.169	0.169	0.243	0.243	0.243	0.243	0.169	0.169	0.169	
Ind 101	Use/DD/Cust(1)	0.000	0.000	0.000	0.306	0.306	0.422	0.422	0.422	0.422	0.306	0.306	0.306	
Sch. 101														
Res 101		-	-	-	293,227	1,320,571	(2,124,474)	-	-	-	-	-	-	-
Com 101		-	-	-	49,433	221,382	(457,112)	-	-	-	-	-	-	-
Ind 101		-	-	-	666	2,982	(6,009)	-	-	-	-	-	-	-
Total 101		-	-	-	343,326	1,544,935	(2,587,595)	-	-	-	-	-	-	-

Monthly Unbilled Calculation

	06 Baseld(1)	Monthly	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09
Unbilled DDH			71.2	4.7	45.3	101.5	369.6	567.2	952.4	-	-	-	-	-	-
Unbilled Factor			63.30%	63.32%	65.28%	62.81%	65.31%	69.16%	68.63%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Res 101	15	'DD/Cust(1)	0.0448	0.0000	0.0000	0.0448	0.0896	0.0951	0.1005	0.1005	0.1005	0.0951	0.0896	0.0896	0.0448
Com 101	12	'DD/Cust(1)	0.0844	0.0000	0.0000	0.0844	0.1688	0.2058	0.2427	0.2427	0.2427	0.2058	0.1688	0.1688	0.0844
Ind 101	0	'DD/Cust(1)	0.1528	0.0000	0.0000	0.1528	0.3055	0.3639	0.4222	0.4222	0.4222	0.3639	0.3055	0.3055	0.1528
Sch. 101															
Res 101			1,643,691	1,230,551	1,268,935	1,816,294	5,592,506	8,422,091	13,936,696	-	-	-	-	-	-
Com 101			159,509	88,780	91,645	188,286	821,640	1,462,007	2,814,427	-	-	-	-	-	-
Ind 101			935	-	-	1,333	9,823	17,955	35,787	-	-	-	-	-	-
Total			1,731,459	1,319,331	1,360,580	2,005,913	6,423,969	9,902,053	16,786,910	-	-	-	-	-	-

Revenue Run Customers (Meters Billed)

Class		Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-06	Nov-06	Dec-06	2006 Total
Residential	01	129,424	129,776	129,941	129,950	129,861	129,773	129,580	129,559	129,589	130,026	130,323	131,009	131,465	1,560,852
Commercial	21	11,702	11,689	11,691	11,700	11,691	11,683	11,724	11,684	11,699	11,692	11,700	11,696	11,757	140,406
Industrial 1(	31	93	92	90	90	87	87	86	87	87	86	87	87	89	1,055
Interdepartn	80	23	23	23	23	23	23	23	24	24	25	25	26	25	287
Total		141242	141,580	141,745	141,763	141,662	141,566	141,413	141,354	141,399	141,829	142,135	142,818	143,336	1,702,600

Exhibit G-2 New versus Existing Usage

Month	New Customers Usage	New Customers Customers	Total Billed Customers Usage	Total Billed Customers Customers	"Existing Customers" Usage	"Existing Customers" Customers
Jan-07	1,620,408	10,898	21,292,599	138,804	19,672,191	127,906
Feb-07	1,565,117	10,871	21,234,566	139,210	19,669,449	128,339
Mar-07	1,001,608	10,114	14,472,322	139,055	13,470,714	128,941
Apr-07	706,395	10,418	9,724,124	139,113	9,017,729	128,695
May-07	412,954	9,679	6,113,562	139,012	5,700,608	129,333
Jun-07	269,857	10,073	3,664,833	138,838	3,394,976	128,765
Jul-07	180,683	9,708	2,462,636	138,877	2,281,953	129,169
Aug-07	141,329	9,388	2,010,203	139,096	1,868,874	129,708
Sep-07	161,990	8,874	2,332,936	139,568	2,170,946	130,694
Oct-07	277,602	8,678	4,484,817	140,039	4,207,215	131,361
Nov-07	613,037	9,448	9,398,517	140,930	8,785,480	131,482
Dec-07	1,548,327	12,244	18,392,852	141,242	16,844,525	128,998
Jan-08	840,804	5,873	20,755,627	141,580	19,914,823	135,707
Feb-08	933,547	6,156	22,514,347	141,745	21,580,800	135,589
Mar-08	590,323	6,100	14,859,076	141,763	14,268,753	135,663
Apr-08	544,390	6,003	13,629,159	141,662	13,084,769	135,659
May-08	304,416	5,532	8,714,627	141,566	8,410,211	136,034
Jun-08	134,597	5,313	4,232,714	141,413	4,098,117	136,100
Jul-08	82,104	5,070	2,763,613	141,354	2,681,509	136,284
Aug-08	66,736	4,934	2,223,233	141,399	2,156,497	136,465
Sep-08	78,849	5,202	2,487,966	141,829	2,409,117	136,627
Oct-08	127,362	5,195	3,933,329	142,135	3,805,967	136,940
Nov-08	276,318	5,260	8,603,159	142,818	8,326,841	137,558
Dec-08	599,812	5,749	15,345,278	143,336	14,745,466	137,587
2007 Annual Totals	8,499,307	120,393	115,583,967	1,673,784	107,084,660	1,553,391
2008 Annual Totals	4,579,258	66,387	120,062,128	1,702,600	115,482,870	1,636,213

These are the amounts booked in the December 2007 journal entry.
However, I discovered when a similar discrepancy occurred in December 2008 that the report had included new customers added during 2004, instead of just those added after December 2004. The date parameters should have been from 1/1/2005 instead of 1/1/2004. The report has since been re-run with the correct parameters and a prior period correction to the deferred revenue of $22,567 will be made with the January 2009 journal.

The correct December 2007 values are:

New Customer Usage	**1,421,829**
New Customer Count	**10,818**

From Avista's original data submission for Question G-5 and Data Request 10-5 and Avista Revenue Runs.

research/into/action inc

Final Report

Independent Third-Party Verification of 2006 Natural Gas DSM Energy Savings: Washington and Idaho Programs

Funded By:

AVISTA Utilities

Prepared By:

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August 20, 2007

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TABLE OF CONTENTS

APPENDICES

DATA

FIGURES

TABLES

ES EXECUTIVE SUMMARY

Avista Utilities (Avista) operates a variety of energy efficiency programs with its residential, limited-income, and nonresidential customers. These programs have the potential to create significant energy savings for Avista's customers, as well as to enable Avista to achieve the gas Demand Side Management (DSM) goals required under an approval agreement for a three-year natural gas decoupling pilot.

Avista must verify achievement of its DSM goals on an annual basis by an independent third-party assessment for the calendar years 2006 through 2008. Research Into Action, together with its subcontractor, Nexant, Inc., has performed the independent verification audit for 2006. The verification was done through a combination of engineering evaluations of the estimated impacts of actions involved in the programs, together with an audit of the program documentation, to determine whether or not the savings and costs were applied to the measures appropriately.

We used common and accepted data sampling and analysis methods to examine multiple strata within each customer group, with the goal of obtaining sufficient statistical power to produce estimates of audit measurements with a precision of ±5%, at a confidence of 95%, over the three-year course of the evaluation.

The verification methodology for all three programs shared three common components:

1. Reviewing the paper documentation of the sampled cases to verify that the input data used to calculate the therms saved on a case-by-case method were correct;
2. Performing an engineering review of the assumptions that went into Avista's calculations of therm savings for the various measures; and
3. Independently calculating therm savings on a case-by-case basis, using either Avista's assumptions or other sets of assumptions resulting from the engineering review.

Specific details of the methodology for each program reflected differences among the programs and program strata in how measures were taken.

DOCUMENTATION REVIEW

The documentation review found sufficient documentation for the majority (162 of 191) of projects. However, we found that the number of documentation issues varied among the programs and program strata. Table ES.1 shows the number of documentation problems within each stratum, along with the percentage of all projects in that stratum that had documentation problems.

Table ES.1: Frequency of Documentation Problems by Group

GROUP	PROJECTS WITH DOCUMENTATION PROBLEMS	
	COUNT	PERCENT OF PROJECTS IN STRATUM
Residential Sample Stratum 1 (*High-Efficiency Furnaces*)	0	0%
Residential Sample Stratum 2 (*Replacement Windows*)	8	33.3%
Residential Sample Stratum 3 (*All Other Measures*)	9	37.5%
Limited-Income Sample Stratum 1 (*Air Infiltration*)	0	0%
Limited-Income Sample Stratum 2 (*Insulation*)	0	0%
Limited-Income Sample Stratum 3 (*All Other Measures*)	4	19.0%
Nonresidential, Seven Largest Projects	1	14.3%
Nonresidential Sample Stratum 1 (*Pre-Rinse Sprayers*)	0	0%
Nonresidential Sample Stratum 2 (*All Other Measures*)	7	30.4%
TOTAL	**29**	

Some of the key findings were:

➡ **In the residential program**, the strata with the largest percentage of documentation problems were, Stratum 2, *Replacement Windows* (33.3% of projects), and Stratum 3, *All Other Measures* (37.5% of projects).

➡ **In the limited-income program**, Stratum 3, *All Other Measures* (19.0% of projects), had the most documentation problems.

➡ **In the nonresidential program**, Stratum 2, *All Other Measures* (30.4% of projects) had the highest percentage of documentation error.

➡ **The most frequent type of documentation problem was insufficient documentation** to confirm information provided on the rebate form (for prescriptive measures) or to compute independent estimates of savings (for non-prescriptive measures). This type of problem accounted for 17 of the 29 projects with documentation problems.

➡ **The remaining documentation problems were:**

- Documentation for the project contradicted information on the rebate form or the input data used to estimate savings (five projects).
- The measure was coded incorrectly in Avista's database (six projects).

- The measure did not qualify for a rebate under the eligibility criteria for a prescriptive program (one project).

The counts of documentation problems included in the table do not include a larger number of cases in each sample stratum for which we requested and received additional documentation from Avista.

Primary reasons for the documentation problems are that: Avista depended on several Community Action Program (CAP) agencies for this information; and when it implemented its energy efficiency programs, Avista did not anticipate that an independent verification would be required and that such detailed documentation would be needed. To address the above issues, we offer some recommendations in the *Conclusions and Recommendations* chapter for how Avista can improve documentation.

ENGINEERING REVIEW AND ANALYSIS OF ENERGY SAVINGS

Our engineering review and analysis of Avista's reporting energy savings found variances between Avista's savings estimates and our computations in all programs and most program strata. Table ES.2 shows the mean differences between Avista's reported therm savings and our computations for each study stratum. This table shows both the mean absolute difference and the mean relative difference (i.e., the mean of the project-by-project differences expressed as a percentage of our results).

Table ES.2: Variances Between Avista's Reported Savings and Audit Results by Group

GROUP	MEAN DIFFERENCE BETWEEN AVISTA'S REPORT AND AUDIT RESULTS	
	THERMS	PERCENT
Residential Sample Stratum 1 (*High-Efficiency Furnaces*)	0	0%
Residential Sample Stratum 2 (*Replacement Windows*)	3.5	8.4%
Residential Sample Stratum 3 (*All Other Measures*)	22.8	27.4%
Limited-Income Sample Stratum 1 (*Air Infiltration*)	15.6	20.1%
Limited-Income Sample Stratum 2 (*Insulation*)	29.1	17.6%
Limited-Income Sample Stratum 3 (*Other Measures*)	19.0	58.3%
Nonresidential, Seven Largest Projects	17,848.5	56.7%
Nonresidential Sample Stratum 1 (*Pre-Rinse Sprayers*)	0	0%
Nonresidential Sample Stratum 2 (*All Other Measures*)	-44.2	-2.3%

As Table ES.2 shows, we found that the variances between Avista's savings estimates and our computations differed among the programs and among the program strata. It should be noted, however, that the 95% confidence interval around the mean difference between Avista's estimate and our assessment encompassed zero difference for most sample strata, and for the combined sample for each program. The following outlines our findings from the engineering review and analysis for each program (residential, limited-income, and nonresidential).

Findings for the Residential Program

The engineering review of Avista's residential program consisted of a check against standard engineering practices, comparing Avista's reported energy savings to other utility DSM program offerings, and performing engineering calculations to verify savings on a measure-by-measure basis. The main findings regarding the residential program were:

- ➡ **For most of the prescriptive measures in the residential program, we arrived at per-unit therm savings that were close to Avista-reported values.** Although there were some variances, in most cases they were not so great as to justify recommending a different value from the one that Avista uses.
- ➡ **For three of the prescriptive measures – high-efficiency tankless, 40-gallon, and 50-gallon water heaters – we recommend higher per-unit reported savings than the ones that Avista reported.**
- ➡ **The review of Strata 1 (*High-Efficiency Furnace*) and 2 (*Replacement Windows*) found small differences between Avista's reported savings and our findings.**
- ➡ **The review of Stratum 3 (*All Other Measures*) found larger relative differences between Avista's reported savings and our findings.** However, the 95% confidence interval for these differences nevertheless encompassed zero difference.
- ➡ **Examination of individual cases within Stratum 3 revealed some systematic sources of error.** However, systematic effects did not account for very much of the difference between Avista's estimates and our calculations.
- ➡ **We are not currently able to account for much of the variances between our calculations and Avista's regarding other measures in Stratum 3, as well as some differences observed in Stratum 2.**

Findings for the Limited-Income Program

The engineering evaluation of Avista's limited-income program consisted of a customer-by-customer analysis based on the inputs provided in the CAP reports. Our chief findings were:

- **The review of Stratum 1 (*Air Infiltration*) found a mean difference between the audit-calculated therm savings and Avista's reported therm savings of 15.6 therms.** The 95% confidence interval for this difference did not encompass zero difference. The main reason for the difference is the methods used to calculate energy savings for air infiltration measures. We were not provided with the algorithms the CAPs used and therefore used our own methods.
- **The review of Stratum 2 (*Insulation*) found a mean difference between the audit-calculated therm savings and Avista's reported savings of 29.1 therms.** The 95% confidence interval for these differences encompassed zero difference. The main reason for the difference is the methods used to calculate energy savings for insulation measures. We were not provided with the algorithms used by the CAP's and therefore used our own methods.
- **The review of Stratum 3 (*All Other Measures*) found a mean difference between the audit-calculated therm savings and Avista's reported savings of 19.5 therms.** The 95% confidence interval for these differences did not encompass zero difference. The main reason for the difference is that the prescriptive savings values Avista used for furnaces were not consistent with their stated values for some projects.
- **The variances in the audit-calculated energy savings for Strata 1 and 2 were not large enough to cause concern.**
- **The variance in the audit-calculated energy savings for Stratum 3 was significant and should be evaluated further by Avista in order to resolve the errors.**

Findings for the Nonresidential Program

The engineering review of Avista's nonresidential program consisted of project-by-project analyses based on the inputs and assumptions provided by Avista, along with a check against standard engineering practices and, in the case of pre-rinse sprayers, a comparison of Avista's reported energy savings to those of other utility DSM program offerings. The following summarizes our findings for the nonresidential programs:

- **The review of the seven largest projects resulted in energy savings close to Avista's reported values in the case of four projects.** Energy savings calculated for two other projects were significantly different than Avista's reported savings and one project had insufficient documentation for us calculate results.
- **We accepted the prescriptive per-unit savings of 176 therms for Stratum 1 (*Pre-Rinse Sprayers*).**
- **The review of the measures in Stratum 2 (*All Other Measures*), which comprised HVAC, shell, rooftop service, and appliances, resulted in values that were close to**

Avista's reported values, with the exception of the rooftop service projects. The 95% confidence interval around the differences that we found encompassed zero difference. We were unable to confirm Avista's reported savings for rooftop service projects based on the information provided.

RECOMMENDATIONS

This first year of the independent verification found a variety of opportunities for Avista to improve recordkeeping and program procedures. The following recommendations should reduce documentation problems and increase the accuracy of engineering calculations and reporting for future years.

Residential Program

- ➡ **Increase the reported savings for high-efficiency continuous-flow (tankless) water heaters from 11 therms to at least 28 therms.**
- ➡ **Increase the reported savings for high-efficiency 40-gallon water heaters from 11 therms to 16 therms.**
- ➡ **Increase the reported savings for high-efficiency 50-gallon water heaters from 8 therms to 11 therms.**
- ➡ **Request more detailed documentation from residential customers and their contractors submitting rebate requests.**
- ➡ **Institute stricter review of rebate applications to ensure that the information on the backup documentation is completely consistent with that listed on the rebate forms.**
- ➡ **Institute an internal system for checking data entry accuracy to ensure that incorrect measure types are not recorded in rebate records.**
- ➡ **Review rules and procedures for assigning or calculating therms in the database to ensure that they are consistent with engineering-established rules and procedures.**

Limited-Income Program

- ➡ **Review the calculation methodologies used by all CAPs to ensure that there is consistency across the various agencies and that energy savings are being calculated correctly.**
- ➡ **Request that all necessary baseline information be recorded and maintained by the agencies.**

Non-Residential Program

➡ **Increase documentation of baseline and retrofit equipment, including model numbers, efficiencies, and shell information.**

➡ **For pre-rinse sprayers, retain invoices for the purchase of the rebated units.**

➡ **Complete a separate evaluation of PECI's *AirCare Plus* program to determine the accuracy of reported energy savings.**

Verification

➡ **Consider conducting further analysis of the 2006 data before adjusting Avista's savings reports based on the results of this audit.** It would be reasonable to have Avista either correct the database behind the reports and have those reports re-verified, or to expand the audit sample on those strata for which the variances between Avista's reports and our estimates were the largest to provide a higher level of confidence and precision for the recommended adjustments.

➡ **The sample requirements for High-efficiency furnaces and Pre-Rinse sprayers for 2007 and 2008 can likely be reduced, given the findings of the 2006 audit.**

1 INTRODUCTION

In February 2007, Avista Utilities (Avista) received approval for a three-year natural gas decoupling pilot, under which it must achieve certain gas Demand Side Management (DSM) goals (i.e., energy savings, expressed in therms) in order to be able to recover tracked margin. The savings are achieved through a variety of residential, limited-income, and nonresidential programs that Avista has undertaken. Avista must verify achievement of its DSM goals on an annual basis by an independent third-party assessment for each of the three years of the pilot.

Avista chose Research Into Action, Inc., to carry out the verification. Together with its subcontractor, Nexant, Inc., Research Into Action has performed an independent verification audit for the calendar year 2006. The verification was done through a combination of engineering evaluations of the estimated impacts of actions involved in the programs, together with an audit of the program documentation, to determine whether or not savings and costs were applied to measures appropriately.

The audit was based on desk review of the paper trail, with possible telephone contacts or in-person visits of samples drawn separately for residential, limited-income, and nonresidential customer categories. The purpose of the audit was to determine whether or not Avista's savings estimates in each case are reasonable. Specifically, we set out to answer the following questions:

1. Were the input data that Avista used to calculate therm savings on a case-by-case basis adequately supported by invoices and related documentation?
2. Were Avista's methods for estimating therm savings for the various measures installed justified from an engineering standpoint?
3. Assuming adequate estimation methods and input data, were Avista's calculations of savings on a case-by-case basis accurate?

This report describes: Avista's residential, limited-income, and nonresidential energy efficiency incentive programs; the audit methods used; the results of the audit; and our recommendations to Avista, based on the audit results.

2 AVISTA UTILITIES ENERGY EFFICIENCY PROGRAMS

Since 2006, Avista Utilities has implemented energy efficiency incentive programs with its residential, limited-income, and nonresidential customers. The programs provide rebates for a variety of energy efficiency measures carried out at customers' homes and businesses. For the calendar year 2006, Avista's customer service database recorded completed installations of 4,212 residential measures, 593 limited-income residential measures, and 651 nonresidential measures. The details of how each program is implemented vary among the three customer categories and, to some degree, among measure types within certain customer categories.

RESIDENTIAL PROGRAM

The residential program provides rebates to residential customers for prescriptive energy efficiency improvements for the following gas measures:

- ➡ High-efficiency gas furnace
- ➡ High-efficiency gas boiler
- ➡ High-efficiency 40-gallon water heater
- ➡ High-efficiency 50-gallon water heater
- ➡ High-efficiency tankless water heater
- ➡ Ceiling/attic insulation
- ➡ Floor or wall insulation
- ➡ Duct insulation
- ➡ New east/west-, north-, or south-facing windows
- ➡ Replacement of east/west-, north-, or south-facing windows
- ➡ Programmable thermostats

Avista supplied Research Into Action with a document listing the eligibility criteria and assumptions used for computing savings for each of the above measures. These are shown in Table 2.1.

Table 2.1: Eligibility Criteria and Assumptions for Computing Savings for Residential Measures

MEASURE	ELIGIBILITY CRITERIA	BASELINE / ASSUMPTIONS	SAVINGS
High-Efficiency Gas Furnace	Minimum Annual Fuel Utilization Efficiency (AFUE) of 90%	Federal minimum AFUE (78%)	72 therms
High-Efficiency Gas Boiler	Minimum AFUE of 85%	Federal minimum (80%)	72 therms
High-Efficiency 40-Gallon Water Heater	Minimum Efficiency Factor (EF) of .62	.59 to .62	11 therms
High-Efficiency 50-Gallon Water Heater	Minimum EF of .60	.58 to .60	8 therms
High-Efficiency Tankless Water Heater	Minimum EF of .65	(not specified)	11 therms
Ceiling/Attic Insulation	Existing insulation less than R-22; a minimum increase of R-10; installed only in areas that separate conditioned from unconditioned areas of the residence	R15 to R25	.042 therms per square foot per R10 added
Floor or Wall Insulation	Existing insulation less than R-11; minimum increase of R-10; installed only in areas that separate conditioned from unconditioned areas of the residence	R5 to R15	209 therms per square foot per R10 added
Duct Insulation	Minimum increase of R-10; installed on heating ducts in unconditioned areas		2.8 therms per linear foot
New East/West-, North-, or South-Facing Windows	Minimum U-factor of .35	U-factor .55 or higher	.24 therms per square foot of window installed
Replacement East/West-, North-, or South-Facing Windows	minimum U-factor of .35	U-factor .55 or higher	.83 therms per square foot of window installed

In the residential customer program, customers deal directly with contractors for installation of measures. The customers record pertinent data about the measures on an Avista *Home Improvement Incentive Form* (rebate form) and submit this form, together with invoices and other relevant documentation from the contractor, to Avista. If the installation meets Avista's eligibility criteria, Avista issues a rebate to the customer.

LIMITED-INCOME PROGRAM

The limited-income program provides rebates to limited-income residential customers for energy efficiency improvements for the following gas measures:

- ➡ Air infiltration
- ➡ ENERGY STAR® windows
- ➡ ENERGY STAR® doors
- ➡ High-efficiency gas furnace
- ➡ High-efficiency 40-gallon water heater
- ➡ High-efficiency 50-gallon water heater
- ➡ High-efficiency tankless water heater
- ➡ Ceiling/attic insulation
- ➡ Floor or wall insulation
- ➡ Duct insulation

To qualify for an energy audit through the limited-income program, customers must attend a workshop to learn about saving energy and are provided low-cost/no-cost tips. After attending the workshop, customers then receive an in-home assessment and a Community Action Program (CAP) agency determines cost-effective measures for installation, based on existing equipment, the shell, and so forth.

One salient characteristic of the limited-income program is that, while there are recommended or suggested guidelines for the installation of measures, the analyses are performed and the incentives are offered on a site-specific basis. Thus, the minimum required efficiencies that apply to some measures in the residential program – such as water heaters and furnaces (see above) – do not necessarily apply in the limited-income program.

The reasoning for this was that the assumptions differed for the residential and limited-income programs. For the residential program, Avista assumed that customers receiving a rebate were replacing a system on or near burnout and that they would need to buy at least a code replacement water heater.

For the limited income program, the assumption was that customers often would replace an inefficient, but still functional, system before burnout, so replacement with a new system would provide a higher savings potential, even with a lower efficiency level. Furthermore, Avista assumed that many limited-income customers in manufactured housing may not have the ability to install a higher efficiency system in the available space.

A second salient characteristic of the limited-income program, which affects the verification methodology, is that all measures in this program are directly installed by CAP agencies. Therefore, the customer neither completes a rebate form nor receives invoices or other supporting documentation from the installer. Instead, CAP installers record all input data (including pre-existing conditions as relevant), either directly into software installed on notebook computers that they carry with them to the location of installation or onto paper forms. The software or paper forms that are used vary among CAPs. With some minor exceptions, no independent hard-copy documentation exists for any of the measures in this group.

NONRESIDENTIAL PROGRAM

The nonresidential program provides rebates for energy efficiency improvements for the following gas measures:

- Appliances
- Heating, ventilation, and air conditioning (HVAC)
- LEED certification
- Shell
- Pre-rinse sprayers
- Rooftop service

The procedures for implementing measures and claiming rebates differ for pre-rinse sprayers, rooftop services, and all other measures. For rebate applications involving pre-rinse sprayers and rooftop service, Avista hires contractors who go to the installation sites. In the case of pre-rinse sprayers, the contractors install the measures directly; in the case of rooftop service, the contractors perform an audit. In both cases, contractors record relevant data about the installation (including pre-existing conditions) directly into software installed on a notebook computer. Little or no additional paper documentation is created for these measures.

For the rebate applications involving lighting, motors, food service, and commercial HVAC variable frequency drive equipment, the customer can purchase and install the measure and submit a rebate form and invoices to Avista. The program for the remaining measure types is site specific, in which customers receive an analysis from Avista prior to ordering and installing equipment, which estimates energy savings and potential incentive. Avista enters into an *Energy Efficiency Agreement* with each customer, which states that they can be reimbursed upon completion of the project, based on project costs and type of equipment installed. The customers sign this agreement and either hire a contractor to install the measure or install it themselves. Upon completion of the project and receipt of invoices, Avista energy efficiency engineers post-verify the installation. If the installation is verified and meets Avista's eligibility criteria, Avista issues a rebate.

3 AUDIT METHODS

We used data sampling and analysis methods that are common and accepted in evaluation research. The sampling methods, described in detail below, examined multiple strata within each customer group. This was done to ensure that highly common measures did not dominate the overall sample. The data analysis, described in the next section, combined an engineering review of Avista's therm-savings calculation methods, a review of the documentation submitted with each record in the samples to determine whether the input data that Avista used to calculate therm savings were accurate, and a data review to evaluate the accuracy of Avista's calculated savings.

SAMPLING METHODOLOGY

The primary consideration that informed our sampling approach was that each sample should have sufficient statistical power to produce estimates of audit measurements with a precision of ±5%, at a confidence of 95%, over the three-year course of the evaluation. Thus estimates of measurements that are expressed as a proportion or percentage of the sample (e.g., percentage of the sample for which the input data recorded on the rebate forms were confirmed by accompanying documentation) should be accurate within plus-or-minus five percentage points. Estimates of the degree of error in Avista's calculation of therm savings should be accurate within ±5% of the mean Avista-calculated therm savings.

In addition to the above primary consideration, our approach incorporated two additional considerations. First, efforts should be made to include the broadest possible range of measure types in the sample. An initial review of the distribution of measure types revealed that a few measure types accounted for a large percentage of measures taken, while several other measure types each accounted for very low percentages. A simple random sample of such a population would have been dominated by the high-frequency measures, and some low-frequency measures might not even be sampled. We used a stratified sampling approach to prevent such an occurrence. As described below, we separated the highest-frequency measure types into their own strata so that they would not dominate the overall sampling. Even with stratification, it was possible that some low-frequency measure types would not be included, but excluding very low-frequency measure types should have little impact on the results.

The second additional consideration was that the independence of observations within each sample should be maximized; therefore, efforts should be made to avoid common sources of variance between any two observations that are not shared among all observations. We observed that within the residential and limited-income categories, there were many instances of multiple measures per customer. Therefore, as described below, our sampling approach was designed to prevent more than one measure for any single customer from appearing in any sample.

Based on the above considerations, the following methodologies were implemented for each customer type.

Residential Program

Avista provided Research Into Action with a data file with 4,212 records, one for each of its calendar year 2006 residential measures. The data file showed the following information for each measure:

- Customer ID
- Measure type (code and description)
- Entry date
- Customer rebate amount ($)
- Estimated kWh savings
- Estimated therm savings

The residential list was marked by a high degree of repetition. That is, a large number of customers had multiple measures (rebates). More than 60% of customers had two or more rebates, and nearly 30% had three or more. In addition, many customers had two or more cases of the same type of measure. Ideally, each customer should be represented in the sample only once, to avoid interdependency among the observations. Moreover, for the sake of sample size calculation, each type of measure should be counted only once for each customer. This prevents over-sampling of measure types for which there are multiple cases for some customers.

A frequency analysis of measure types showed a large degree of variation in the number of cases of the various measure types – that is, some measures were installed at many residences, while others were installed at a few. The distribution of projects across measure types was similar, regardless of whether or not multiple cases of a single measure type for a given customer were counted (see Figure 3.1 and Figure 3.2). The most frequent measure type was *High-efficiency furnaces*, with approximately 30% of the cases. *Replacement Windows* (*East/West Facing*, *North Facing*, and *South Facing*) together made up about 44% of the cases. The remaining measure types made up about 26% of the cases.

Creating separate strata for the high-frequency measure types prevents them from dominating a single, purely random sample. Therefore, based on the above findings, we identified three strata from which to sample: *High-efficiency furnaces*, *Replacement Windows*, and *All Other Measures*.

Figure 3.1: Frequency Count of Residential Program Codes: All Cases Counted

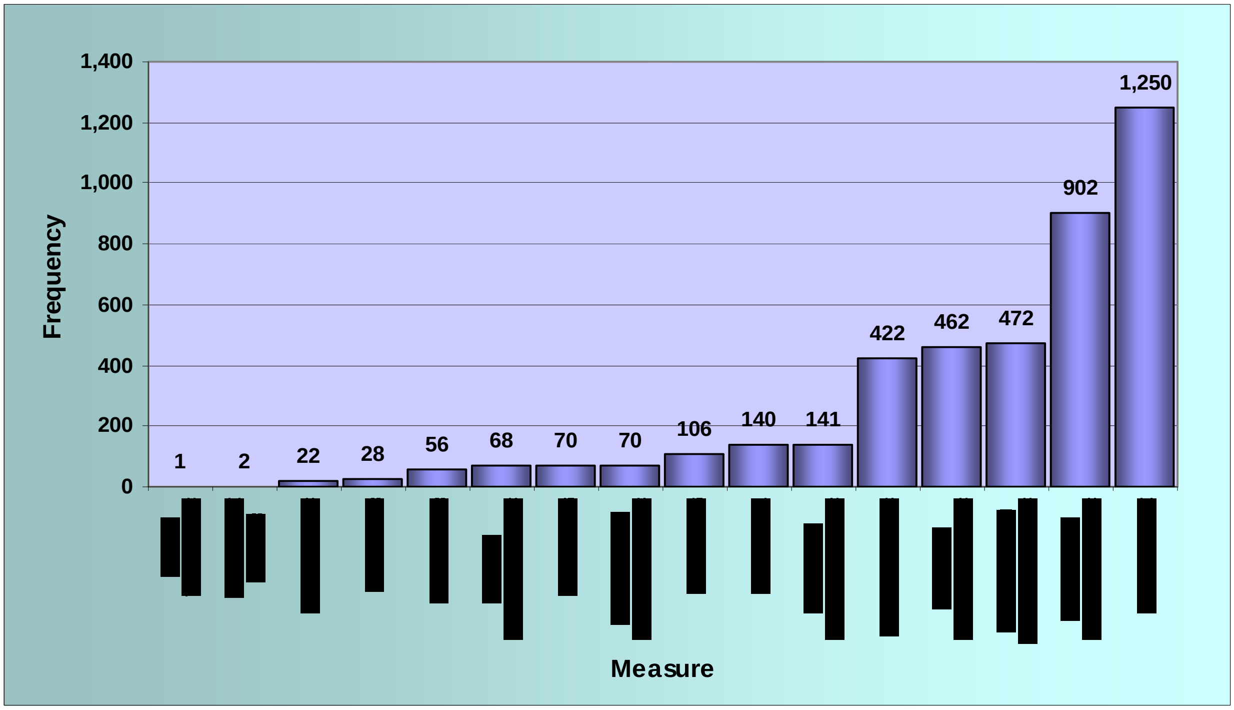
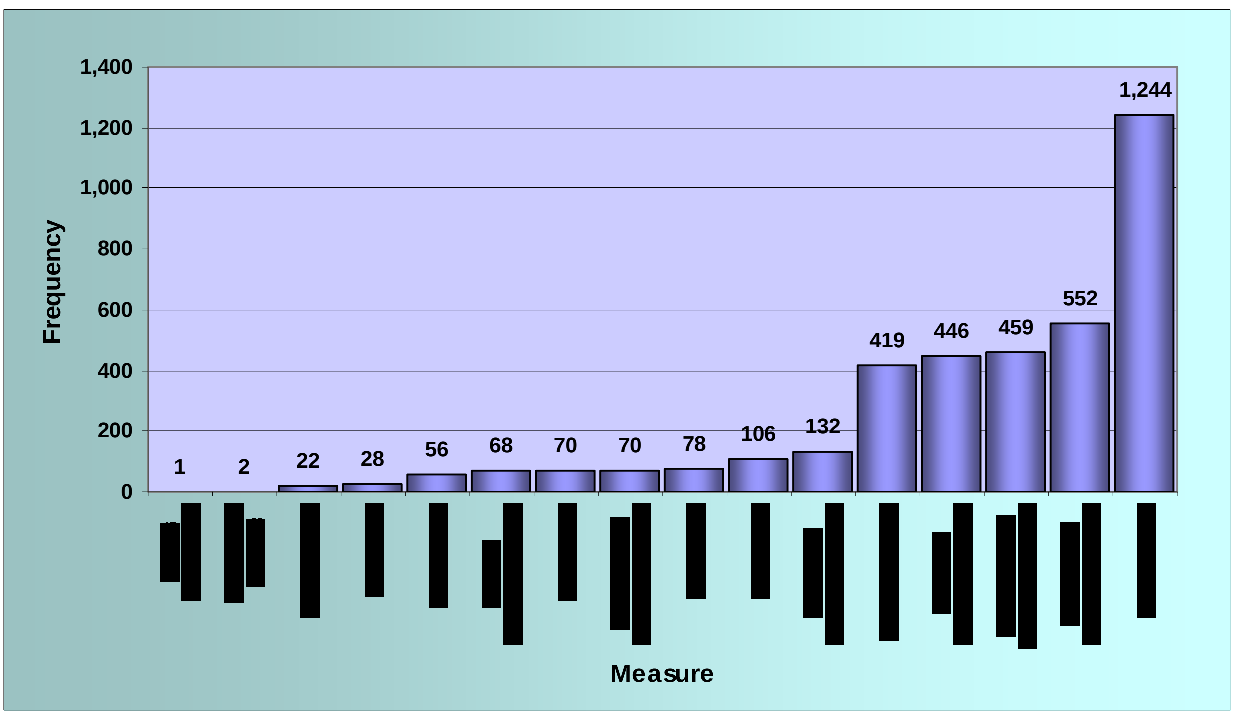


Figure 3.2: Frequency Count of Residential Program Codes: Excluding Multiple Cases of a Single Program Code for a Given Customer



Limited-Income Program

For the calendar year 2006, Avista provided Research Into Action with a data file containing 593 records of limited-income residential measures from its customer service database. The data file showed the following data for each measure:

- Customer ID
- Measure type (code and description)
- Entry date
- Customer cost ($)
- Customer rebate amount ($)
- Estimated kWh savings
- Estimated therm savings

Initial review of this file identified eight records that had been coded as a gas measure, but reported 0 therm savings. Avista reported to us that these records should have been coded as *Health & Human Safety* and should not have appeared in the file for the limited-income program. By contrast, three records coded as *Health & Human Safety* also recorded therm savings; these records were retained in the file as *Health & Human Safety* records with positive therm savings.

The limited-income list had characteristics similar to the residential list: a large number of cases with multiple measures per customer and a highly unequal distribution of cases across measure type. In this case, *Air Infiltration* accounted for approximately 29% of the cases; *Insulation* (*Ceiling*, *Floor*, and *Wall*) accounted for about 49%; and *All Other Measures* made up about 22%.

As with the residential category, the distribution of cases across program types was similar, regardless of whether or not multiple cases of a single program type for a given customer were counted (graphics not included). Following the reasoning for the residential group, we identified three strata from which to sample: *Air Infiltration*, *Insulation*, and *All Other Measures*.

Nonresidential Program

For 2006, Avista's customer service database recorded completed installations of 651 nonresidential measures.[1] Avista provided Research Into Action with a data file containing 651

[1] The original count was 652, but one of these was a prescriptive lighting record that had been erroneously included and was later deleted per Avista.

records – one for each of the 651 measures. The data file showed the following information for each measure:

- Application number
- Measure type
- Building type
- Estimated therm savings
- Date created
- Phase (completed for all measures)
- State (Washington or Idaho for all measures)

The size of reported savings (therms) was highly positively skewed, with a small number of measures representing extremely high reported savings. Therefore, the *Seven Largest Measures* were singled out and evaluated as one stratum, separately from the random sample.

Among the remaining 644 measures, there were some dependencies among measure type, building type, and size of reported savings. A cross-tabulation of measure type and building type showed a clear tendency for *Pre-Rinse Sprayer* to be associated with *Food Service* (Table 3.1).

Table 3.1: Measure Type by Building Type

BUILDING TYPE	MEASURE TYPE						
	APPLIANCE	HVAC	LEED CERTIFICATION	PRE-RINSE SPRAYER	ROOFTOP SERVICE	SHELL	Total
Agricultural	0	4	0	0	0	4	**8**
Church	0	1	0	0	0	0	**1**
Food Service	4	8	0	245	15	3	**275**
Government	4	21	2	57	7	12	**103**
Health Care	0	1	0	8	1	0	**10**
Hospitality	1	13	0	16	3	8	**41**
Manufacturing	1	6	0	0	0	5	**12**
Office	2	42	0	4	12	34	**94**
Residential	0	1	0	0	0	4	**5**
Retail	4	19	0	8	45	19	**95**
TOTAL	**16**	**116**	**2**	**338**	**83**	**89**	**644**

Pre-rinse sprayers accounted for a very large number of total measures and represented a fairly narrow band of reported savings sizes (although there was some variability). The other measure types appeared to be distributed more-or-less similarly across the building types.

On the basis of this, we treated *Pre-Rinse Sprayers* (the most common measure type and highly concentrated in food service, the most common building type) as a second stratum and *All Other Measures* as a third stratum. The advantage of this is that, if pre-rinse sprayers were not separated out from the other measures, then they would represent a very large proportion of the entire sample; treating them as a separate stratum allowed the other measure types to be relatively over-sampled.

We treated *All Other Measures* as a single stratum. Therefore, the data collection approach for nonresidential customers consisted of one census (of the *Seven Largest Measures*) and two strata that were randomly sampled: *Pre-Rinse Sprayers* and *All Other Measures*.

In addition, we found three cases in which the same application number was found on two records; in all other cases, there was only one record per application number. In all three cases, the two records with the same application both had identical information (i.e., same measure type, building type, estimated therm savings, and so forth), with one exception: the date that the record was created was different by one day for one set of duplicate application numbers. We notified Avista of the duplications and requested the record files associated with those three application numbers to determine, on a case-by-case basis, whether the two records with the same application number represented separate measures or whether they were the same measure recorded twice. None of the six records with duplicated application numbers was randomly drawn for the survey.

Sample Size Determination

As indicated above, we calculated sample sizes to yield precise estimates for the completed three-year verification. Since the settlement agreement does not specify sample sizes, precision, or confidence level, we have conservatively assumed a precision of 5% and a confidence interval of 95% for the three-year sample. We determined the sample size for each year by dividing the three-year sample size by three. This will reduce the precision of the year-by-year estimates; actual precision levels for the 2006 sample are given in the *Results* chapter.

As noted in the introduction to this report, this audit was designed to answer three research questions:

1. Were the input data that Avista used to calculate therm savings on a case-by-case basis adequately supported by invoices and related documentation?
2. Were Avista's methods for estimating therm savings for the various measures installed justified from an engineering standpoint?

3. Assuming adequate estimation methods and input data, were Avista's calculations of savings on a case-by-case basis accurate?

These questions required different kinds of data. The first question relates to the *paper trail*. We addressed this question by calculating the percentage of records in each sample that were adequately supported by external documentation. On the other hand, the second and third questions relate to Avista's calculations of savings. We addressed the second question through an engineering review of Avista's methods. We addressed the third question by calculating our own estimates of therm savings on a case-by-case basis and comparing those estimates with Avista's estimates. These different kinds of data required different methods for determining the necessary sample size.

Sample Size Determination for the Paper-Trail Audit

Calculating the sample size needed for the paper-trail audit was relatively straightforward. The main issue was estimating the likely percentage of cases in which the input data would be verified. For any sample size, the precision of an estimate of a percentage is greater the further the percentage departs from 50% (because the standard deviation of a percentage is least as the percentage approaches 0 or 100). Thus, for any specified level of precision, the more the percentage departs from 50%, the smaller the sample size that is needed. In the present case, we assumed that Avista's inputs would be adequately documented in at least 95% of the cases.

Sample Size Determination for the Check of Avista's Savings Estimates

Calculating the sample size needed for the check of Avista's calculations was more complicated. Since the answer to this question is a mean (the mean difference between Avista's estimated therm savings and our estimated savings), calculating the necessary sample size required estimating the standard deviation of that mean. Doing so was somewhat complicated in this case. Although we can calculate the standard deviation of Avista's estimates for any sample stratum, we cannot know ahead of time the standard deviation of the difference between Avista's estimates and the audit's estimates.

To address this complication, we used two separate approaches to estimating the standard deviation of the difference between Avista's estimated savings and the audit's estimates within each sample stratum. In the first approach, we used a randomization algorithm to compute a new variable for each record. In each case, the value of the created variable varied randomly from Avista's estimated therm savings for that case within the range of ±15% of Avista's estimate. For each record, we calculated the difference between Avista's estimate of therm savings and the created variable, and computed the standard deviation of that difference for each sample stratum. This yielded an estimate of the standard deviation of the difference between Avista's and the audit's computations of therm savings, assuming that Avista's estimates would generally be within 15% of what the audit would find.

In the second approach, we estimated the standard deviation of the difference between Avista's estimates and the audit's estimates as 10% of the standard deviation of the measure itself. This was based on the assumption that any errors in Avista's computations of therm savings would be correlated with the size of the computation, but that the relative size of the errors would generally be small.

Calculated Sample Sizes

These calculations are shown in Table 3.2 and Table 3.3. The sample sizes in Table 3.2 are total sample sizes across the three-year period, not samples per year.

Table 3.2: Sample Sizes Over the Three-Year Period, Assuming 5% Precision

PROGRAM	STRATUM	ESTIMATED THREE-YEAR POPULATION	PAPER TRAIL AUDIT	COMPUTATION AUDIT – METHOD 1	COMPUTATION AUDIT – METHOD 2
Residential	High-Efficiency Furnaces	3,381	72	13	N/A*
	Replacement Windows	4,155	72	24	12
	All Other Measures	2,784	71	32	28
Limited-Income	Air Infiltration	429	64	31	36
	Insulation	726	67	39	20
	All Other Measures	369	61	43	28
Nonresidential	Seven Largest Programs	21	21	21	21
	Pre-Rinse Sprayers	1,014	68	28	12
	All Other Measures	918	68	31	30
All Programs	All Strata	**13,797**	**560**	**261**	**124**

* There was no variability in Avista's estimates within this stratum. Since this method for computing sample size was based on the standard deviation of Avista's estimate, it was not possible to determine the sample size for this stratum using this method.

The total sample sizes for each year are one-third of this and are shown in Table 3.3. These tables show that the sample sizes needed to answer the second research question were the largest. Therefore, we used these sample sizes. They did, in fact, provide better precision for the estimates of error in Avista's therm saving computations than the sample sizes calculated specifically for those estimates.

Table 3.3: Sample Sizes for One Year, Based on 5% Precision Over Three Years

PROGRAM	STRATUM	ESTIMATED THREE-YEAR POPULATION	PAPER TRAIL AUDIT	COMPUTATION AUDIT – METHOD 1	COMPUTATION AUDIT – METHOD 2
Residential	High-Efficiency Furnaces	3,381	24	5	N/A*
	Replacement Windows	4,155	24	8	4
	All Other Measures	2,784	24	11	10
Limited-Income	Air Infiltration	429	22	11	12
	Insulation	726	23	13	7
	All Other Measures	369	21	15	10
Nonresidential	Seven Largest Programs	21	7	7	7
	Pre-Rinse Sprayers	1,014	23	10	4
	All Other Measures	918	23	11	10
All Programs	All Strata	**13,797**	**189**	**91**	**43**

* There was no variability in Avista's estimates within this stratum. Since this method for computing sample size was based on the standard deviation of Avista's estimate, it was not possible to determine the sample size for this stratum using this method.

Randomization

Within each customer type, we partitioned the list into the specified strata discussed above. Then we created an *SPSS* data set for each stratum. Within each stratum, we created a new variable that was populated with a different random number for each record (using a uniform distribution). We ordered each data set by the random variable, which randomized the order of the cases within that set. Then, within each data set, we selected the first *n* cases, where *n* was the specified sample size for that stratum.

We had determined that if a given customer was selected more than once, the duplicate *i* selections of that customer would be replaced with the next *i* records in that stratum. This occurred three times.

VERIFICATION METHODOLOGY

The verification methodology for all three programs shared three common components:

1. Reviewing the paper documentation of the sampled cases to verify that the input data used to calculate the therms saved on a case-by-case method were correct;

2. Performing an engineering review of the assumptions that went into Avista's calculations of therm savings for the various measures; and
3. Independently calculating therm savings on a case-by-case basis, using either Avista's assumptions or other sets of assumptions resulting from the engineering review.

Some differences existed among the programs and program strata in how measures were installed. These differences resulted in variances in the nature of the input data sources and how they were documented. The verification methods specific to each program (residential, limited-income, and nonresidential) are described separately for each program.

Residential Program

In the residential program, customers dealt directly with contractors for installation of measures. The customers recorded pertinent data about the measures on an Avista *Home Improvement Incentive Form* (rebate form) and submitted this form, together with invoices and other relevant documentation from the contractor, to Avista. Avista forwarded electronic copies of rebate forms, invoices, and other relevant documentation for the sample cases to Research Into Action.

Data Entry and Coding

For each sample stratum, we created an *Excel* workbook for recording details about the documentation received from Avista. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not the records, including an invoice, had been received; disposition codes; and notes describing any exceptions. In addition, each workbook included columns for recording the input data recorded for each case. Finally, each workbook had columns pre-coded with the Avista-supplied per-unit savings values or algorithms for calculating savings (as explained below) for each case. (In the event that our engineering review suggested different per-unit values or algorithms, we substituted these for those supplied by Avista.)

For each case, we reviewed all invoices and other documentation to confirm the information listed on the rebate form for the measure in question. For example, if the rebate form listed a 40-gallon, high-efficiency gas water heater with an Efficiency Factor (EF) of .63, we checked to see if the invoice and/or other documentation confirmed all of that information. Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. For the residential strata, the possible codes were:

1 = Invoice or other documentation confirms rebate form

2 = Invoice does not provide sufficient information to confirm rebate form

3 = Invoice contradicts rebate form

4 = Measure was incorrectly coded in the Avista database

5 = Does not qualify for a rebate

We assigned a code of "1" if the invoice or other documentation provided sufficient details to compute therm savings based on Avista's criteria and confirmed the information provided on the rebate form. For example, if the measure was a 40-gallon high-efficiency water heater and the invoice or other material documented that measure, as well as either the EF or the model number (which could be used to determine the EF), and the EF met Avista's eligibility standard, then we assigned a code of "1". Similarly, if the measure was a high-efficiency furnace and the invoice or other materials documented that measure as well as the AFUE% or model number, and the AFUE% met Avista's eligibility standard, then we assigned a code of "1". Note that, even if the invoice did not document the EF or AFUE%, if we were able to obtain this information based on the model information, then we assigned a code of "1". In the case of insulation, the measure, area, and pre- and post- R-values were necessary.

For windows, it was necessary for the invoice to document the measure, as well as the area covered. However, we found that the invoice typically did not specify the direction that the windows faced, or gave window size subtotals for various directions faced. Therefore, our protocol was that if the invoice documented windows and it was possible to determine the total area of the windows, and if the total area on the rebate form did not exceed the total area on the invoice, then we assigned a code of "1".

We assigned a code of "2" if the invoice and other materials did not provide sufficient input data to confirm information on the rebate form. For example, if the invoice and other materials did not document the input data recorded on the rebate form, we assigned a code of "2". Similarly, if the invoice and supporting materials documented neither EF nor the model for a water heater, or did not document the model or AFUE% for a furnace, we assigned a code of "2". In the case of windows, we assigned a "2" if the area covered was not documented. For insulation, we assigned a "2" if the area, the existing R-value, or the final R-value was not documented.

If the invoice and/or other materials showed input data that contradicted that shown on the rebate form, we assigned a code of "3". For the purposes of this audit, we defined "contradiction" as a difference of greater than 5% of that recorded on the rebate form in the direction that would result in computation of fewer therms than recorded for that measure. For example, if the measure in question was windows or insulation, and the square footage recorded on the rebate form exceeded that recorded on the invoice or other documentation by more than 5%, we then assigned a disposition code of "3" (because the savings estimated from the rebate form exceeded by more than 5% the amount that would be estimated from the value on the invoice).

If the invoice or other documentation showed a measure other than what was recorded for that case in the Avista database, we assigned a code of "4". Finally, we found a few cases in which the EF of a water heater or AFUE% of a furnace was not documented, but where we were able to obtain this information from the manufacturer, and thus found that the EF or AFUE% did not meet Avista's eligibility standards, even though a rebate had been issued. In these cases, we assigned a code of "5".

Note that a code of "3", "4", or "5" did not necessarily mean that there was not sufficient documentation of input data, simply that those data may not have been correctly reported.

If the *Initial Disposition Code* was other than "1", we recorded an explanation in the *Notes* column of the workbook.

Data Clarification

If the information on the supporting documentation was incomplete, we attempted to obtain the missing information by contacting Avista and/or the manufacturer, supplier, or dealer of the installed measure. For example, if the EF for a water heater was not documented, but the model number was, we contacted the manufacturer, supplier, or dealer to find out the EF for the listed model. Using the information obtained through these contacts, we assigned a *Final Disposition Code* to each case and updated the case notes.

Paper-Trail Analysis

Our paper-trail analysis consisted of computing the percent of cases in each residential stratum with each final disposition code, along with 95% confidence intervals.

Engineering Review

The engineering review of Avista's residential program consisted of a check against standard engineering practices, comparing Avista's reported energy savings to other utility DSM program offerings, and performing engineering calculations to verify savings on a measure-by-measure basis. We used Avista's assumptions and rebate qualifications for each measure (e.g., window U-value requirements, EF of water heaters) in the engineering review. We also evaluated them for appropriateness, such as by comparing them to code values for Washington and Idaho.

The following outlines the review methods for each measure in the program:

- **High-Efficiency Furnace and Gas Boiler:** The review included the use of ENERGY STAR®'s online calculator[2] for the regions in Avista's Washington and Idaho territory, along with values used by other utility companies for similar baseline and retrofit requirements, adjusted for heating-degree-days.

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2 See the ENERGY STAR® website: http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammablethermostat.xls.

- **High-Efficiency Water Heater (40- and 50-gallon):** The review included engineering calculations using Avista's Energy Factor (EF) qualifications and a comparison with other utility company reported values for similar baseline and retrofit requirements.
- **High-Efficiency Tankless Water Heater:** The review included engineering calculations using a baseline EF of 0.58 and a retrofit EF of 0.80 (typical for tankless water heaters), and a comparison with savings values reported by other utility companies and the California Database for Energy Efficient Resources (DEER).
- **Ceiling/Attic/Floor/Wall/Duct Insulation Measures:** The review included engineering calculations based on the *modified heating-degree-day* method, using Avista's stated baseline and retrofit assumptions. We also used heating-degree-days for Spokane, Washington, and a seasonal equipment efficiency rating of 0.60 in the calculations.
- **New Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals*[3] method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of a new window. We used baseline and retrofit assumptions for U-factors, as stated by Avista, in the analysis. We also used heating-degree-days for Spokane, Washington, and a seasonal equipment efficiency rating of 0.60 in the review.
- **Replacement Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals* method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of a replacement window. We used baseline and retrofit assumptions for U-factors, as stated by Avista, in the analysis. We also used heating-degree-days for Spokane, Washington, and a seasonal equipment efficiency rating of 0.60 in the calculations.
- **Programmable Thermostats:** The review included running ENERGY STAR®'s online calculator for programmable thermostats, using all available locations in Avista's Washington and Idaho service territory, and averaging the savings results across all regions. We discounted the ENERGY STAR® savings value to 25%, based on Energy Information Administration (EIA) surveys, which reported that only 25% of installed programmable thermostats are correctly programmed.[4]

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3 *2005 ASHRAE Handbook Fundamentals*, Section 27.21, "Residential Calculations Examples," Equation 40.

4 *A Look at Residential Energy Consumption in 1997*, DOE/EIA-0632 (97), Energy Information Administration.

Analysis of Avista's Savings Estimates

As a check of Avista's therm savings estimates, we used the Avista-supplied per-unit savings values or algorithms, as verified or modified by our engineering review, and the input data recorded on the rebate form to compute therm savings for each case.

Avista supplied the following prescriptive therm savings:

➡ **High-Efficiency Gas Furnace (≥ 90% AFUE):**	72 therms
➡ **High-Efficiency Water Heater, 50-Gallon (≥ .60 EF):**	8 therms
➡ **High-Efficiency Water Heater, 40-Gallon (≥ .62 EF):**	11 therms
➡ **High-Efficiency Water Heater, Tankless (≥ .65 EF):**	11 therms
➡ **Ceiling/Attic Insulation (minimum R-10 increase):**	.042 therms/square foot/R-10 added
➡ **Wall/Floor Insulation (minimum R-10 increase):**	.209 therms/square foot/R-10 added
➡ **Duct Insulation (R-10 increase):**	2.8 therms per linear foot
➡ **New Windows (U-factor at least .35):**	.42 therms per square foot
➡ **Replacement Windows (U-factor at least .35):**	.83 therms per square foot
➡ **Programmable Thermostat:**	31 therms

For each case in each sample stratum, we computed the difference between Avista's estimate of therm savings and ours. We excluded cases for which the documentation did not provide sufficient data to compute an estimate, as specified above. However, we included cases with final disposition codes of "3", "4", or "5" if we had sufficient data to compute an estimate. The reasoning was that these cases provide appropriate information regarding Avista's computations of therm savings on a case-by-case basis. Note, however, that they also are included in our paper-trail analysis, which shows the percentage of cases with documentation problems.

Limited-Income Program

The limited-income program is non-prescriptive, so the analyses are performed and incentives offered on a site-specific basis. As noted above, CAPs directly install all measures in the limited-income program and record all input data either directly into software installed on notebook computers that they carry with them to the location of installation or onto paper forms. The customer neither completes a rebate form nor receives invoices or other supporting documentation from the installer, and little or no independent hard-copy documentation exists for any of the measures in this sample.

Avista forwarded to Research Into Action electronic copies of software screen captures or paper forms from the CAP agencies. All such documents were labeled *Invoice Form* and showed output data for the measure; in some cases, forms were included that showed input data that went into computing the output data.

Data Entry and Coding

As with the residential program, we created an *Excel* workbook to record details about the documentation we received for each case in the limited-income sample strata. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not the records had been received; disposition codes; and notes describing any exceptions. In addition, each workbook included columns for recording the input data recorded for each case, as well as columns pre-coded with the Avista-supplied per-unit values or algorithms for each measure.

Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. Disposition codes were defined so as to be consistent, to the degree possible, with the codes for the residential program. However, because of the way that measures were installed and documented in the limited-income program, the definitions of the first two codes are slightly different from those for the residential program. Moreover, the residential disposition code "3" – which indicates a data disagreement between the rebate form and other documentation – does not apply to the limited-income program, as typically there was no independent paper documentation other than the rebate form in this program. Thus, the possible codes for the limited-income strata were:

1 = Invoice form with detailed input data and no coding errors

2 = Input data were not detailed

4 = Measure was incorrectly coded in the Avista database

5 = Does not qualify for rebate

Our criteria for assigning a code of "1" were similar to those for the residential program, except that there was no criterion of independently confirming the information on the rebate form (since there typically was no independent documentation). Instead, the criteria were that the invoice form provide sufficient detail to compute therm savings, based on Avista's criteria, and to verify that the measure qualified for a rebate. For example, if the measure was a 40-gallon, high-efficiency water heater, and the invoice form documented that measure, as well as either the EF or the model number (which could be used to determine the EF), and the EF met Avista's eligibility standard, then we assigned a code of "1". Similarly, if the measure was a high-efficiency furnace, and the invoice documented that measure, as well as the AFUE% or model number, and the AFUE% met Avista's eligibility standard, then we assigned a code of "1". As with the cases in the residential program, even if the invoice did not document the EF or AFUE%, if we were able to obtain this information based on the model information, then we assigned a code of "1". For windows, it was necessary for the invoice to document the measure, as well as the area covered. In the case of insulation, the measure, area, and pre- and post- R-values were necessary.

Again, our criteria for assigning a code of "2" were similar to those for the residential program, except for the reference to confirming the information on the rebate form. Instead, the criteria were that the invoice form did not provide input data sufficient to compute therm savings or to verify that the measure qualified for a rebate. For example, if the invoice documented neither EF nor the model for a water heater, or it did not document the model or AFUE% for a furnace, we assigned a code of "2". In the case of windows, we assigned a "2" if the area covered was not documented. For insulation, we assigned a "2" if the area, the existing R-value, or the final R-value was not documented.

As indicated above, we did not assign a code of "3" to any of the cases in the limited-income program.

If the invoice form showed a measure other than what was recorded for that case in the Avista database, we assigned a code of "4". Finally, in a few cases the invoice did not document the EF of a water heater or AFUE% of a furnace, but we were able to obtain this information from the manufacturer, and thus found that the EF or AFUE% did not meet Avista's eligibility standards, even though a rebate had been issued. We assigned a code of "5" to these cases.

As with the residential program, a code of "4" or "5" did not mean that there was not sufficient documentation of input data, but only that those data may not have been correctly reported.

Data Clarification

If the *Initial Disposition Code* was other than "1", we recorded an explanation in the *Notes* column of the workbook. For all such cases, we contacted Avista to attempt to obtain additional information to clarify the cases' disposition. Based on the results of our efforts, we assigned a *Final Disposition Code* to each case, using the same coding scheme as for the initial disposition.

Paper-Trail Analysis

Our paper-trail analysis consisted of computing the percent of cases in each limited-income stratum with each final disposition code, along with 95% confidence intervals.

Engineering Review

All of the projects in the limited-income program were custom projects. Therefore, our engineering review of the limited-income program consisted of a check against standard engineering practices. We used baseline and retrofit values reported for each measure (e.g., window U-values, insulation R-values) in the engineering review.

The following outlines the review methods for each measure in the program:

- **Air Infiltration:** The review included calculating heating energy savings achieved by heating less infiltrated outside air to the desired inside air temperature. Air change rates before and after infiltration reductions were used to capture the associated heating energy savings. The assumptions and inputs used in the calculations were taken from customer files provided by Avista or from standard engineering manuals' practices.
- **ENERGY STAR® Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals* method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of ENERGY STAR® windows. Baseline and retrofit values for each customer were provided by Avista and used in the analysis.
- **ENERGY STAR® Doors:** A review of the measure was not completed because no such measure was selected in the sample.
- **High-Efficiency Furnace:** The review included the use of ENERGY STAR®'s online calculator for the regions in Avista's Washington and Idaho territory, along with values used by other utility companies for similar baseline and retrofit requirements, adjusted for heating-degree-days.
- **High-Efficiency Water Heater (40- and 50-gallon):** The review included engineering calculations using Avista's Energy Factor (EF) qualifications and a comparison with other utility company reported values for similar baseline and retrofit requirements.
- **High-Efficiency Tankless Water Heater:** The review included engineering calculations using a baseline EF of 0.58 and a retrofit EF of 0.80 (typical for tankless water heaters), and a comparison with savings values reported by other utility companies and the California DEER database.
- **Ceiling/Attic/Floor/Wall/Duct Insulation Measures:** The review included engineering calculations based on the modified heating-degree-day method. Baseline and retrofit values for each customer were provided by Avista and used in the analysis.

- ➡ **Health and Human Safety:** These measures typically fell under one of the categories already provided and the methodology used to evaluate the energy savings was the same as provided for each measure type (e.g., air infiltration reduction).

Analysis of Avista's Savings Estimates

For the limited-income sample, we calculated savings on a measure-by-measure basis using either Avista's assumptions and methods (if confirmed in our engineering review), or our own proposed ones.

For each case, in each sample stratum, we computed the difference between Avista's estimate of therm savings and ours. We excluded cases for which the documentation did not provide sufficient data to compute an estimate. However, we included cases with final disposition codes of "3" or "4" if we had sufficient data to compute an estimate. The reasoning was that these cases provide appropriate information regarding Avista's computations of therm savings on a case-by-case basis. Since we performed this analysis simply as a check of Avista's computations, not to provide alternative estimates of therm savings, including these cases is proper. Note, however, that they also are included in our paper-trail analysis, which shows the percent of cases with documentation problems.

Nonresidential Program

The majority of the projects in the nonresidential program involved non-prescriptive, custom engineering projects. For these projects, Avista completed the individual energy calculations either in spreadsheet tools or through modeling programs. The only projects that were not custom were those that involved installation of pre-rinse sprayers; these were prescriptive-rebate projects with a set energy savings value per item.

For each custom engineering project, Avista forwarded electronic copies of the project evaluation report, the agreement, invoices, and other relevant documentation to Research Into Action. Information for the pre-rinse sprayers consisted of an *Excel* spreadsheet, also supplied to Research Into Action, that listed: number of sprayers installed; equipment manufacturer; location of the sprayer; pre- and post-GPM data; water temperature data; and additional notes as necessary. Invoices for the purchase of the sprayer were not provided.

Data Entry and Coding

For each group, we created an *Excel* workbook to record details about the documentation received from Avista. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not records had been received; disposition codes; and notes describing any exceptions.

Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. For the nonresidential strata, the possible codes were:

1 = Documentation supports input data

2 = Insufficient documentation

3 = Documentation contradicts input data

We assigned a code of “1” if the documentation provided sufficient detail to compute therm savings based on Avista’s criteria and confirmed the information provided in the evaluation report. Sufficient documentation included data such as modeling inputs and/or outputs, baseline assumptions, and spreadsheet tools that allowed us to evaluate the project through our own use of models or spreadsheet, and to confirm the energy savings value reported by Avista.

We assigned a code of “2” if the documentation provided did not offer sufficient data to confirm the energy savings reported by Avista. Sufficient data included modeling inputs and/or outputs, baseline assumptions, and spreadsheet tools that allowed us to evaluate the project through our own use of models or spreadsheets, and to confirm the energy savings value reported by Avista.

If the invoice and/or other materials showed input data that contradicted that shown in the evaluation report, we assigned a code of “3”. For the purposes of this audit, we defined “contradiction” as a difference between the baseline and/or retrofit assumptions used by Avista in the calculation of project energy savings and those listed in the evaluation report. Note that a code of “3” did not necessarily mean that there was not sufficient documentation of input data, simply that those data may not have been correctly reported.

If the *Initial Disposition Code* was other than “1”, we recorded an explanation in the *Notes* column of the workbook.

Data Clarification

If the information in the supporting documentation was incomplete, we attempted to obtain the missing data by contacting Avista. For example, if the baseline assumptions used in the spreadsheet calculation of a project were not provided, we asked Avista for these assumptions. Using the information obtained, we assigned a *Final Disposition Code* to each case and updated the case notes.

Paper-Trail Analysis

Our paper-trail analysis consisted of computing the percent of cases in each nonresidential group with each final disposition code, along with 95% confidence intervals.

Engineering Review

For the engineering review of the Avista nonresidential programs, we carried out a project-by-project analysis of the measures installed and the energy savings reported. As part of the evaluation, we reviewed the engineering calculations, modeling simulations, and assumptions that Avista used for each project, along with a check against standard engineering practices, in order to determine the accuracy of the methodologies used to determine energy savings. We performed separate engineering calculations and modeling simulations to verify accuracy if we deemed it necessary. For our engineering evaluation for pre-rinse sprayers, we checked Avista's reported savings value for accuracy and appropriateness.

Analysis of Avista's Savings Estimates

Nonresidential Stratum 1 (*Seven Largest Projects*) and Stratum 3 (*All Other Measures*) are custom projects, in which the calculated energy savings are based on the conditions of the baseline and retrofit system. In the data analysis for these groups, we recalculated the therm savings for all cases, based on the results of our engineering analysis; in most cases, this did not involve a "check" of Avista's computation for the project. Stratum 2 (*Pre-Rinse Sprayers*) involved a pre-negotiated energy savings value per unit (sprayer) and, therefore, was the only nonresidential group that involved a check of Avista's assumed therm value and recorded data. For this group, we used an Avista-supplied value of 176 therms per sprayer and the input data (number of sprayers per location) recorded in Avista's tracking spreadsheet to compute therm savings for each case. For each case, in all three strata, we computed the difference between Avista's estimate of therm savings and ours.

We excluded cases for which the documentation did not provide sufficient data to compute an estimate. However, we included cases with a final disposition code of "3" if we had sufficient data to compute an estimate. Note, however, that these cases also are included in our paper-trail analysis, which shows the percent of cases with documentation problems.

4 RESULTS

We present the results separately for the residential, limited-income, and nonresidential programs. For each program, the results for the documentation program are followed by those for the engineering review and evaluation of Avista's savings estimates. (The individual data for each project are presented in Table A.1 through Table A.9 in Appendix A.)

RESIDENTIAL PROGRAM

Documentation Review

Table 4.1 shows the summary final disposition data for the residential sample. The table shows, for each stratum (*High-efficiency furnaces*, *Replacement Windows*, and *All Other Measures*), as well as for the combined sample, the number and percentage of cases with each of five dispositions. The table also shows the 95% confidence intervals around the percentage of each disposition for each stratum and for the combined sample.

Table 4.1: Final Disposition of Sampled Residential Cases

DISPOSITION	NUMBER OF CASES	PERCENT*	CONFIDENCE INTERVAL
STRATUM 1: HIGH-EFFICIENCY FURNACES			
1 = Documentation supports input data	24	100.0%	n/a
2 = Insufficient documentation	0	0%	n/a
3 = Documentation contradicts input data	0	0%	n/a
4 = Measure was incorrectly coded	0	0%	n/a
5 = Measure does not qualify for rebate	0	0%	n/a
TOTAL	**24**	**100.0%**	
STRATUM 2: REPLACEMENT WINDOWS			
1 = Documentation supports input data	16	66.7%	47.8 to 85.5
2 = Insufficient documentation	4	16.7%	1.8 to 31.6
3 = Documentation contradicts input data	4	14.9%	1.8 to 31.6
4 = Measure was incorrectly coded	0	0%	n/a
5 = Measure does not qualify for rebate	0	0%	n/a
TOTAL	**24**	**98.3%**	
			Continued

DISPOSITION	NUMBER OF CASES	PERCENT*	CONFIDENCE INTERVAL
STRATUM 3: ALL OTHER MEASURES			
1 = Documentation supports input data	15	62.5%	43.1 to 81.9
2 = Insufficient documentation	3	12.5%	0 to 25.7
3 = Documentation contradicts input data	1	4.2%	0 to 12.2
4 = Measure was incorrectly coded	4	16.7%	1.8 to 31.6
5 = Measure does not qualify for rebate	1	4.2%	0 to 12.2
TOTAL	**24**	**100.1%**	
WEIGHTED TOTALS			
1 = Documentation supports input data	55.1	76.5%	66.7 to 86.3
2 = Insufficient documentation	7.3	10.1%	3.1 to 17.0
3 = Documentation contradicts input data	5.6	7.8%	1.6 to 14.0
4 = Measure was incorrectly coded	3.2	4.5%	0 to 9.3
5 = Measure does not qualify for rebate	0.8	1.1%	0 to 3.6
TOTAL	**72.0**	**100.0%**	

* Note: Percent totals do not always equal 100% due to rounding.

The confidence intervals around the percentages for the second and third strata (particularly for *Documentation supports input data*) were somewhat large, indicating that these estimates are not highly precise. There are two reasons for this. First, as indicated in the *Audit Methods* discussion, the sample precision for this audit was applied to the entire three-year sample, not the year-to-year samples; the smaller size of the year-to-year samples results in less precise estimates. Second, the percentages of cases with well-documented input data in these two strata were lower than expected. As explained earlier, for a given sample size, precision increases as the percentage of the sample with a given characteristic approaches 0 or 100; conversely, the precision decreases as the percentage approaches 50. Since the sample sizes were calculated based on an assumed high percentage of cases having well documented input data (which was, in fact, found for Stratum 1), the lower percentages that were actually found in this audit have less precision.

Weighting Individual Stratum for Combined Results

The combined sample data are weighted to account for differences among the strata in the percentage of the population sampled. The population of Stratum 1 is 1,127; thus, Stratum 1 was sampled at a ratio of 24:1,127 or 1:47.0. Similarly, the population of Stratum 2 is 1,385, so that stratum was sampled at a ratio of 1:57.7. The population of Stratum 3 is 928; it was sampled at a ratio of 1:38.7. Since the various strata contributed proportionately different weights to the combined sample, we adjusted their contributions to the totals for each disposition based on their different weights. For each disposition, the formula for determining the weighted *n* was:

$$(((n_1 * w_1) + (n_2 * w_2) + (n_3 * w_3)) / N) * 72$$

where:

n_1, n_2, and n_3	**= the number of cases with disposition 1 in Stratum 1, 2, and 3**
w_1, w_2, and w_3	**= the weights of Stratum 1, 2, and 3 (47.0, 57.7, and 38.7, respectively),**
N	**= the combined population for the three strata**

Final Dispositions for the Combined Sample and by Stratum

Across all three strata, the input data were well documented for 55 of the 72 cases sampled. When weights are applied to the individual strata data to account for differences in sampling ratios, the weighted percent of cases with well-documented input is 76.5%. The 95% confidence interval for this figure is about 67% to about 86%. Conversely, 17 cases (24.5%) had documentation problems.

Even though the estimates from this one-year sample are not highly precise, comparing the strata may reveal useful information about documentation problems. As Table 4.1 shows, the percentage of cases in which the input data on the rebate form were well documented varies among the sample strata. The highest percentage was for Stratum 1 (*High-efficiency furnaces*), with 24 of 24 (100.0%) of the cases well documented. Stratum 2 (*Replacement Windows*) and Stratum 3 (*All Other Measures*) both had lower levels of well-documented cases (16 of 24, 66.7%, and 15 of 24, 62.5%, respectively). The difference between Stratum 2 and Stratum 3 is well within the large confidence intervals; however, the differences between Stratum 1 and both 2 and 3 lie outside the confidence intervals. Thus, we can accept with confidence that the input data were well documented for a higher percentage of cases in the first stratum than in the other two.

Types of Documentation Problems

Table 4.2 shows details of the cases from the three strata for which the final disposition was that the input data were not well documented. The two most frequent problems were that the invoice provided information that contradicted the rebate form and that the invoice and/or other documentation did not provide sufficient detail to check the input data on the rebate form; these types of problems each occurred in 7 of 17 (41.2%) of the cases.

Table 4.2: Residential Sample Cases with Documentation Problems

STRATUM	CASE ID	MEASURE TYPE	EXCEPTION
2	115	Replace South-Facing Windows	The invoice does not provide any detail on window dimensions or size.
2	1214	Replace East/West-Facing Windows	The window size recorded on the rebate form exceeds that recorded on the invoice by more than 5%.
2	1787	Replace East/West-Facing Windows	The window size recorded on the rebate form exceeds that recorded on the invoice by more than 5%.
2	2118	Replace North-Facing Windows	The invoice does not provide any detail on window dimensions or size.
2	2173	Replace East/West-Facing Windows	The window size recorded on the rebate form exceeds that recorded on the invoice by more than 5%.
2	2745	Replace East/West-Facing Windows	The invoice does not provide any detail on window dimensions or size.
2	2975	Replace East/West Facing Windows	The invoice does not provide any detail on window dimensions or size.
3	93	Insulation – Duct	The rebate form counts insulation that was documented as water pipe insulation, not duct insulation, on the invoice.
3	110	High-Efficiency Water Heater /40-gallon	Model number on rebate form is for 50-G, not 40-G.
3	121	High-Efficiency Water Heater /50-gallon	The invoice specifies tankless water heater.
3	861	High-Efficiency Water Heater /40-gallon	The Efficiency Factor does not meet minimum standard for rebate.
3	1083	High-Efficiency Water Heater /50-gallon	The invoice specifies tankless water heater.
3	1269	New North-Facing Windows	No invoice was provided. No other paper documentation provides detail on window dimensions or size.
3	1497	ENERGY STAR® Home	The measure was electric, not gas.
3	2373	Replace East/West-Facing Windows	The window size recorded on the rebate form exceeds that recorded on the invoice by more than 5%.
3	3002	Insulation – Floor	The invoice does not provide any detail on amount of insulation installed.
3	3298	New South-Facing Windows	No invoice was provided. Letter provided by contractor did not provide detail on window dimensions or size.

In four of the seven cases in which the invoice contradicted the rebate form (IDs 1214, 1787, 2173, and 2373), the size of installed windows shown on the rebate form exceeded that documented on the invoice by more than 5% (actual differences ranged from 6% to 30%). In one case (ID 93), the number of linear feet of insulation recorded on the rebate form greatly exceeded that which the invoice documented (220 vs. 120 linear feet). In two cases (IDs 121 and 1083), the Avista database recorded installation of a high-efficiency 50-gallon water heater, while the invoice documented installation of a tankless water heater. Contact with Avista revealed that the same database code and measure description were used for high-efficiency 50-gallon and tankless water heaters, as Avista had evaluated both as providing savings of 11 therms. However, the Avista database actually recorded different therm savings for 50-gallon and tankless water heaters.

In four of the seven cases with insufficiently detailed documentation (IDs 115, 2118, 2745, and 2975), the invoice did not specify size or dimensions of installed windows. In one case (ID 3002), the invoice did not specify the amount of insulation installed. No invoice was provided in two cases (IDs 1269 and 3298). Contact with Avista revealed that in both of these cases, the contractor did not provide the customer with an invoice. In one case, the contractor provided a letter stating that the windows were upgraded to the higher efficiency level; however, this letter did not detail the window dimensions or size. In the other case, an Avista staff member contacted the vendor to verify the installation information, but no written documentation was provided.

Of the remaining three cases with documentation problems, one (ID 861) was an installation of a water heater that did not meet the criteria for Avista's rebate program. In one case (ID 110), the invoice did not specify the model, size, or Efficiency Factor of the installed water heater. Subsequent contact with the manufacturer revealed that the model number listed on the rebate form was for a 50-gallon heater, whereas the size listed on the rebate form was 40-gallon. Finally, one case (ID 1497) was an ENERGY STAR® Home for which all therm savings were for electric measures, not gas measures; this case was mistakenly included in the list of gas measures from which the sample was drawn.

Engineering Review

The engineering review of Avista's residential program consisted of a check against standard engineering practices, comparing Avista's reported energy savings to other utility DSM program offerings, and performing engineering calculations to verify savings on a measure-by-measure basis.

Table 4.3 summarizes the results of our engineering evaluation for the residential program. As this table shows, our engineering evaluation of most measures produced per-unit estimates that were slightly at variance with Avista's, but not so much as to warrant replacing Avista's per-unit estimates with our own. The only exceptions were for high-efficiency water heaters. For continuous-flow (tankless) water heaters, our evaluation produced a per-unit estimate of at least 28 therms, the value that is currently being reported by the California DEER database; for 40-

and 50-gallon water heaters, our evaluation produced per-unit estimates of 16 and 11 therms, respectively, based on engineering calculations using the baseline and retrofit qualifications listed by Avista, with some assumptions about usage and water consumption.

Table 4.3: Summary of Engineering Evaluation for Residential Program

MEASURE	UNITS	SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	SAVINGS RECORDED IN AVISTA DATABASE	AUDIT VERIFIED SAVINGS	RECOMMENDED SAVINGS
High-Efficiency Natural Gas Boiler	per measure	71.6	71.6	68.9	71.6
High-Efficiency Natural Gas Furnace	per measure	71.6	71.6	68.9	71.6
High-Efficiency Natural Gas Water Heater (40-Gallon)	per measure	11	11	16	16
High-Efficiency Natural Gas Water Heater (50-Gallon)	per measure	8	8	11	11
High-Efficiency Natural Gas Water Heater (Tankless)	per measure	11	11	28	28
Ceiling/Attic Insulation	per sq ft	0.042	0.042	0.041	0.042
Floor Insulation	per sq ft	0.209	0.209	0.205	0.209
Wall Insulation	per sq ft	0.209	0.209	0.205	0.209
New East/West-Facing Windows	per sq ft	0.42	0.42	0.51	0.42
New North-Facing Windows	per sq ft	0.42	0.42	0.51	0.42
New South-Facing Windows	per sq ft	0.42	0.42	0.51	0.42
Replace East/West-Facing Windows	per sq ft	0.83	0.83	0.89	0.83
Replace North-Facing Windows	per sq ft	0.83	0.83	0.89	0.83
Replace South-Facing Windows	per sq ft	0.83	0.83	0.89	0.83
Duct Insulation	per linear ft	2.8	2.8	2.79	2.8
Programmable Thermostat W/AC	per measure	31	31	33.43	31

Analysis of Avista's Savings Estimates

As described above, for each case in the residential sample, we estimated therm savings using the input data that were provided in the case records and either Avista's verified per-unit values or others (if our engineering review indicated that others should be used). We verified Avista's methods for all of the measures except for tankless water heaters, for which we propose a savings of 28 rather than 11. Therefore, we used 28 therms for tankless water heaters in our analysis of Avista's savings estimates.

For each case, we subtracted our estimates from Avista's estimates to yield a *difference score* for that case. The purpose of computing a difference score was to remove any variance associated with differences among measure types from the comparison of our estimates with Avista's estimates. This was particularly important in the third sample stratum, which includes cases representing a variety of measure types.

In addition to computing a simple difference score for each case, we also computed the absolute value of the difference score. The reason is that difference score for any case may be positive or negative (i.e., Avista's estimate may be greater than ours or less than ours). In the summary statistics, the positive and negative differences may to some degree cancel each other out and make the overall difference appear smaller than it is. Therefore, we report the summary data for both the difference scores and the absolute values of the difference scores.

Table 4.4 summarizes the results for the difference scores. For each stratum, it shows the mean difference between Avista's reported savings and our computed savings, the 95% confidence interval associated with that difference, the difference expressed as a percentage of our estimate (labeled *Mean Difference Percent*), and the minimum and maximum difference scores found within that stratum. It also shows these data for the absolute value of the difference between Avista's estimate and our computation.

Finally, we computed summary statistics for the combined sample. We computed the mean, confidence interval, and difference percent using weights reflecting the sampling ratio of each stratum, using an approach similar to what we used in the analysis of documentation adequacy. The minimum and maximum values for the combined sample are simply the minimum and maximum values found across all strata.

Note that Table 4.4 includes two additional sections: *Stratum 3 (modified)* and *Combined (modified)*. We explain these, below, in the discussion of Stratum 3 results.

Table 4.4: Comparison of Avista's Reported Residential Therm Savings with the Audit's Computations

STRATUM	MEAN DIFFERENCE		95% CONFIDENCE INTERVAL	DIFFERENCE SCORE	
	VALUE	PERCENT		MINIMUM	MAXIMUM
STRATUM 1: HIGH-EFFICIENCY FURNACES					
Avista Reported Savings Minus Computed Savings	0.0	0.0%	0.0 to 0.0	0.0	0.0
Absolute Value of Reported Minus Computed Savings	0.0	0.0%	0.0% to 0.0	0.0	0.0
STRATUM 2: REPLACEMENT WINDOWS					
Avista Reported Savings Minus Computed Savings	3.5	8.4%	-2.2 to 14.1	-1.0	58.0
Absolute Value of Reported Minus Computed Savings	3.1	6.9%	0 to 8.8	0.0	58.0
STRATUM 3: ALL OTHER MEASURES					
Avista Reported Savings Minus Computed Savings	-47.2	-32.1%	-93.7 to -0.7	-298.6	280.0
Absolute Value of Reported Minus Computed Savings	75.2	73.3%	36.9 to 113.6	0.0	298.6
COMBINED SAMPLE					
Avista Reported Savings Minus Computed Savings	-12.0	-5.6%	-24.4 to 0.5	-298.6	280.0
Absolute Value of Reported Minus Computed Savings	22.8	23.9%	12.5 to 33.1	0.0	298.6
STRATUM 3 (MODIFIED)					
Avista Reported Savings Minus Computed Savings	24.1	29.4%	-9.1 to 57.3	-3.0	280.0
Absolute Value of Reported Minus Computed Savings	24.9	24.2%	0 to 58.0	0.0	280.0
COMBINED (MODIFIED)					
Avista Reported Savings Minus Computed Savings	8.2	11.7%	-0.8 to 17.2	-3.0	280.0
Absolute Value of Reported Minus Computed Savings	8.2	9.7%	0 to 17.2	0.0	280.0

Stratum 1: High-Efficiency Furnaces

As Table 4.4 shows, we found no differences between our estimates and Avista's for Stratum 1. This is not surprising. This stratum was composed entirely of high-efficiency furnaces; Avista reported a savings of 72 therms for each case in this stratum, and our engineering evaluation supported this claim.

Stratum 2: Replacement Windows

For Stratum 2 (*Replacement Windows*), we found some differences between our computations and Avista's reported savings. The mean difference across all cases was 3.5, indicating that Avista's reported savings were, on the average, 3.5 therms higher than our computations. This represented a difference percent rate of 8.4%: that is, assuming that the audit's figures are correct, Avista over-reported therm savings by an average of just over 8% for this stratum. Across the stratum, the actual difference score ranged from -1 (i.e., Avista underestimated savings by 1 therm for at least one case) to 58 therms (i.e., Avista overestimated savings by 58 therms).

The figures for the absolute values of the difference scores do not differ much from those for the regular difference scores. This suggests that the majority of the differences were in the positive direction, as the range of difference scores also shows. In fact, inspection of the individual records in this stratum shows that, by far, the majority of the difference between Avista's estimate and our calculation is due to one case – the case by which Avista over-estimated savings by 58 therms. This case was an installation of east/west-facing replacement windows. The rebate form listed a total of 40.46, which calculates to 34 therms according to the information that Avista supplied (40.46 x .83 = 34). However, the Avista database reported 92 therms for this case. For five other cases in this stratum, Avista underestimated savings by 1 therm. In all other cases, Avista's estimate matched ours.

Stratum 3: All Other Measures

Finally, we initially found considerable differences between our estimates and Avista's for Stratum 3 (*All Other Measures*). The mean difference score was -47.2 therms, representing a mean level of underestimation of about 32%. Difference scores varied from -298.6 to 280.0. The absolute value figures show a mean difference of 75.2 therms, for a relative difference of about 73%.

Examination of the individual records revealed some consistent patterns across measure types. The greatest degree of difference was for insulation measures. For the majority of the differences in this group, Avista's estimate was well below our computation. In telephone discussions with Avista staff, we determined that this was because Avista had conservatively estimated therm savings by using a different algorithm than the one that they had reported.

As indicated above, Avista reported that their algorithm for estimating therm savings for insulation was .042 therms per square foot per R-10 added for attics/ceilings and .209 therms per square foot per R-10 added for walls and floors. Thus, increasing insulation in an attic from R-19 to R-38 over an area of 1,000 square feet should result in a savings estimate of .042 x 1000 x 1.9 (i.e., 1.9 increases of R-10), or 79.8 therms. This is the algorithm that we used for our estimates. However, we found that Avista's estimated therm savings for attics/ceilings were consistently equal to .042 per square foot, without reference to the amount added. Similarly, Avista's estimates for walls and floors also ignored multiples of R-10 added. (Avista's program required a minimum increase of R-10, and our document review confirmed that all cases met this requirement.)

When we used the modified algorithms, the difference between Avista's estimate and ours disappeared for all cases of attic/ceiling and wall/floor insulation. The effect that this had across the stratum can be seen in the section of Table 4.4 that is labeled *Stratum 3 (modified)*. This section shows the summary data for Stratum 3, with the modified algorithms for insulation used instead of the reported ones. The mean difference score falls to 24.1; the mean absolute value of the difference scores decreased to 24.9. The relative differences also fell by large amounts.

However, some differences remained for other measures. Notably, in one case of duct insulation (the only case in the sample and the only one reported for the residential program in 2006), Avista estimated savings of 616 therms, compared with our computation of 336. We found that the difference was the result of the customer's claiming more duct insulation than was actually installed. The rebate form for this customer recorded 220 linear feet of duct insulation. However, the invoice documented only 120 linear feet of duct insulation, plus an additional 100 linear feet of water pipe insulation. Since water pipe insulation is not part of Avista's residential program, this should not have been claimed.

Combined Sample

The results across the three strata, weighted to account for differences in the sampling ratio among the strata, showed a mean difference of -12.0, indicating a mean savings underestimation of just under 6%. When absolute values are considered, the mean difference is 22.8, representing a mean relative difference of about 24%. However, when the modified insulation calculation is used, ignoring the amount of added insulation (above an increase of R-10), the weighted mean difference score falls to 8.2 therms (about 12% overestimation), with a mean absolute value difference of 8.2 therms (about a 10% relative difference).

LIMITED-INCOME PROGRAM

Documentation Review

Table 4.5 shows summary final disposition data for the limited-income sample. This table shows for each stratum (*Air Infiltration*, *Insulation*, and *All Other Measures*), as well as for the combined sample: the number and percentage of cases (with 95% confidence intervals) with each of the four dispositions. The table also shows weighted data for the combined sample, calculated with the same method as used for the residential program (see above).

Table 4.5: Final Disposition of Sampled Limited-Income Cases

DISPOSITION	NUMBER OF CASES	PERCENT	CONFIDENCE INTERVAL
STRATUM 1: AIR INFILTRATION			
1 = Invoice form with detailed input data / no coding errors	22	100.0%	n/a
2 = Input data were not detailed	0	0%	n/a
4 = Measure was incorrectly coded in Avista database	0	0%	n/a
5 = Does not qualify for rebate	0	0%	n/a
TOTAL	**24**	**100.0%**	
STRATUM 2: INSULATION			
1 = Invoice form with detailed input data / no coding errors	23	100.0%	n/a
2 = Input data were not detailed	0	0%	n/a
4 = Measure was incorrectly coded in Avista database	0	0%	n/a
5 = Does not qualify for rebate	0	0%	n/a
TOTAL	**23**	**100.0%**	
STRATUM 3: ALL OTHER MEASURES			
1 = Invoice form with detailed input data / no coding errors	17	81.0%	64.2 to 97.7
2 = Input data were not detailed	2	9.5%	0 to 22.1
4 = Measure was incorrectly coded in Avista database	2	9.5%	0 to 22.1
5 = Does not qualify for rebate	0	0%	n/a
TOTAL	**21**	**100.0%**	
			Continued
WEIGHTED TOTALS			
1 = Invoice form with detailed input data / no coding errors	63.0	95.4%	90.3 to 100
2 = Input data were not detailed	1.5	2.3%	0 to 5.9
4 = Measure was incorrectly coded in Avista database	1.5	2.3%	0 to 5.9
5 = Does not qualify for rebate	0.0	0%	n/a
TOTAL	**66.0**	**100.0%**	

For the limited-income sample, 62 of 66 cases had detailed input data. This represents a weighted percentage of 95.4% of the cases, with a 95% confidence interval of about 90% to 100%.

In contrast to the residential data, the percent of cases with good documentation was high (100%) for the first two of the three strata. Stratum 3 had a somewhat lower percentage of well-documented cases (81.0%), with a confidence interval of about 64% to 98%.

Across all three strata, four cases had documentation problems. Information on these cases is shown in Table 4.6. For two of the four cases, the documentation did not provide sufficient detail. For both of these (IDs 319 and 399), the Avista database recorded therm savings for *Health & Human Safety* measures. However, the invoice forms did not provide detail on the measures taken and they indicated that there were no therm savings. We were not able to obtain sufficient details to evaluate either the measures taken or the reported savings.

Table 4.6: Limited-Income Sample Cases with Documentation Problems

STRATUM	CASE ID	MEASURE TYPE	EXCEPTION
3	319	Health & Human Safety	The Avista database recorded 3 therms for *Health & Human Safety* measures for this case. We received only invoice form screen captures with output data, and no input data. The form indicates that *Health & Safety* was "N/A", with 0 therms, but a cost of $154.67.
3	399	Health & Human Safety	The Avista database recorded 2 therms for *Health & Human Safety* measures for this case. The invoice form documents *Health & Safety* expenses, but does not document the measures installed and indicates 0 therm savings.
3	236	High-Efficiency 50-Gallon Water Heater	The invoice documents a 40-gallon water heater, not a 50-gallon heater.
3	272	High-Efficiency Furnace	The invoice documents electric to gas conversion, not a high-efficiency gas furnace.

For two of the four cases, the documentation contradicted the measure code and description that the Avista database recorded for those cases. In one case (ID 236), the Avista database recorded a 50-gallon high-efficiency water heater, but the invoice form documented a 40-gallon water heater. In the other case, the database recorded a high-efficiency furnace, but the invoice documented an electric-to-gas conversion (ID 272).

Analysis of Avista's Savings Estimates

The engineering evaluation for all measures of the limited-income program included a project-by-project analysis based on the inputs provided by the CAPs. For each case for which we were able to calculate energy savings, we computed a *difference score,* as well as the absolute value of the difference score.

Table 4.7 summarizes the results for the difference scores – and difference score absolute values – for each stratum of the limited-income sample. As for the residential sample, it shows the mean difference score with its 95% confidence interval, the mean difference percentage, and the range of difference scores found within each stratum, as well as for the combined sample.

Table 4.7: Comparison of Avista's Reported Limited-Income Therm Savings with the Audit's Computations

STRATUM	MEAN DIFFERENCE		95% CONFIDENCE INTERVAL	DIFFERENCE SCORE	
	VALUE	PERCENT		MINIMUM	MAXIMUM
STRATUM 1: AIR INFILTRATION					
Avista Reported Savings Minus Computed Savings	15.6	20.1%	7.3 to 23.8	-10.0	69.9
Absolute Value of Reported Minus Computed Savings	16.8	21.7%	9.0 to 24.6	0.4	69.9
STRATUM 2: INSULATION					
Avista Reported Savings Minus Computed Savings	29.1	17.6%	-19.5 to 77.7	-89.4	266.7
Absolute Value of Reported Minus Computed Savings	86.6	52.2%	51.9 to 121.2	0.8	266.7
STRATUM 3: ALL OTHER MEASURES					
Avista Reported Savings Minus Computed Savings	19.5	60.7%	3.0 to 36.0	-35.7	108.4
Absolute Value of Reported Minus Computed Savings	23.7	73.7%	8.5 to 38.9	0.0	108.4
					Continued
COMBINED SAMPLE					
Avista Reported Savings Minus Computed Savings	22.5	29.9%	-1.2 to 46.3	-89.4	266.7
Absolute Value of Reported Minus Computed Savings	49.8	50.5%	32.9 to 66.7	0.0	266.7

Stratum 1: Air Infiltration

The differences between Avista's estimated therm savings and our computations were less for Stratum 1 (*Air Infiltration*) and Stratum 3 (*All Other Measures*) than for Stratum 2 (*Insulation*).

However, the confidence intervals around all three estimates are rather wide, so it cannot be concluded with confidence that this is the case in for all non-sampled cases as well.

The mean difference score for Stratum 1 was 15.6 therms, representing a mean over-estimation of about 20%. The 95% confidence interval around the mean difference was about 7 to 24. We found similar results when we examined the absolute value of the difference score, with a mean of 16.8 therms and difference percent of about 22%. The 95% confidence interval for the mean absolute value of the difference was 9 to about 25.

Stratum 2: Insulation

Within the limited-income sample, we found the greatest mean differences between our estimates and Avista's in Stratum 2 (*Insulation*). The mean difference score was 29.1, indicating a mean over-estimation of about 18%. The absolute value figures show a mean difference of 51.9 therms, for a mean difference percent of about 52%.

The difference scores for this stratum showed a much larger range (-89.4 to 266.7) than was observed in the other strata. This suggests the possibility of both systematic over- and under-estimation. Examination of the individual records showed that Avista's estimates of therms saved through wall and floor insulation were consistently lower than the results that the audit achieved using the provided input values, while Avista's estimates for ceiling/attic insulation were higher than the audit's. The mean difference score for wall and floor insulation was -38 (i.e., Avista's estimates were, on average, 38 therms lower than the audit's computations), with values ranging from -83 to 32. On the other hand, the mean difference score for ceiling/attic insulation was 102 (i.e., Avista's estimates averaged 102 therms higher than the audit's), with a range of -89 to 267.

Stratum 3: All Other Measures

The mean difference score between Avista's estimates and our own in the third limited-income stratum (*All Other Measures*) was 19.5, and the mean absolute value of the difference score was 23.7. Although these values were lower than the corresponding values in Stratum 2, the mean difference percent was about 61% for the regular difference scores and 74% for the absolute value scores. Thus, the relative difference percent in this stratum was above that found in the second stratum.

Examination of the individual records revealed some systematic sources of error. In two cases, a high-efficiency furnace was installed and the savings were recorded as 150 therms, rather than 72, as per Avista's program documentation. Discussion with Avista revealed that the probable reason that 150 therms had been claimed for these two projects was because the furnaces were replaced prior to burnout, so greater savings were claimed. However, we were not able to verify the state of the existing furnaces, so we could not independently verify savings of 150 therms.

NONRESIDENTIAL PROGRAM

Documentation Review

Table 4.8 shows summary final disposition data for the three nonresidential groups. Recall that, for the nonresidential program, we performed a census evaluation of the *Seven Largest Projects* and a stratified random sample of the remaining projects. The two strata were: *Pre-Rinse Sprayers* and *All Other Measures*. This table shows, for each group, the number and percentage of cases (with 95% confidence intervals) with each of three dispositions, and weighted data for the combined sample (excluding the seven largest projects), calculated with the same method as for the residential program (see above).

Table 4.8: Final Disposition of Sampled Nonresidential Cases

DISPOSITION	NUMBER OF CASES	PERCENT	CONFIDENCE INTERVAL
SEVEN LARGEST PROJECTS			
1 = Documentation supports input data	6	85.7%	59.8 to 100
2 = Insufficient documentation	1	14.3%	0 to 40.2
3 = Documentation contradicts input data	0	0.0%	n/a
TOTAL	**7**	**100.0%**	
			Continued
STRATUM 1: PRE-RINSE SPRAYERS			
1 = Documentation supports input data	23	100.0%	n/a
2 = Insufficient documentation	0	0%	n/a
3 = Documentation contradicts input data	0	0%	n/a
TOTAL	**23**	**100.0%**	
STRATUM 2: ALL OTHER MEASURES			
1 = Documentation supports input data	16	69.6%	50.8 to 88.4
2 = Insufficient documentation	7	30.4%	11.6 to 49.2
3 = Documentation contradicts input data	0	0.0%	n/a
TOTAL	**23**	**100.0%**	
WEIGHTED TOTALS			
1 = Documentation supports input data	39.3	85.5%	75.4 to 95.7
2 = Insufficient documentation	6.7	14.5%	4.3 to 24.6
3 = Documentation contradicts input data	0.0	0%	n/a
TOTAL	**46.0**	**100.0%**	

The table shows that we were able to obtain detailed documentation, sufficient to calculate an independent estimate of savings, for six of the seven largest projects (85.7%). For four of these projects (ID 20933, 21310, 21314, and 21202), our estimate was sufficiently in line with Avista's estimate to justify accepting the Avista calculation. For two projects (ID 19719 and 21542), our estimate was significantly below Avista's original estimate. For project ID 21542, Avista had revised its estimate based on billing data, resulting in an estimate that was much higher than ours. We determined that Avista should have used a different billing baseline period and therefore overestimated savings for this project. We were unable to obtain sufficient documentation to calculate independent estimates for one project (ID 20608).

Summary descriptions of each of the seven largest nonresidential projects are provided in Appendix B.

As Table 4.8 further shows, we received complete documentation on all pre-rinse sprayer projects (Stratum 1). This was a direct-install measure, for which all data were recorded by Avista contractors in a spreadsheet and no other documentation was created. For Stratum 2 (*All Other Measures*), we obtained sufficient documentation for 16 of 23 cases (69.6%). We were not able to obtain sufficient documentations for six rooftop service projects and one shell project.

Engineering Review

As described above, the engineering evaluation for all measures of the nonresidential program, except pre-rinse sprayers, included a project-by-project analysis based on the assumptions stated in Avista's evaluation report. When sufficient documentation was provided, we recalculated energy savings using standard engineering methods or modeling simulations. When insufficient documentation was provided, the methodology used by Avista and the energy savings reported were evaluated for appropriateness.

The engineering evaluation for the pre-rinse sprayers included a check of Avista's reported savings value for accuracy and appropriateness. Avista's prescriptive energy savings of 176 therms per sprayer is based on the value used by the Regional Technical Forum. Our review found this savings value appropriate. In addition, in reviewing Avista's summary spreadsheet, we noted that all sampled pre-rinse sprayers had a nominal flow rate of 1.6 GPM, which is consistent with current market high-efficiency standards and other utility program offerings.

Analysis of Avista's Savings Estimates

For each case for which we were able to calculate energy savings, we computed a *difference score,* as well as the absolute value of the difference score. We discuss the differences scores for the three nonresidential groups in the following subsections.

The Seven Largest Projects

Results of our engineering review for the seven largest nonresidential programs are presented in Table 4.9.

Table 4.9: Comparison of Avista's Reported Nonresidential Therm Savings for the Seven Largest Projects with the Audit's Computations

STRATUM	MEAN DIFFERENCE		DIFFERENCE SCORE	
	VALUE	PERCENT	MINIMUM	MAXIMUM
SEVEN LARGEST PROJECTS				
Avista Reported Savings Minus Computed Savings	17,848.5	56.7	-827.7	72,950.0
Absolute Value of Reported Minus Computed Savings	21,098.1	44.4	0.0	72,950.0
SEVEN LARGEST PROJECTS (EXCLUDING #21542)				
Avista Reported Savings Minus Computed Savings	8,664.7	28.7	-827.7	38,855.0
Absolute Value of Reported Minus Computed Savings	10,727.8	29.0	0	38,855.0

As this table shows, the mean difference score between the audit's results and Avista's reported savings was nearly 18,000 therms, and the mean of the absolute value of difference scores was more than 21,000. The percent difference between our estimates and Avista's was about 57% (about 44% when absolute values were considered).

However, the majority of this difference came from one project (ID 21542), for which Avista's estimate was above 110,000 and ours was under 40,000 (see *Documentation Review*, above). As the second section of Table 4.9 shows, when this case was excluded from the analysis, Avista's mean estimate was about 29% above ours.

Sample Stratum 1: Pre-Rinse Sprayers

As Table 4.10 shows, there were no differences between Avista's reported savings for pre-rinse sprayers (Stratum 1) and our computations. As noted above, we accepted Avista's figure of 176 therms per sprayer, so the results shown in Table 4.10 for this stratum are simply a confirmation of Avista's accuracy in computing savings for projects with multiple sprayers.

Table 4.10: Comparison of Avista's Reported Nonresidential Therm Savings with the Audit's Computations

STRATUM	MEAN DIFFERENCE		95% CONFIDENCE INTERVAL	DIFFERENCE SCORE	
	VALUE	PERCENT		MINIMUM	MAXIMUM
STRATUM 1: PRE-RINSE SPRAYERS					
Avista Reported Savings Minus Computed Savings	0.0	0.0%	0.0 to 0.0	0.0	0.0
Absolute Value of Reported Minus Computed Savings	0.0	0.0%	0.0 to 0.0	0.0	0.0
STRATUM 2: ALL OTHER MEASURES					
Avista Reported Savings Minus Computed Savings	-44.2	-2.3%	-183.9 to 95.4	-827.0	500.0
Absolute Value of Reported Minus Computed Savings	151.6	10.1	32.9 to 270.4	0.0	827.0
COMBINED SAMPLE					
Avista Reported Savings Minus Computed Savings	-25.0	-1.3%	-88.6 to 38.5	-827.0	500.0
Absolute Value of Reported Minus Computed Savings	85.7	5.7	32.1 to 139.1	0.0	827.0

Sample Stratum 2: Other Measures

Also shown in Table 4.10 is the analysis summary for *All Other Measures* (Stratum 2). Measures evaluated in this stratum included HVAC retrofits, shell measures, appliances, and rooftop services (also known as the *AirCare Plus* program). Across all projects, the mean difference between Avista's estimates and our independently computed estimates was -44.2, indicating that Avista's estimates were, on average, about 2% below ours. However, the 95% confidence interval for this mean was rather wide (about -184 to 95). When the absolute value of difference scores was considered, the mean variance between Avista's estimates and ours was 151.6 therms (95% confidence interval, about 33 to 270), reflecting a mean difference of about 10%.

Avista used *EZ Sim Billing Analysis* software to calculate energy savings for several projects evaluated in this stratum. *EZ Sim* uses actual utility data for a facility and calibrates potential energy savings to utility history. For several of the reviewed projects, we noted that changes were made to inputs, such as heating-degree-days, in order to calibrate to actual utility usage at the facility in question. However, we note that making changes to inputs simply to calibrate to utility usage can result in unreliable estimation of savings. In addition, we found multiple cases for which we could not verify inputs used in the *EZ Sim* tool, nor was an explanation provided if non-standard inputs were used for a facility. For each of these projects, we calculated energy savings using standard engineering methods, based on the information provided. Most of our results were close to Avista's reported values. We noted that one *EZ Sim* project did not have sufficient documentation. We determined that inaccurate inputs were used in the model (specifically heating-degree-days) for this project, with no explanation of the inputs provided. Therefore, we did not have sufficient documentation to confirm the energy savings value.

We also found insufficient documentation for the six rooftop service projects (*AirCare Plus*) that we reviewed in this stratum. The component of the *AirCare Plus* program under review was the *programmable thermostat modification*, as this was the only component that resulted in gas (therms) savings. The calculated energy savings for this measure was difficult to reproduce based on the data that we were provided. Therefore, we used the California DEER database's reported typical energy savings from programmable thermostats in nonresidential buildings (reported separately for office, retail, healthcare, and food service) and adjusted to heating-degree-days for Avista's service territory. We applied the DEER-calculated value to the known building characteristics for each facility, resulting in calculated energy savings for each project. Of the six measures evaluated using this method, we found two to be within 30% of Avista's reported value, we verified one project within 75% of the reported savings, and the remaining three projects were off by 100% or greater.

Because of the large discrepancy between our calculated savings and Avista's reported savings, and the lack of sufficient documentation for these projects, we neither reject nor accept Avista's reported savings and offer the recommendation that additional review be conducted of the *AirCare Plus* program.

5 CONCLUSIONS AND RECOMMENDATIONS

Avista's calendar year 2006 natural gas residential, limited-income, and nonresidential programs are broad in nature, providing multiple opportunities to its customer base. In most cases, we found the projects to have well-documented records with sufficient supporting documentation.

Our audit confirmed the per-unit therm savings that Avista reported for the majority of the prescriptive measures in the residential program. The one exception is that our engineering review suggests a value of 28 therms for high-efficiency tankless water heaters, rather than 11 therms, which Avista reported. We also confirmed Avista's use of 176 therms per unit for pre-rinse sprayers in the nonresidential program.

We found variances between Avista's savings estimates and our computations that ranged from 0% to more than 50% among the programs and the program strata. In almost all sample strata and in the combined sample for all programs, the 95% confidence interval around the mean difference between Avista's estimate and our calculations encompassed zero difference. Some of the variance found in individual strata can be attributed to systematic sources that are easily remedied. Some of the variance (specifically, in the savings reported for insulation) resulted from Avista's using more conservative methods for estimating savings than the methods they reported to use and which we initially used in our computations. However, we were not able to account for much of the variance, as we did not receive information on the computation methods used for some of the measures.

The results revealed varying degrees of documentation issues among the programs and program strata. Part of the reason for the documentation problems and for our inability to review the computation methods for some measures is that Avista had to depend on several CAPs for this information. Discussions with Avista revealed that when Avista implemented its energy efficiency programs, it did not anticipate that an independent verification would be required and that such detailed documentation would be needed from the CAPs.

Following is a brief summary of the main problems we faced in verifying Avista's savings estimates, and we offer some recommendations for how Avista can improve documentation and its ability to carry out accurate engineering calculations in 2007 and 2008.

SUMMARY OF VERIFICATION PROBLEMS

We found unresolved documentation problems for 17 of 72 cases (24.5%) in the residential sample, for 4 of the 66 cases (5%) in the limited-income sample, for 7 of 23 custom projects (30.4%) in the nonresidential sample, and for one of the seven largest nonresidential projects (14.3%). These figures do not include a larger number of cases in each stratum for which we requested and received additional documentation from Avista to compute therm savings estimates. For example, the initial case-by-case documentation that we received from Avista (and which Avista had received from the CAPs) was insufficient to provide independent estimates of savings. We requested additional documentation from Avista and received it in the majority of cases.

The most frequent problems in the residential stratum were: 1) the invoice provided information (e.g., window size or amount of insulation installed) that contradicted the rebate form; and 2) the invoice and/or other documentation did not provide sufficient detail to check the input data on the rebate form. Other problems were incorrect coding in the Avista database of the measure taken and acceptance of a measure that did not meet Avista's efficiency criterion. Of the four cases with documentation problems in the limited-income program, the documentation contradicted the measure that was recorded in the Avista database for two cases, and we were not able to obtain sufficient detail to calculate independent estimates for the remaining two. All of the problems in the nonresidential program were an issue of insufficient documentation.

Insufficient documentation for a project meant that we could not adequately check Avista's estimated therm savings for that project. In fact, if we could not obtain sufficient input data for a project, we excluded that project from our case-by-case analysis of savings estimates. Among those projects for which we had sufficient input data to calculate savings estimates, we found large variations in the degree to which our calculations agreed with Avista's, both in terms of individual projects within a stratum and in terms of mean differences across strata.

Our review of the residential data used both Avista-supplied input data and Avista-supplied per-unit therm values or algorithms. Therefore, differences found between Avista's calculations and ours for that program reflect either data entry errors, errors in calculation, or the use by Avista of input data, per-unit therm values, or algorithms other than those they provided to us. We were able to identify systematic sources of variance for some of the projects (e.g., high-efficiency water heaters, which also applied to the limited-income program); however, in most cases, we were not able to identify the source of the difference between Avista's estimate and ours. As noted in the *Results* chapter, above, we determined that Avista had used a different (more conservative) algorithm to estimate savings for insulation than the one they originally provided to us. However, this did not account for all of the variance.

RECOMMENDATIONS FOR IMPROVING ENGINEERING AND REPORTING ACCURACY

Residential Program

We suggest the following actions for the residential program to increase accuracy of engineering calculations and reporting:

➡ **Increase the reported savings for high-efficiency continuous-flow (tankless) water heaters from 11 to at least 28 therms.** Re-evaluate the energy savings value based on qualifications that Avista may choose to specify for this measure (e.g., minimum Energy Factor).

➡ **Request more detailed documentation from residential customers and their contractors submitting rebate requests.** Specifically, request that invoice and/or other documentation provide: the number of square feet of installed windows facing each direction; the number of square feet of insulation used for each type of area insulated (i.e., walls, floors, ceiling/attic, etc.); the model number and AFUE% of high-efficiency furnaces and boilers; and the model number and EF of high-efficiency water heaters. Although some residential customers and/or contractors may find it burdensome to supply all of the above documentation, the majority of applications submitted already included the requested information, and it is possible that many or most of those who omitted it did so because they were not aware of its importance.

➡ **Institute stricter review of rebate applications to ensure that the information on the invoices and/or other documentation is completely consistent with that listed on the rebate forms.** If the information on the rebate form is not thoroughly documented, contact the customer, contractor, and/or manufacturer to obtain the additional needed information and document that information on a separate form for inclusion in the files and later review. Not only would this help to ensure better accuracy of input data, but it also would help ensure that rebates are not given for measures that do not meet Avista's program standards.

➡ **Institute an internal system for checking data entry accuracy to ensure that incorrect measure types are not recorded in rebate records.** For example, check lists of newly entered records against the hard-copy rebate forms.

➡ **Review rules and procedures for assigning or calculating therms in the database to ensure that they are consistent with engineering-established rules and procedures.**

Limited-Income Program

We offer the following recommendations to increase the accuracy of engineering calculations and reporting for the limited-income measures:

➡ **Review the calculation methodologies used by all CAPs to ensure that there is consistency across the various agencies and that energy savings are being calculated correctly**.

➡ **Request that all necessary baseline information be recorded and maintained by the agencies.** This will permit greater accuracy for future evaluations or checks that Avista may choose to do throughout the year. We found multiple cases for which important baseline information – such as insulation square feet, house volume, R-values, and U-factors – was not recorded in the customer files and had to be requested separately.

Nonresidential Program

Regarding the nonresidential program, we offer the following recommendations to increase the accuracy of engineering calculations and reporting:

- ➡ **Increase documentation of baseline and retrofit equipment, including model numbers, efficiencies, and shell information.** This will allow for more accurate verification of reported energy savings values.
- ➡ **For pre-rinse sprayers, retain the invoice for the purchase of the rebated units.**
- ➡ **Complete a separate evaluation of PECI's *AirCare Plus* program to determine the accuracy of reported energy savings.**

VERIFICATION RECOMMENDATIONS

The relatively large variations in the degree to which our calculations of therm savings for individual projects agreed with Avista's within several strata means that the confidence intervals around the mean differences between Avista's estimates and ours for those strata were wide. Hence, the precision of estimate of Avista's error (relative to our calculations) was low. We recognize that the required precision levels pertain to the entire three-year sample. Moreover, we expect the above recommendations to result in greater accuracy of savings estimates.

However, to ensure accuracy and precision of claims going forward, we also make the following recommendations:

- ➡ **Consider conducting further analysis of the 2006 data before adjusting Avista's savings reports based on the results of this audit.** It would be reasonable to have Avista either correct the database behind the reports and have those reports re-verified, or to expand the audit sample on those strata for which the variances between Avista's reports and our estimates were the largest to provide a higher level of confidence and precision for the recommended adjustments.
- ➡ **The sample requirements for High-efficiency furnaces and Pre-Rinse sprayers for 2007 and 2008 can likely be reduced given the findings of the 2006 audit**.

APPENDICES

APPENDIX A: CASE-BY-CASE RESULTS

APPENDIX B: SEVEN LARGEST NONRESIDENTIAL PROJECTS

A CASE-BY-CASE RESULTS

RESIDENTIAL PROGRAM

Table A.1: Case-by-Case Results for Residential Program Stratum 1 (*High-Efficiency Furnaces*)

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
326	High-Efficiency Furnace	1	72	72	0	0
404	High-Efficiency Furnace	1	72	72	0	0
470	High-Efficiency Furnace	1	72	72	0	0
475	High-Efficiency Furnace	1	72	72	0	0
548	High-Efficiency Furnace	1	72	72	0	0
589	High-Efficiency Furnace	1	72	72	0	0
688	High-Efficiency Furnace	1	72	72	0	0
869	High-Efficiency Furnace	1	72	72	0	0
877	High-Efficiency Furnace	1	72	72	0	0
879	High-Efficiency Furnace	1	72	72	0	0
959	High-Efficiency Furnace	1	72	72	0	0
1024	High-Efficiency Furnace	1	72	72	0	0
1310	High-Efficiency Furnace	1	72	72	0	0
1590	High-Efficiency Furnace	1	72	72	0	0
1709	High-Efficiency Furnace	1	72	72	0	0
1744	High-Efficiency Furnace	1	72	72	0	0
2313	High-Efficiency Furnace	1	72	72	0	0
2375	High-Efficiency Furnace	1	72	72	0	0
2816	High-Efficiency Furnace	1	72	72	0	0
2884	High-Efficiency Furnace	1	72	72	0	0
						Continued

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
3091	High-Efficiency Furnace	1	72	72	0	0
3204	High-efficiency furnace	1	72	72	0	0
1251	High-efficiency furnace	1	72	72	0	0
1113	High-efficiency furnace	1	72	72	0	0

Table A.2: Case-by-Case Results for Residential Program Stratum 2 (*Replacement Windows*)

ID #	DIRECTION OF REPLACEMENT WINDOWS	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
115	South Facing	2	41	41	0	0
418	South Facing	1	52	52	0	0
641	South Facing	1	133	133	0	0
768	East/West Facing	1	33	33	0	0
985	East/West Facing	1	40	40	0	0
1214	East/West Facing	3	83	83	0	0
1335	North Facing	1	27	28	-1	1
1621	South Facing	1	17	18	-1	1
1787	East/West Facing	3	13	13	0	0
1813	East/West Facing	1	60	60	0	0
1869	East/West Facing	1	27	28	-1	1
1940	East/West Facing	1	42	43	-1	1
2118	North Facing	2	12	—	—	—
2173	East/West Facing	3	92	34	58	58
2232	South Facing	1	15	15	0	0
2271	North Facing	1	12	12	0	0
2373	East/West Facing	3	53	53	0	0
2441	South Facing	1	17	17	0	0
2588	South Facing	1	37	37	0	0
2745	East/West Facing	2	71	—	—	—
2959	South Facing	1	36	36	0	0
2975	East/West Facing	2	59	—	—	—
3161	North Facing	1	32	32	0	0
3248	East/West Facing	1	76	76	0	0

Table A.3: Case-by-Case Results for Residential Program Stratum 3 (*All Other Measures*)

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
93	Insulation – Duct	3	616	336	280	280
110	High Efficiency Water Heater /40g	4	11	11	0	0
121	High Efficiency Water Heater /50g	4	8	28	-20	20
570	Insulation – Ceiling/Attic	1	42	160	-118	118
722	Insulation – Ceiling/Attic	1	4	8	-4	4
861	High Efficiency Water Heater /40g	5	11	11	0	0
1083	High Efficiency Water Heater /50g	4	8	28	-20	20
1269	New North-Facing Windows	2	17	17	0	0
1357	Insulation – Floor	1	332	631	-299	299
1444	Insulation – Ceiling/Attic	1	50	151	-101	101
1497	ENERGY STAR® Homes	4	197	—	—	—
1674	Insulation – Ceiling/Attic	1	32	123	-91	91
1680	Insulation – Wall	1	334	435	-101	101
1811	High Efficiency Water Heater /50g	1	8	8	0	0
1874	Insulation – Ceiling/Attic	1	102	245	-143	143
2076	Insulation – Ceiling/Attic	1	50	101	-51	51
2277	Insulation – Ceiling/Attic	1	54	135	-81	81
2288	High Efficiency Water Heater /40g	1	11	11	0	0
2793	Insulation – Ceiling/Attic	1	59	112	-53	53
2795	Insulation – Ceiling/Attic	1	83	157	-74	74
3002	Insulation – Floor	2	233	698	-465	465
3018	New South-Facing Windows	1	147	147	0	0
3048	Insulation – Ceiling/Attic	1	33	137	-104	104
3298	New South-Facing Windows	2	21	—	—	—

LIMITED INCOME PROGRAM

Table A.4: Case-by-Case Results for Limited-Income Program Stratum 1 (*Air Infiltration*)

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
47	Air Infiltration	1	198	148	50	50
54	Air Infiltration	1	122	132	-10	10
113	Air Infiltration	1	168	125	43	43
119	Air Infiltration	1	34	25	9	9
136	Air Infiltration	1	57	42	15	15
137	Air Infiltration	1	45	45	0	0
159	Air Infiltration	1	37	34	3	3
172	Air Infiltration	1	47	35	12	12
173	Air Infiltration	1	72	54	18	18
189	Air Infiltration	1	32	23	9	9
190	Air Infiltration	1	86	65	21	21
200	Air Infiltration	1	23	23	0	0
250	Air Infiltration	1	158	118	40	40
265	Air Infiltration	1	276	206	70	70
271	Air Infiltration	1	332	327	5	5
277	Air Infiltration	1	66	64	2	2
314	Air Infiltration	1	41	45	-4	4
351	Air Infiltration	1	63	47	16	16
356	Air Infiltration	1	14	13	1	1
369	Air Infiltration	1	115	86	29	29
392	Air Infiltration	1	52	39	13	13
427	Air Infiltration	1	14	13	1	1

Table A.5: Case-by-Case Results for Limited-Income Program Stratum 2 (*Insulation*)

ID #	LOCATION OF INSULATION	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
8	Insulation – Floor	1	41	33	8	8
17	Insulation – Floor	1	187	188	-1	1
32	Insulation – Floor	1	146	213	-67	67
72	Insulation – Wall	1	54	99	-45	45
80	Insulation – Wall	1	203	287	-84	84
83	Insulation – Wall	1	215	183	32	32
101	Insulation – Floor	1	308	68	240	240
117	Insulation – Floor	1	19	22	-3	3
168	Insulation – Ceil/Attic	1	137	30	107	107
171	Insulation – Wall	1	271	240	31	31
172	Insulation – Wall	1	164	239	-75	75
175	Insulation – Floor	1	80	91	-11	11
274	Insulation – Ceil/Attic	1	354	435	-81	81
301	Insulation – Ceil/Attic	1	395	484	-89	89
305	Insulation – Ceil/Attic	1	218	287	-69	69
315	Insulation – Ceil/Attic	1	86	82	4	4
319	Insulation – Ceil/Attic	1	74	101	-27	27
349	Insulation – Ceil/Attic	1	302	141	161	161
350	Insulation – Ceil/Attic	1	319	58	261	261
372	Insulation – Ceil/Attic	1	92	134	-42	42
392	Insulation – Ceil/Attic	1	299	79	220	220
415	Insulation – Ceil/Attic	1	146	213	-67	67
418	Insulation – Floor	1	375	108	267	267

Table A.6: Case-by-Case Results for Limited-Income Program Stratum 3 (*All Other Measures*)

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
1	High Efficiency Water Heater /50g	1	8	8	0	0
15	High Efficiency Water Heater /50g	1	8	8	0	0
50	High-efficiency furnace	1	72	72	0	0
76	High Efficiency Water Heater /50g	1	25	8	14	14
135	High Efficiency Water Heater /50g	1	8	8	0	0
214	High Efficiency Water Heater /50g	1	25	8	14	14
229	High Efficiency Water Heater /40g	1	11	11	0	0
234	ENERGY STAR® Windows	1	163	55	108	108
236*	High Efficiency Water Heater /40g	4	25	11	17	17
237	High Efficiency Water Heater /40g	1	25	11	17	17
243	High-efficiency furnace	1	70	72	-2	2
272**	E to G furnace conversion*	4	72	—	—	—
279	High Efficiency Water Heater /50g	1	25	8	14	14
289	ENERGY STAR® Windows	1	111	65	46	46
319	Health & Human Services	2	3	—	—	—
344	High-efficiency furnace	1	150	72	78	78
369	High Efficiency Water Heater 40g	1	11	11	0	0
399	Health & Human Services	2	2	—	—	—
401	ENERGY STAR® Windows	1	50	86	-36	36
421	High-efficiency furnace	1	150	72	78	78
424	High Efficiency Water Heater /50g	1	8	8	0	0

* Incorrectly coded as high-efficiency water heater /50g in Avista database.

**Incorrectly coded as high-efficiency furnace in Avista database.

NONRESIDENTIAL PROGRAM

Table A.7: Case-by-Case Results for Nonresidential Program (*Seven Largest Projects*)

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
19719	HVAC	1	54,332	15477	38,855	38,855
20608	HVAC	2	19,096	—	—	—
20933	HVAC	1	20,228	21,056	-828	828
21202	Resource Management	1	71,731	71,731	0	0
21310	HVAC	1	29,651	21,134	8,517	8,517
21314	HVAC	1	27,193	21,754	5,439	5,439
21542	HVAC	1	110,558	37,608	72,950	72,950

Table A.8: Case-by-Case Results for Nonresidential Program Stratum 1 (*Pre-Rinse Sprayer*)

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
23016	Pre-Rinse Sprayer	1	176	176	0	0
23218	Pre-Rinse Sprayer	1	176	176	0	0
23222	Pre-Rinse Sprayer	1	176	176	0	0
23265	Pre-Rinse Sprayer	1	352	352	0	0
23288	Pre-Rinse Sprayer	1	176	176	0	0
23323	Pre-Rinse Sprayer	1	352	352	0	0
23345	Pre-Rinse Sprayer	1	176	176	0	0
23356	Pre-Rinse Sprayer	1	176	176	0	0
23400	Pre-Rinse Sprayer	1	704	704	0	0
23436	Pre-Rinse Sprayer	1	176	176	0	0
23444	Pre-Rinse Sprayer	1	704	704	0	0
23450	Pre-Rinse Sprayer	1	528	528	0	0
23453	Pre-Rinse Sprayer	1	176	176	0	0
23464	Pre-Rinse Sprayer	1	176	176	0	0
23488	Pre-Rinse Sprayer	1	176	176	0	0
23732	Pre-Rinse Sprayer	1	528	528	0	0
23801	Pre-Rinse Sprayer	1	176	176	0	0
23806	Pre-Rinse Sprayer	1	880	880	0	0
23818	Pre-Rinse Sprayer	1	176	176	0	0
23828	Pre-Rinse Sprayer	1	176	176	0	0
23865	Pre-Rinse Sprayer	1	704	704	0	0
23868	Pre-Rinse Sprayer	1	528	528	0	0
23887	Pre-Rinse Sprayer	1	352	352	0	0

Table A.9: Case-by-Case Results for Nonresidential Program Stratum 2 (*All Other Measures*)

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS BY SOURCE OF CALCULATION		COMPARISON OF AVISTA AND AUDIT RESULTS	
			AVISTA	AUDIT	DIFFERENCE IN THERMS	ABSOLUTE VALUE OF DIFFERENCE
7082	Shell	1	4600	4600	0	0
19629	HVAC	1	319	297	22	22
20873	HVAC	1	8159	8986	-827	827
21238	Shell	1	1028	917	111	111
21282	HVAC	1	6798	6298	500	500
21674	Shell	1	93	97	-4	4
22019	HVAC	1	3651	4170	-519	519
22257	Shell	2	797	—	—	—
22308	Shell	1	216	247	-31	31
22417	HVAC	1	1588	1574	14	14
22425	HVAC	1	162	226	-64	64
22492	Shell	1	1280	1189	91	91
22514	Appliances	1	769	669	100	100
22595	Shell	1	220	249	-29	29
22597	Shell	1	134	125	9	9
22601	Shell	1	166	153.8	12	12
22604	Shell	1	258	351	-93	93
23092	Rooftop Service	2	518	—	—	—
23120	Rooftop Service	2	1359	—	—	—
23237	Rooftop Service	2	1428	—	—	—
23549	Rooftop Service	2	145	—	—	—
23592	Rooftop Service	2	736	—	—	—
23594	Rooftop Service	2	29	—	—	—

B SEVEN LARGEST NONRESIDENTIAL PROJECTS

19719 – SPOKANE PUBLIC FACILITIES

This is a new construction project. The customer is claiming therms savings for a proposed central heating system in lieu of packaged rooftop units. A Carrier HAP model output summary and the equipment schedule showing the boiler rated heating capacity and efficiency were provided. We also were provided with information pertaining to the DHW heating upgrade, which accounts for 2,033 therms of the 54,332 therms reported.

For the review, we created an *EZ Sim* model and calibrated the annual gas usage to match the base case gas usage provided by Avista's HAP model. However, because we did not have many of the details of the HAP model, our calibration procedure is partially incomplete. Using the estimated boiler heating capacity from our *EZ Sim* model, we ran an hourly temperature bin analysis to compute the annual gas savings.

The energy savings calculated from our analysis are significantly less than Avista's reported value (13,444 therms vs. a reported value of 52,299 therms). We were able to verify the reported energy savings from the DHW heating upgrade and confirmed Avista's reported savings of 2,033 therms. Therefore, our overall calculated savings came to 15,477, approximately 28% of Avista's reported savings.

20608 – KOOTENAI MEDICAL CENTER

During our review, we found no documentation or M&V (measurement and verification) conducted to show that the air flow rate is at 12,485 CFM, as reported. Also, there was no documentation to show that at 65% effectiveness, the heat exchanger is able to achieve a 45^{o} F temperature rise, without knowing what the hot and cold fluid streams temperatures are going in and out of the heat exchanger. We deemed an 80% AFUE or thermal efficiency for the gas heater to be a reasonable assumption.

Because of the lack of documentation to validate the stated assumptions for this project, we were unable to verify the project savings.

20933 – HUNTWOOD INDUSTRIES

During our review, we found no documentation on the size of the heating equipment and no indication that the DDC on/off occupied/unoccupied time schedule has been programmed into the EMCS. We were not able to verify whether the *EZ Sim* model had accurately estimated the required heating load of the building. However, while using the *EZ Sim* estimated heating equipment size, we recalculated the energy savings from the given occupied/unoccupied set points. The results of our analysis were approximately 4% higher than the *EZ Sim* results.

21202 – SPOKANE PUBLIC SCHOOLS

This is a special partnership program between Avista and the Spokane Public School District (SPSD), called the *Resource Management Partnership Program* (RMPP), which aims to "promote resource savings and demonstrate the cost effectiveness of improved operations and maintenance within existing facilities... to reduce user-oriented inefficiencies in fuel source consumption..."

We received historical utility data and irrigation reports for all the facilities in the Spokane Public School District. We checked the analysis and found no errors, and therefore we have approved the reported energy savings as submitted.

21310 – EAST VALLEY SCHOOL DISTRICT

During our review, we found no documentation to support the assumed base case boiler efficiency of 60%. A 60% boiler efficiency was deemed too low and, in the absence of proper documentation, we increased the baseline efficiency. There was also no identifiable reason as to why the W/SF for the DHW heater decreased after reducing the storage tank volume, therefore we revised the proposed 0.25 W/SF back to the base case value of 0.29 W/SF. We used the original *EZ Sim* model with slight modifications to the input parameters, as described above, to obtain our savings value of 21,134 therms, which was about 29% less than Avista's reported savings of 29,651.

21314 – TRIPLE PLAY PARK (HVAC)

For this measure, we calculated savings using a catalogue-sizing approach – that is, using the manufacturer's method for unit sizing. We checked this approach against ASHRAE and found it to be reasonably conservative. However, the calculation further divided the recovered energy by heater efficiency of 80%. This is an unnecessary step because this heat did not originate from the pool heater, but rather is the latent heat of vaporization from the dehumidifier. We accepted the assumption of 80% recoverable heat, and our calculated results were about 20% lower than Avista's reported value.

21542 – SPOKANE ATHLETIC CLUB

Avista used *EZ Sim* to model the gas savings from the installation of the new high efficiency burners for two existing boilers. The burners on the existing boilers were being replaced because they were found to be malfunctioning. The facility contacted Avista when they noticed a large increase in utility usage and stated that the boilers were barely able to maintain the space heating and water heating load for the facility. The original energy savings for this project were reported at 17,260 therms, based on the *EZ Sim* model. Avista revised this energy savings amount after reviewing and comparing the customer's gas usage for the period 10/2005 through 6/2006 against gas usage from one year before (10/2004 through 6/2005). Based on the utility bill data (adjusted for heating degree-days), the energy savings were increased to 110,558 therms.

We have determined that the baseline energy usage must not be based solely on the 10/2004-6/2005 gas billing data, because we believe that during this period the boilers were malfunctioning and operating at an unusually high gas usage rate. Therefore, we evaluated the energy savings based on 2002 and 2003 utility history and calculated energy savings to be approximately 66% lower than Avista's reported savings estimate of 110,558 therms.

research/into/action inc

Final Report

Independent Third-Party Verification of 2006 and 2007 Natural Gas DSM Energy Savings: Washington and Idaho Programs

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TABLE OF CONTENTS

TABLES AND FIGURES

ES EXECUTIVE SUMMARY

Avista Utilities (Avista) operates a variety of energy efficiency programs with its residential, limited-income, and nonresidential customers. These programs have the potential to create significant energy savings for Avista's customers, as well as to enable Avista to achieve the gas Demand Side Management (DSM) goals required under an approval agreement for a three-year natural gas decoupling pilot.

Avista must verify achievement of its DSM goals on an annual basis by an independent third-party assessment for the calendar years 2006 through 2008. Research Into Action, together with its subcontractor, Nexant, Inc., has performed the independent verification audit for 2006 and 2007. The verification was done through a combination of engineering evaluations of the estimated impacts of actions involved in the programs, together with an audit of the program documentation, to determine whether or not the savings and costs were applied to the measures appropriately.

We used common and accepted data sampling and analysis methods to examine multiple strata within each customer group[1], with the goal of obtaining sufficient statistical power to produce estimates of audit measurements with a minimum precision of ±10%, at a confidence of 90%, over the three-year course of the evaluation.

The verification methodology for all three programs shared three common components:

1. Reviewing the paper documentation of the sampled cases to verify that the input data used to calculate the therms saved on a case-by-case method were correct;
2. Performing an engineering review of the assumptions that went into Avista's calculations of therm savings for the various measures; and
3. Independently calculating therm savings on a case-by-case basis, using either Avista's assumptions or other sets of assumptions resulting from the engineering review.

Specific details of the methodology for each program reflected differences among the programs and program strata in how measures were taken.

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[1] For the 2007 audit, we modified the stratification plan that we had followed for the 2006 audit. In combining the 2006-2007 results, we used the new stratification. This is described in detail in Section 3, *Audit Methods*.

DOCUMENTATION REVIEW

For program year 2007, the documentation review was able to obtain sufficient documentation for the majority (158 of 194) of projects. However, we found that the number of documentation issues varied among the programs and program strata. Table ES.1 shows the number of documentation problems within each stratum, along with the percentage of all projects in that stratum that had documentation problems.

Table ES.1: Frequency of Documentation Problems by Group

GROUP	PROJECTS WITH UNRESOLVABLE DOCUMENTATION PROBLEMS			
	2007		2006-2007	
	COUNT	%	COUNT	%[1]
Residential Stratum 1 (*Windows*)	7	17.5	16	24.6
Residential Stratum 2 (*Insulation*)	5	12.5	7	13.4
Residential Stratum 3 (*Furnaces/Boilers*)	1	14.3	1	7.7
Residential Stratum 4 (*All Other Measures*)	3	30.0	8	48.3
Residential Sample – Totals	16	16.5	32	19.1
Limited-Income Stratum 1 (*Insulation*)	0	0.0	0	0.0
Limited-Income Stratum 2 (*Air Infiltration*)	0	0.0	0	0.0
Limited-Income Stratum 3 (*ENERGY STAR® Windows and Doors*)	0	0.0	0	0.0
Limited-Income Stratum 4 (*All Other Measures*)	0	0	2	11.8
Limited-Income Sample – Totals	0	0	2	1.0
Nonresidential, Largest Projects	1	20.0	2	16.7
Nonresidential Stratum 1 (*Pre-Rinse Sprayers*)	0	0.0	0	0.0
Nonresidential Stratum 2 (*All Other Measures*)	17	65.4	24	49.1
Nonresidential Sample – Totals	18	22.6	26	19.5
TOTAL	**36**		**62**	

[1] The various measure types had different sampling ratios in 2006 and 2007; therefore, the 2006 and 2007 percentages were based on weighted counts, to account for the different sampling ratios. However, the counts presented in this table are unweighted.

Some of the key findings were:

➡ **In the residential program**, the strata with the largest percentage of documentation problems were, Stratum 4, *All Other Measures* (30.0% of projects in the 2007 sample, 48.3% overall), and Stratum 1, *Windows* (17.5% of projects in 2007 data, 24.6% overall).

➡ **In the nonresidential program**, Stratum 2, *All Other Measures* (65.4% of projects in the 2007 sample, 49.1% overall) had the highest percentage of documentation error.

➡ **The most frequent type of documentation problem was insufficient documentation** to confirm information provided on the rebate form (for prescriptive measures) or to compute independent estimates of savings (for non-prescriptive measures). This type of problem accounted for 21 of the 36 projects with documentation problems in the 2007 audit, and 38 of the 65 projects examined across 2006-2007.

➡ **The remaining documentation problems were:**

- Documentation for the project contradicted information on the rebate form or the input data used to estimate savings (seven projects in 2007, 12 total).
- The measure was coded incorrectly in Avista's database (two projects in 2007, nine total).
- The measure did not qualify for a rebate under the eligibility criteria for a prescriptive program (six projects in 2007, seven total).

The counts of documentation problems included in the table do not include a larger number of cases in each sample stratum for which we requested and received additional documentation from Avista.

We offer some recommendations in the *Conclusions and Recommendations* chapter for how Avista can improve documentation.

ENGINEERING REVIEW AND ANALYSIS OF ENERGY SAVINGS

Our analysis of Avista's reporting energy savings found variances between Avista's savings estimates and our computations in all three programs and in most program strata.

Table ES.2 shows the mean differences between Avista's reported therm savings and our computations for each study stratum, for the 2007 sample and the combined 2006-2007 data.

Table ES.2: Variances Between Avista's Reported Savings and Audit Results by Group

GROUP	MEAN DIFFERENCE BETWEEN AVISTA'S REPORT AND AUDIT RESULTS			
	2007		2006-2007	
	THERMS	PERCENT	THERMS	PERCENT
Residential Stratum 1 (*Windows*)	1.4	1.9	0.8	1.2
Residential Stratum 2 (*Insulation*)	10.8	10.6	10.9	11.5
Residential Stratum 3 (*Furnaces/Boilers*)	10.3	16.7	5.6	8.0
Residential Stratum 4 (*All Other Measures*)	2.7	42.1	2.0	28.9
Residential – Weighted Totals	5.3	23.9	3.9	8.4
Limited-Income Stratum 1 (*Insulation*)	38.1	28.6	33.5	21.9
Limited-Income Stratum 2 (*Air Infiltration*)	6.2	7.4	11.3	14.1
Limited-Income Stratum 3 (*ENERGY STAR® Windows and Doors*)	-28.5	-19.7	-4.2	-3.3
Limited-Income Stratum 4 (*All Other Measures*)	10.1	15.5	13.3	27.8
Limited-Income – Weighted Totals	19.6	15.9	20.5	15.3
Nonresidential, Largest Projects	-5,879	-16.1	8,685	19.3
Nonresidential Stratum 1 (*Pre-Rinse Sprayers*)	0.0	0.0	0.0	0.0
Nonresidential Stratum 2 (*All Other Measures*)	18.7	0.9	-15.2	-0.8
Nonresidential – Weighted Totals[1]	6.4	0.2	-6.1	-0.3

[1] Excludes "Largest Projects".

As

Table ES.2 shows, we found that the mean level of discrepancy between Avista's claimed savings and our computations differed among the programs and among the program strata. The following outlines our findings from the engineering review and analysis for each program (residential, limited-income, and nonresidential).

Findings for the Residential Program

As part of our 2006 audit, we performed an engineering review of Avista's residential program that consisted of a check against standard engineering practices. We compared Avista's reported energy savings to other utility DSM program offerings and performed engineering calculations to verify savings on a measure-by-measure basis. For the audit of the 2007 program year, we determined whether any of our previous recommendations should be revised based on new information either reported by Avista or found in the literature.

The main findings regarding the residential program were:

➡ **During the 2006 audit, we arrived at per-unit therm savings that were close to Avista-reported values for most of the prescriptive measures in the residential program.** Although there were some variances, in most cases they were not so great as to justify recommending a different value from the one that Avista uses. For the current audit, we made few modifications to our previous recommendations.

➡ **For three of the prescriptive measures – high-efficiency tankless, 40-gallon, and 50-gallon water heaters – we previously recommended higher per-unit reported savings than the ones that Avista reported.** We maintain the same recommendations regarding the 40-gallon and 50-gallon water heaters, but we have increased our recommended per-unit value for continuous-flow (tankless) water heaters for the 2008 program year based on Avista's increase in the minimum efficiency rating for that measure.

➡ **The review of Stratum 1 (*Windows*) from the 2007 program found small differences (1.4 therms, -0.1%) between Avista's reported savings and our findings.** The combined 2006-2007 data showed similarly small differences between the Avista and audit values.

➡ **The review of Stratum 2 (*Insulation*) from the 2007 program found moderately small differences (10.8 therms, 6.4%) between Avista's reported savings and our findings.** Most of the difference was attributable to two cases (out of 40) in which we could document much less area covered than was claimed on the rebate form and one case that should not have qualified (and to which we assigned a value of 0 therms). In the combined 2006-2007 data, the difference was smaller, with Avista's values exceeding the audit values by a mean of 3.3%.

➡ **The review of the other residential strata (*Furnaces and Boilers* and *Water Heaters*) from the 2007 program found larger relative differences between Avista's reported**

savings and our findings—14.3% and 33.3%, respectively. Cases of measures that should not have qualified (and which we gave 0 therms) accounted for all of the difference for these two strata). When the combined 2006-2007 samples were considered, the mean differences were somewhat smaller.

➡ **Across all measure types, the weighted differences between Avista's values and the audit's values were relatively small (5.3 therms, 6.5%).** When the combined 2006-2007 data were considered, Avista's values exceeded those of the audit by a mean of 3.9 therms, a mean excess of 2.6%.

Findings for the Limited-Income Program

The engineering evaluation of Avista's limited-income program consisted of a customer-by-customer analysis based on the inputs provided in the CAP reports. Our main findings were:

➡ **The review of Stratum 1 (*Insulation*) found a mean difference between the audit-calculated therm savings and Avista's reported therm savings of 38.1 therms.** The mean difference for the combined 2006-2007 data was 33.5 therms. The main reason for the difference is the methods used to calculate energy savings for insulation measures. We were not provided with the algorithms the CAPs used and therefore used our own methods.

➡ **The review of Stratum 2 (*Air Infiltration*) found a mean difference between the audit-calculated therm savings and Avista's reported savings of 6.2 therms.** The mean difference for the combined 2006-2007 data was 11.3 therms. The main reason for the difference is the methods used to calculate energy savings for air infiltration measures. We were not provided with the algorithms used by the CAP's and therefore used our own methods.

➡ **The review of Stratum 3 (*ENERGY STAR® Windows and Doors*) found a mean difference between the audit-calculated therm savings and Avista's reported savings of -28.5 therms.** The mean difference for the combined 2006-2007 data was -4.2 therms. The main reason for the difference is the methods used to calculate energy savings for window and door measures. We were not provided with the algorithms used by the CAP's and therefore used our own methods.

➡ **The review of Stratum 4 (*All Other Measures*) found a mean difference between the audit-calculated therm savings and Avista's reported savings of 10.1 therms.** The mean difference for the combined 2006-2007 data was 13.3 therms. The main reason for the difference is that the prescriptive savings values Avista used for water heaters is different than recommended and the algorithms used by the Agencies for calculating savings for furnaces were unknown and therefore we used our own methods

- ➡ **The discrepancies between Avista's reported savings and the audit's calculated energy savings for Strata 2 and 4 of the 2007 sample were not large enough to cause concern.** The combined 2006-2007 mean differences for these two strata were somewhat higher, indicating a trend toward reduced overall discrepancy for these strata.
- ➡ **The discrepancy between Avista's and the audit's calculated energy savings for Stratum 1 was significant—both in the 2007 data and in the combined sample—and should be evaluated further by Avista in order to resolve the errors.**
- ➡ **The discrepancy for Stratum 3 was significant in the 2007 data, but indicated that Avista may be underreporting savings in this stratum.** The discrepancy was much smaller in the combined 2006-2007 data.

Findings for the Nonresidential Program

The engineering review of Avista's nonresidential program consisted of project-by-project analyses based on the inputs and assumptions provided by Avista, along with a check against standard engineering practices and, in the case of pre-rinse sprayers, an evaluation of Avista's metering data study completed in 2007 for a sample of installed units. The following summarizes our findings for the nonresidential programs:

- ➡ **The review of the five largest projects resulted in energy savings close to Avista's reported values in the case of three projects.** Across the two program years, we obtained results that were close to Avista's for seven of 12 large projects. Energy savings calculated for two other 2007 projects were significantly different from Avista's reported savings. As was the case in the 2006 audit, the likely reason for the significant differences in energy savings for these two projects was the unavailability of some assumptions used by Avista to calculate energy savings; therefore we used our own engineering assumptions in our models.
- ➡ **We accepted the prescriptive per-unit savings of 44 therms for Stratum 1 (*Pre-Rinse Sprayers*), but note that this may be conservative.**
- ➡ **The review of the measures in Stratum 2 (*All Other Measures*), which comprised HVAC, shell, rooftop service, and appliances, resulted in values that were close to Avista's reported values, with the exception of a few HVAC measures and all of the rooftop service projects.** We evaluated the rooftop service projects using eQuest and the assumptions provided to us by PECI. There were significant differences in our values and Avista's reported values due to the lack of clarifying information provided by PECI and because we modeled the savings in eQuest as opposed to PECI's own modeling tool. We had similar difficulties in evaluating rooftop service projects in the 2006 audit.

RECOMMENDATIONS

This first year of the independent verification found a variety of opportunities for Avista to improve recordkeeping and program procedures. The following recommendations should reduce documentation problems and increase the accuracy of engineering calculations and reporting for future years.

Residential Program

- ➡ **Increase the reported savings for high-efficiency continuous-flow (tankless) water heaters from 11 therms to at least 52 therms.**
- ➡ **Decrease the reported savings for high-efficiency 40-gallon water heaters from 11 therms to 8 therms.**[2]
- ➡ **Increase the reported savings for high-efficiency 50-gallon water heaters from 8 therms to 11 therms.**
- ➡ **Request more detailed documentation from residential customers and their contractors submitting rebate requests.**
- ➡ **Provide outreach to vendors to educate them about what kind of information is needed on the invoices.**
- ➡ **Institute stricter review of rebate applications to ensure that the information on the backup documentation is completely consistent with that listed on the rebate forms.**
- ➡ **Make the rebate form consistent with the way that measures are recorded in the customer service database or change the customer service database to be consistent with the rebate form.**
- ➡ **Identify furnace, boiler, and water heater models that do and do not meet minimum efficiency requirements and provide this information to vendors or customers or use it to review incoming applications.**
- ➡ **Institute an internal system for checking data entry accuracy to ensure that incorrect measure types are not recorded in rebate records.**
- ➡ **Institute a system for reviewing the entire database on a regular basis to identify and report therm values that are inconsistent with the measure.**

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2 The report of the 2006 audit erroneously stated that Avista should increase reported savings for this measure to 16 therms.

➡ **Review rules and procedures for assigning or calculating therms in the database to ensure that they are consistent with engineering-established rules and procedures.**

Limited-Income Program

➡ **Review the calculation methodologies used by all CAPs to ensure that there is consistency across the various agencies and that energy savings are being calculated correctly.**

➡ **Request that all necessary baseline information be recorded and maintained by the agencies.**

Non-Residential Program

➡ **Increase documentation of baseline and retrofit equipment, including model numbers, efficiencies, and shell information.**

➡ **For pre-rinse sprayers, retain invoices for the purchase of the rebated units.**

➡ **Complete a separate evaluation of PECI's *AirCare Plus* program to determine the accuracy of reported energy savings.**

Verification

➡ **Consider conducting further analysis of the 2007 data before adjusting Avista's savings reports based on the results of this audit.** It would be reasonable to have Avista either correct the database behind the reports and have those reports re-verified, or to expand the audit sample on those strata for which the variances between Avista's reports and our estimates were the largest to provide a higher level of confidence and precision for the recommended adjustments.

1 INTRODUCTION

In February 2007, Avista Utilities (Avista) received approval for a three-year natural gas decoupling pilot, under which it must achieve certain gas Demand Side Management (DSM) goals (i.e., energy savings, expressed in therms) in order to be able to recover tracked margin. The savings are achieved through a variety of residential, limited-income, and nonresidential programs that Avista has undertaken. Avista must verify achievement of its DSM goals on an annual basis by an independent third-party assessment for each of the three years of the pilot.

Avista chose Research Into Action, Inc., to carry out the verification. Together with its subcontractor, Nexant, Inc., Research Into Action has performed independent verification audits for the calendar years 2006 and 2007. The verifications were done through a combination of engineering evaluations of the estimated impacts of actions involved in the programs, together with audits of the program documentation, to determine whether or not savings and costs were applied to measures appropriately.

The audits were based on desk review of the paper trail, with possible telephone contacts or in-person visits, of samples drawn separately for residential, limited-income, and nonresidential customer categories. The purpose of the audits was to determine whether or not Avista's savings estimates in each case are reasonable. Specifically, we set out to answer the following questions:

1. Were the input data that Avista used to calculate therm savings on a case-by-case basis adequately supported by invoices and related documentation?
2. Were Avista's methods for estimating therm savings for the various measures installed justified from an engineering standpoint?
3. Assuming adequate estimation methods and input data, were Avista's calculations of savings on a case-by-case basis accurate?

In August 2007, Research Into Action submitted a report to Avista detailing the results of the audit of year 2006 programs. The report described: Avista's residential, limited-income, and nonresidential energy efficiency incentive programs; the audit methods used; the results of the audit; and our recommendations to Avista, based on the audit results.

The current report covers the audit of the 2007 programs as well as cumulative 2006-07 results. It includes the descriptions of the Avista programs and audit methods as well as the 2007 and cumulative results. Based on the results of the 2006 audit, we have made some changes to the sampling method, which we describe in the appropriate section of this report.

2 AVISTA UTILITIES ENERGY EFFICIENCY PROGRAMS

Since 2006, Avista Utilities has implemented energy efficiency incentive programs with its residential, limited-income, and nonresidential gas customers. The programs provide rebates for a variety of energy efficiency measures carried out at customers' homes and businesses. For the calendar years 2006 and 2007, Avista's customer service database recorded completed installations of 9,222 residential measures, 1,112 limited-income residential measures, and 1,691 nonresidential measures. The details of how each program is implemented vary among the three customer categories and, to some degree, among measure types within certain customer categories.

RESIDENTIAL PROGRAM

The residential program provides rebates to residential customers for prescriptive energy efficiency improvements for the following gas measures:

- High-efficiency furnace
- High-efficiency boiler
- High-efficiency 40-gallon water heater
- High-efficiency 50-gallon water heater
- High-efficiency tankless water heater
- Ceiling/attic insulation
- Floor or wall insulation
- Duct insulation
- New east/west-, north-, or south-facing windows
- Replacement of east/west-, north-, or south-facing windows
- Programmable thermostats
- ENERGY STAR® homes
- Fireplace damper

For the 2006 audit, Avista supplied Research Into Action with the eligibility criteria and assumptions used for computing savings for each of the above measures. These are shown in Table 2.1.

Table 2.1: Eligibility Criteria and Assumptions for Computing Savings for Residential Measures

MEASURE	ELIGIBILITY CRITERIA	BASELINE / ASSUMPTIONS	SAVINGS
High-Efficiency Gas Furnace	Minimum Annual Fuel Utilization Efficiency (AFUE) of 90%	Federal minimum AFUE (78%)	72 therms
High-Efficiency Gas Boiler	Minimum AFUE of 85%	Federal minimum (80%)	72 therms
High-Efficiency 40-Gallon Water Heater	Minimum Efficiency Factor (EF) of .62	.59 to .62	11 therms
High-Efficiency 50-Gallon Water Heater	Minimum EF of .60	.58 to .60	8 therms
High-Efficiency Tankless Water Heater	Minimum EF of .65	(not specified)	11 therms
Ceiling/Attic Insulation	Existing insulation less than R-22; a minimum increase of R-10; installed only in areas that separate conditioned from unconditioned areas of the residence	R15 to R25	.042 therms per square foot[3]
Floor or Wall Insulation	Existing insulation less than R-11; minimum increase of R-10; installed only in areas that separate conditioned from unconditioned areas of the residence	R5 to R15	209 therms per square foot[4]
Duct Insulation	Minimum increase of R-10; installed on heating ducts in unconditioned areas		2.8 therms per linear foot

3 The savings reported in this table differ slightly from those reported in the corresponding table in the report on 2006 projects. The original documentation that Avista supplied for the 2006 audit indicated that claimed savings for insulation were calculated based on both the number of square feet covered and the number of multiples of R-10 of insulation added, and this was what was reported in the table. However, a review of the data reported for 2006 projects indicated that the claimed savings did not increase for multiples of R-10 beyond the first R-10 added. This was also the case for the 2007 data. Therefore, we have altered this table to show that claimed savings were based solely on number of square feet covered, with a minimum increase of R-10.

4 See footnote 1.

MEASURE	ELIGIBILITY CRITERIA	BASELINE / ASSUMPTIONS	SAVINGS
New East/West-, North-, or South-Facing Windows	Minimum U-factor of .35	U-factor .55 or higher	.42 therms per square foot of window installed[5]
Replacement East/West-, North-, or South-Facing Windows	minimum U-factor of .35	U-factor .55 or higher	.83 therms per square foot of window installed

Our review of the claimed therms recorded in the Avista database for 2007 projects and discussion with Avista staff during the 2007 audit indicated that Avista continued to use the above criteria and assumptions for 2007 projects. That review identified an additional measure, ENERGY STAR® Homes, which was not included in the 2006 audit. For this measure, the eligibility criterion is that it is an ENERGY STAR® qualified new home, and the savings is deemed at 197 therms per home.

In the residential customer program, customers deal directly with contractors for installation of measures. The customers record pertinent data about the measures on an Avista *Home Improvement Incentive Form* (rebate form) and submit this form, together with invoices and other relevant documentation from the contractor, to Avista. If the installation meets Avista's eligibility criteria, Avista issues a rebate to the customer.

LIMITED-INCOME PROGRAM

The limited-income program provides rebates to limited-income residential customers for energy efficiency improvements for the following gas measures:

- Air infiltration
- ENERGY STAR® windows
- ENERGY STAR® doors
- High-efficiency furnace
- High-efficiency 40-gallon water heater

5 The original table reported that the claimed savings for new windows was calculated as .24 therms per square foot, but review of the data reported (for both 2006 and 2007) indicated that the claimed savings actually was calculated as .42 therms per square foot, and this figure was supported by our engineering review. Therefore, we have altered this table to show that claimed savings were calculated as .42 therms per square foot of window installed.

- High-efficiency 50-gallon water heater
- High-efficiency tankless water heater
- Ceiling/attic insulation
- Floor or wall insulation
- Duct insulation

To qualify for an energy audit through the limited-income program, customers must attend a workshop to learn about saving energy and are provided low-cost/no-cost tips. After attending the workshop, customers then receive an in-home assessment and a Community Action Program (CAP) agency determines cost-effective measures for installation, based on existing equipment, the shell, and so forth.

One salient characteristic of the limited-income program is that, while there are recommended or suggested guidelines for the installation of measures, the analyses are performed and the incentives are offered on a site-specific basis. Thus, the minimum required efficiencies that apply to some measures in the residential program—such as water heaters and furnaces (see above)—do not necessarily apply in the limited-income program.

The reasoning for this was that the assumptions differed for the residential and limited-income programs. For the residential program, Avista assumed that customers receiving a rebate were replacing a system on or near burnout and that they would need to buy at least a code replacement water heater.

For the limited income program, the assumption was that customers often would replace an inefficient, but still functional, system before burnout, so replacement with a new system would provide a higher savings potential, even with a lower efficiency level. Furthermore, Avista assumed that many limited-income customers in manufactured housing may not have the ability to install a higher efficiency system in the available space.

A second salient characteristic of the limited-income program, which affects the verification methodology, is that all measures in this program are directly installed by CAP agencies. Therefore, the customer neither completes a rebate form nor receives invoices or other supporting documentation from the installer. Instead, CAP installers record all input data (including pre-existing conditions as relevant), either directly into software installed on notebook computers that they carry with them to the location of installation or onto paper forms. The software or paper forms that are used vary among CAPs. With some minor exceptions, no independent hard-copy documentation exists for any of the measures in this group.

NONRESIDENTIAL PROGRAM

The nonresidential program provides rebates for energy efficiency improvements for the following gas measures:

- Appliances
- Heating, ventilation, and air conditioning (HVAC)
- LEED certification
- Shell
- Pre-rinse sprayers
- Rooftop service

The procedures for implementing measures and claiming rebates differ for pre-rinse sprayers, rooftop services, and all other measures. For rebate applications involving pre-rinse sprayers and rooftop service, Avista hires contractors who go to the installation sites. In the case of pre-rinse sprayers, the contractors install the measures directly; in the case of rooftop service, the contractors perform an audit. In both cases, contractors record relevant data about the installation (including pre-existing conditions) directly into software installed on a notebook computer. Little or no additional paper documentation is created for these measures.

For the rebate applications involving lighting, motors, food service, and commercial HVAC variable frequency drive equipment, the customer can purchase and install the measure and submit a rebate form and invoices to Avista. The program for the remaining measure types is site specific, in which customers receive an analysis from Avista prior to ordering and installing equipment, which estimates energy savings and potential incentive. Avista enters into an *Energy Efficiency Agreement* with each customer, which states that they can be reimbursed upon completion of the project, based on project costs and type of equipment installed. The customers sign this agreement and either hire a contractor to install the measure or install it themselves. Upon completion of the project and receipt of invoices, Avista energy efficiency engineers post-verify the installation. If the installation is verified and meets Avista's eligibility criteria, Avista issues a rebate.

3 AUDIT METHODS

We used data sampling and analysis methods that are common and accepted in evaluation research. The sampling methods, described in detail below, examined multiple strata within each customer group. This was done to ensure that highly common measures did not dominate the overall sample. The data analysis, described in the next section, combined an engineering review of Avista's therm-savings calculation methods, a review of the documentation submitted with each record in the samples to determine whether the input data that Avista used to calculate therm savings were accurate, and a data review to evaluate the accuracy of Avista's calculated savings.

SAMPLING METHODOLOGY

The primary consideration that informed our sampling approach was that each sample should have sufficient statistical power to produce estimates of audit measurements with good precision and confidence levels over the three-year course of the evaluation. In the report of the 2006 audit, we indicated a goal of achieving ±5% and 95% confidence. These levels were based on the assumption of a very low rate of documentation error. However, based on the results of the 2006 audit, achieving these highly stringent precision/confidence levels would require significantly larger samples. Since these levels go beyond industry standards (typically ±10% precision and 90% confidence) and were not mandated by WUTC, we have relaxed them slightly to ±10% precision and 95% confidence.

Thus estimates of measurements that are expressed as a proportion or percentage of the sample (e.g., percentage of the sample for which the input data recorded on the rebate forms were confirmed by accompanying documentation) should be accurate within plus-or-minus ten percentage points. Estimates of the degree of error in Avista's calculation of therm savings should be accurate within ±10% of the mean Avista-calculated therm savings.

In addition to the above primary consideration, our approach incorporated two additional considerations. First, efforts should be made to include the broadest possible range of measure types in the sample. An initial review of the distribution of measure types revealed that a few measure types accounted for a large percentage of measures taken, while several other measure types each accounted for very low percentages. A simple random sample of such a population would have been dominated by the high-frequency measures, and some low-frequency measures might not even be sampled. We used a stratified sampling approach to prevent such an occurrence. As described below, we separated the highest-frequency measure types into their own strata so that they would not dominate the overall sampling. Even with stratification, it was possible that some low-frequency measure types would not be included, but excluding very low-frequency measure types should have little impact on the results.

The second additional consideration was that the independence of observations within each sample should be maximized; therefore, efforts should be made to avoid common sources of variance between any two observations that are not shared among all observations. We observed that within the residential and limited-income categories, there were many instances of multiple measures per customer. Therefore, as described below, our sampling approach was designed to prevent more than one measure for any single customer from appearing in any sample.

The following describes our methodology for each customer type, as it was initially developed for the 2006 audit as well as any subsequent refinements.

Residential Program

For each program year, Avista provided Research Into Action with a data file with a separate record for each residential measure. The data file showed the following information for each measure:

- Customer ID
- Measure type (code and description)
- Entry date
- Customer rebate amount ($)
- Estimated kWh savings
- Estimated therm savings

Within each program year, a large number of customers had multiple measures (rebates). In addition, many customers had two or more cases of the same type of measure. Ideally, each customer should be represented in the sample only once, to avoid interdependency among the observations. Moreover, for the sake of sample size calculation, each type of measure should be counted only once for each customer. This prevents over-sampling of measure types for which there are multiple cases for some customers.

Identification of Residential Strata for 2006 Audit

As noted above, we found that some measures were installed at many residences while others were installed at a few. The distribution of measure types was similarly skewed regardless of whether we counted a single case or multiple cases of each measure type for a given customer (see **Error! Reference source not found.** and Figure 3.2).

Figure 3.1: Frequency Count of Residential Program Codes: All Cases Counted

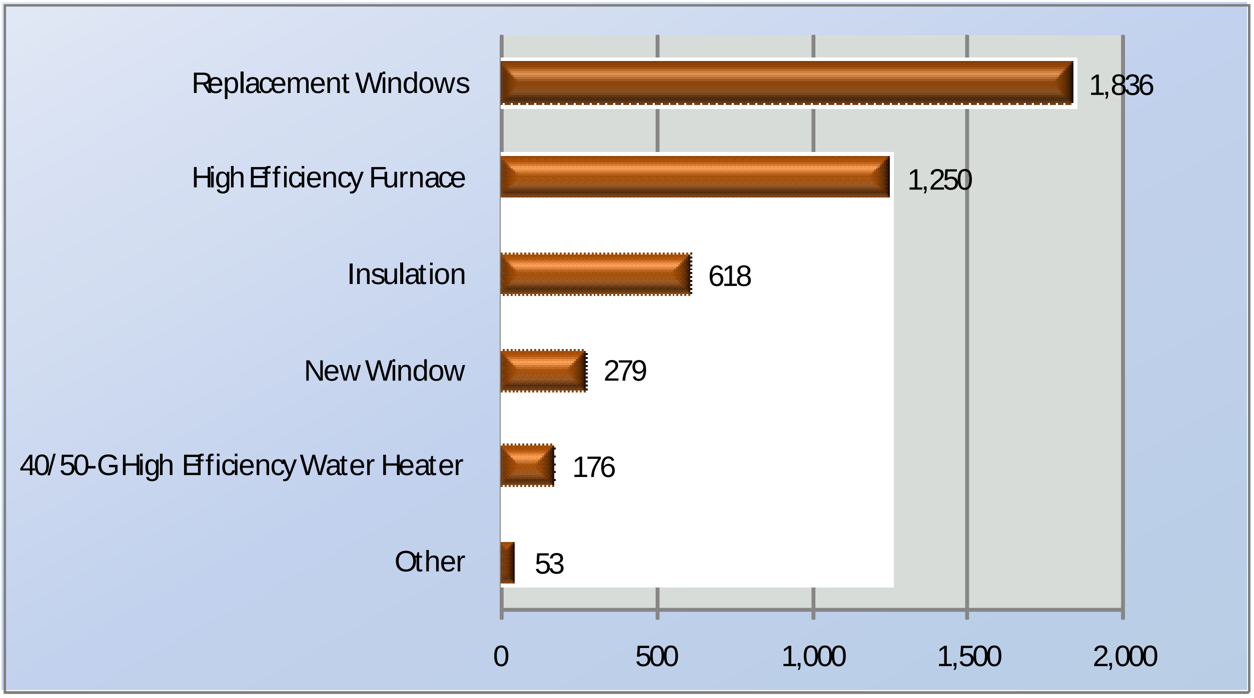
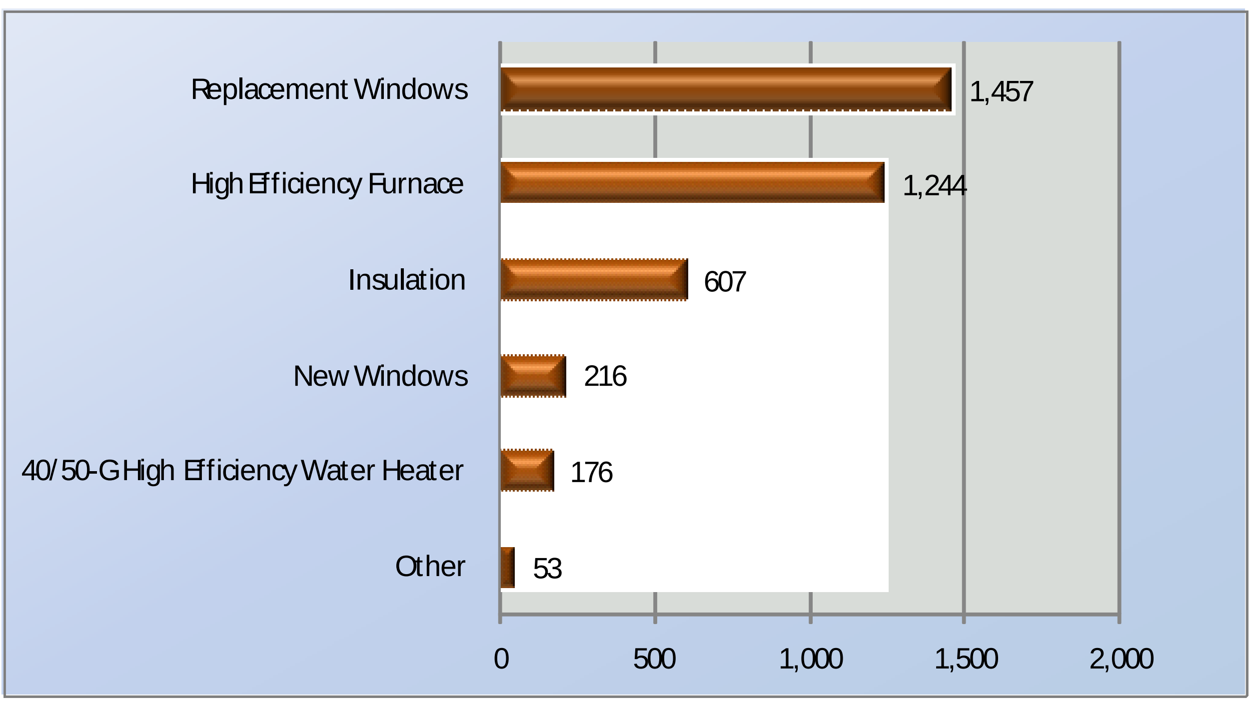


Figure 3.2: Frequency Count of Residential Program Codes: Excluding Multiple Cases of a Single Program Code for a Given Customer

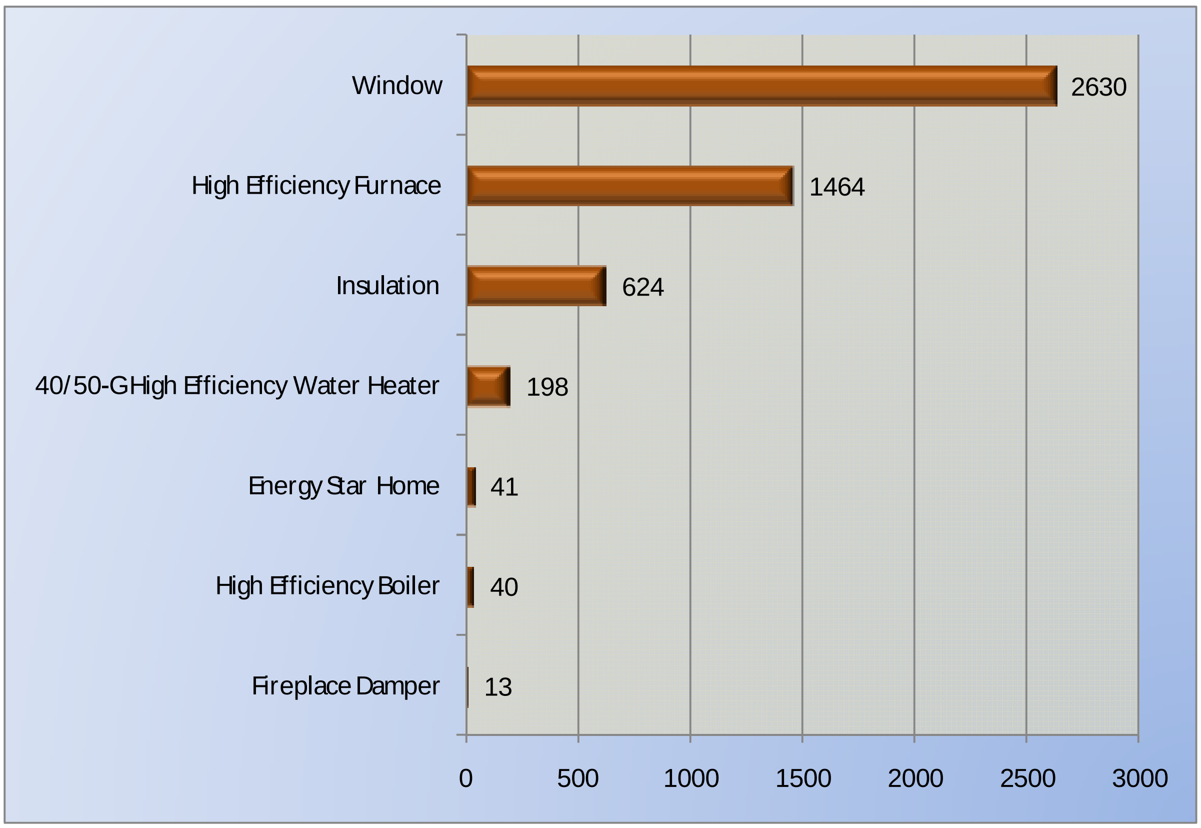


The most frequent single measure type was *High-Efficiency Furnaces*, with approximately 30% of the cases. *Replacement Windows* (*East/West Facing*, *North Facing*, and *South Facing*) together made up about 44% of the cases. The remaining measure types made up about 26% of the cases. Therefore, we identified three strata from which to sample: *High-Efficiency Furnaces*, *Replacement Windows*, and *All Other Measures*.

Refinement of Residential Stratification Plan for 2007 Audit

The distribution of measure types in the 2007 program was similar to that for 2006 (see Figure 3.3). However, for a variety of reasons, we decided to modify the stratification plan for the 2007 verification somewhat to include four strata rather than three.

Figure 3.3: Frequency Distribution of 2007 Residential Measure Types



First, in the 2006 verification, *Replacement Windows* was a single stratum and *New Windows* were included with *All Other Measures*. The method for calculating therm savings is similar for both types of windows (the difference is only in the coefficient that is applied) and so the potential sources of error for these measure types are very similar. This argues for combining these two measure types into a single stratum. By taking *New Windows* out of the *All Other Measures* stratum, a larger number of other measure types can be included in that division.

Second, the *All Other Measures* stratum in the 2006 verification included *Insulation* measures together with a variety of prescriptive and non-prescriptive measures. Given that *Insulation* measures constitute a substantial portion of total measures, it seems reasonable to sample them as a separate stratum.

Third, and finally, *High-Efficiency Furnaces* is a prescriptive measure and so data-entry error is the only source of variation in the amount of claimed savings. In fact, there was no error at all recorded for the *High-Efficiency Furnaces* measure in the 2006 audit. Even though it accounts for a large percentage of cases, *High-Efficiency Furnaces* accounts for a small percentage of the error in savings estimation. Some cases of this measure should still be included in the documentation review; however, it seems reasonable that it should consist of a smaller percentage of the residential sample than previously represented.

Based on the above considerations, we stratified the 2007 residential data as follows:

- Stratum 1: New and Replacement Windows (Calculated)
- Stratum 2: Insulation (Calculated)
- Stratum 3: High-Efficiency Furnaces and Boilers (Prescriptive)
- Stratum 4: All Other Measures (Prescriptive)

The size of each stratum is explained below.

Limited-Income Program

For each program year, Avista provided Research Into Action with a data file containing records of limited-income residential measures from its customer service database. The data file showed the following data for each measure:

- Customer ID
- Measure type (code and description)
- Entry date
- Customer cost ($)
- Customer rebate amount ($)
- Estimated kWh savings
- Estimated therm savings

Identification of Limited Income Strata for 2006 Audit

The limited-income list had characteristics similar to the residential list: a large number of cases with multiple measures per customer and a highly unequal distribution of cases across measure type. In this case, *Air Infiltration* accounted for approximately 29% of the cases; *Insulation* (*Ceiling*, *Floor*, and *Wall*) accounted for about 49%; and *All Other Measures* made up about 22%.

As with the residential category, the distribution of measure types was similarly skewed regardless of whether only a single case or multiple cases of a measure type were counted for a given customer (graphics not included). Following the reasoning for the residential group, we identified three strata from which to sample: *Air Infiltration*, *Insulation*, and *All Other Measures*.

Refinement of Limited-Income Stratification Plan for 2007 Audit

As with the residential program, the distribution of measure types in the 2007 limited-income program was similar to that for 2006. The 2006 verification found moderate levels of error in claimed therms for both insulation and air infiltration; as they continue to constitute more than two-thirds of the entire limited-income pool, we decided to continue sampling each as separate strata.

However, for the 2007 verification, we decided to sample the remaining measures in two strata rather than one. One stratum includes *ENERGY STAR® Windows* and *ENERGY STAR® Doors*. The other stratum includes the remaining measures (*High-Efficiency Furnaces*, *40-* and *50-Gallon High-Efficiency Water Heaters*, and *Programmable Thermostats*), each of which constitutes a small proportion of the measures.

By dividing the sample into four strata instead of three, we will sample fewer of the *Insulation* and *Air Infiltration* measures and therefore will be able to include more of the others.

Therefore, we stratified the 2007 limited-income data as follows:

- ➡ Stratum 1: *Insulation*
- ➡ Stratum 2: *Air Infiltration*
- ➡ Stratum 3: *ENERGY STAR® Windows and Doors*
- ➡ Stratum 4: *All Other Measures*

Nonresidential Program

For each program year, Avista provided Research Into Action with a data file containing a separate record for each nonresidential project. The data file showed the following information for each record:

- Application number
- Measure type
- Building type
- Estimated therm savings
- Date created
- Phase (completed for all measures)
- State (Washington or Idaho for all measures)

Identification of Nonresidential Strata for 2006 Audit

The size of reported savings (therms) was highly positively skewed, with a small number of measures representing extremely high reported savings. Therefore, the *Five largest Measures* were singled out and evaluated as one stratum, separately from the random sample.

Among the remaining 644 measures, there were some dependencies among measure type, building type, and size of reported savings. A cross-tabulation of measure type and building type showed a clear tendency for *Pre-Rinse Sprayer* to be associated with *Food Service* (Table 3.1).

Pre-rinse sprayers accounted for a very large number of total measures and represented a fairly narrow band of reported savings sizes (although there was some variability). The other measure types appeared to be distributed more-or-less similarly across the building types.

On the basis of this, we treated *Pre-Rinse Sprayers* (the most common measure type and highly concentrated in food service, the most common building type) as a second stratum and *All Other Measures* as a third stratum. The advantage of this is that, if pre-rinse sprayers were not separated out from the other measures, then they would represent a very large proportion of the entire sample; treating them as a separate stratum allowed the other measure types to be relatively over-sampled.

We treated *All Other Measures* as a single stratum. Therefore, the data collection approach for nonresidential customers consisted of one census (of the *Five largest Measures*) and two strata that were randomly sampled: *Pre-Rinse Sprayers* and *All Other Measures*.

Table 3.1: Measure Type by Building Type

BUILDING TYPE	MEASURE TYPE						
	APPLIANCE	HVAC	LEED CERTIFICATION	PRE-RINSE SPRAYER	ROOFTOP SERVICE	SHELL	Total
Agricultural	0	4	0	0	0	4	**8**
Church	0	1	0	0	0	0	**1**
Food Service	4	8	0	245	15	3	**275**
Government	4	21	2	57	7	12	**103**
Health Care	0	1	0	8	1	0	**10**
Hospitality	1	13	0	16	3	8	**41**
Manufacturing	1	6	0	0	0	5	**12**
Office	2	42	0	4	12	34	**94**
Residential	0	1	0	0	0	4	**5**
Retail	4	19	0	8	45	19	**95**
TOTAL	**16**	**116**	**2**	**338**	**83**	**89**	**644**

In addition, we found three cases in which the same application number was found on two records; in all other cases, there was only one record per application number. In all three cases, the two records with the same application both had identical information (i.e., same measure type, building type, estimated therm savings, and so forth), with one exception: the date that the record was created was different by one day for one set of duplicate application numbers. We notified Avista of the duplications and requested the record files associated with those three application numbers to determine, on a case-by-case basis, whether the two records with the same application number represented separate measures or whether they were the same measure recorded twice. None of the six records with duplicated application numbers was randomly drawn for the survey.

Refinement of Nonresidential Stratification Plan for 2007 Audit

The only difference between the audits of the 2006 and 2007 nonresidential data was that we selected the five largest measures for separate evaluation in the 2007audit, whereas we had selected the seven largest measures in the 2006 audit. The difference related to the different locations of an observable break in the distribution of claimed therms in the 2006 and 2007 data.

Otherwise, there was no reason to stratify the 2007 nonresidential sample differently from the 2006 sample. As previously, *Pre-Rinse Sprayers*, a prescribed measure, accounted for a very large number of total measures. The remaining projects were all site-specific and were largely comprised of *Rooftop Service*, *HVAC*, and *Shell* measures. A very small number of miscellaneous project types (12 projects) were not sufficiently frequent to justify creating a separate stratum.

Based on the above considerations, after identifying the five largest measures (not a stratum of the randomly drawn sample), we stratified the 2007 limited-income data as follows:

- ➡ Stratum 1: *Pre-Rinse Sprayers*
- ➡ Stratum 2: *All Other Measures*

Sample Size Determination

Prior to the 2006 verification, we calculated sample sizes to yield precise estimates for both the paper train audit and the check of Avista's calculated therm savings for the completed three-year verification. We determined the sample size for each year by dividing the three-year sample size by three.

Also as noted above, our initial sample size estimates were based on a desire to achieve very high levels of confidence and precision, combined with assumptions of very low rates of documentation error, which turned out to be incorrect. The following describes how we revised sample-size estimates based on error rates obtained during the 2006 verification, to achieve confidence and precision levels that still meet or exceed industry standards.

Sample Size Determination for the Audit of Avista's Savings Estimates

The formula for calculating the sample size for the audit of Avista's calculations for a particular group includes the standard deviation of the differences between Avista's and the audit's estimated therm savings across all measures within that group. Prior to the 2006 verification, this value was not known, so it was necessary to estimate it.

In most cases, the 2006 verification results showed greater variance (larger standard deviations) in the differences between Avista's and the audit's savings estimates than was anticipated. This meant that larger samples would be needed to achieve the 95/5 level of confidence and precision that we originally had set for this evaluation. In fact, the sample sizes needed would be impractical and cost-prohibitive to achieve in the 2007 and 2008 verifications. However, as noted above, the 95/5 confidence level was not mandated by the Settlement Agreement, and it is more stringent than the industry-standard levels of 90% confidence and 10% precision.

We re-calculated revised sample sizes using the standard deviations of the differences between Avista's and the audit's savings estimates from the 2006 data. We re-calculated both the estimated three-year sample sizes along with those for the 2007 verification.

In addition, in contrast to the approach taken previously, the new sample size calculations for the audit of savings estimates considered only calculated measures (i.e., measures that require some computation to arrive at the therm savings, such as windows or insulation, as opposed to purely prescriptive measures, such as furnaces or water heaters). We continued to sample prescriptive measures as part of the paper-trail audit and compared the savings recorded for each of those measures against Avista's prescribed savings (see below). However, since the only source of variance in those measures would be data-entry error (not calculation error), we did not consider them part of the savings estimates audit.

To compute the sample sizes for the calculated measures, we used the pooled standard deviations across those strata with calculated measures within each group. The results are shown in Table . Even using the 95/10 confidence/precision level, which is somewhat more stringent than the industry-standard 90/10 level, the re-calculated sample size estimates are smaller than the sample sizes for the 2006 verification for the limited-income and nonresidential samples (61 vs. 68 and 5 vs. 23, respectively), while that for the residential group is only somewhat larger than for the 2006 verification. The required sample size for the nonresidential group is very small, despite a large standard deviation of the Avista-audit differences, because these projects generally had very large savings and so the margin of error was proportionately large. Thus, while the standard deviation of the differences between Avista's and the audit's estimates was larger than in the other strata, it was small in comparison to the margin of error and therefore a relatively small sample delivers good precision. However, as explained below, the requirements of the paper-trail audit resulted in a much larger sample for the nonresidential group than that shown in Table .

Table 3.2: Revised Sample Size Estimates for Therm Savings Audit – Calculated Measures Only

GROUP	ESTIMATED[1] THREE-YEAR POPULATION	2006 ESTIMATED[2] STANDARD DEVIATION OF AVISTA AUDIT DIFFERENCE	2006 DATA		SAMPLE SIZE ESTIMATE			
			SAMPLE SIZE	STANDARD DEVIATION OF AVISTA AUDIT DIFFERENCE[3]	USING 95/10 STANDARD CONFIDENCE/PRECISION LEVEL		USING 90/10 STANDARD CONFIDENCE/PRECISION LEVEL	
					THREE-YEAR	2007[4]	THREE-YEAR	2007[4]
Residential Sample	6,331	6.9	72	59.9	231	83	163	(55)
Limited-Income Sample	1,525	23.2	68	85.7	182	(61)	134	(45)
Nonresidential[5]	935	209.5	23	285.0	14	(5)	10	(4)

1 The three-year populations were estimated by multiplying the 2006 populations (excluding duplicate records for a given customer) for each group by three; comparison of 2006 and 2007 data indicated similar levels of calculated measures when duplicate records were removed from each population.

2 These estimated standard deviations were used to approximate the sample sizes for the 2006 verification; the method used to generate them is described in the Final Report for the 2006 verification.

3 The standard deviation for the Residential sample was computed as a pooled standard deviation across those strata that were comprised only of calculated measures: Stratum 1 (New and Replacement Windows) and Stratum 3 (Insulation).

4 The 2007 sample sizes were calculated by subtracting the 2006 sample size from the estimated three-year sample size and dividing by two; however, this produced very small 2007 sample sizes for strata comprised of prescriptive measures and some other measure types with very low error rates, which had resulted in larger-than-necessary 2006 samples. In those cases, we conservatively set the estimated 2007 sample sizes at one-third of the estimated three-year sizes; the sample sizes for those strata are shown in parentheses.

5 Note that the required sample size for this group is very small, despite the fact that the standard deviation of the Avista audit differences was quite large. This is because the projects in this stratum generally had very large savings and so the margin of error was proportionately large. Thus, while the standard deviation of the differences between Avista's and the audit's estimates was larger than in the other strata, it was small in comparison to the margin of error, and therefore a relatively small sample delivers good precision.

Sample Size Determination for the Paper-Trail Audit

In originally calculating the sample size for the paper-trail audit, we assumed that Avista's inputs would be adequately documented in at least 95% of the cases. As Table shows, we found no documentation errors in four of the eight strata. However, the rate of documentation error in the other four strata ranged from about 14% to 37%, which was much larger than that used to generate the estimated three-year sample sizes. This affects the sample size required for the 95/5 level of confidence/precision.

Table 3.3: Documentation Error and Mean Error of Savings Estimation by Group, 2006 Verification

GROUP	DOCUMENTATION ERROR		MEAN ESTIMATION ERROR (As Percent of Total)
	COUNT	PERCENT OF PROJECTS IN STRATUM	
Residential Sample Stratum 1 (*High-Efficiency Furnaces*)	0	0%	0.0%
Residential Sample Stratum 2 (*Replacement Windows*)	8	33.3%	8.4%
Residential Sample Stratum 3 (*All Other Measures*)	9	37.5%	29.4%
Limited-Income Sample Stratum 1 (*Air Infiltration*)	0	0%	20.1%
Limited-Income Sample Stratum 2 (*Insulation*)	0	0%	17.6%
Limited-Income Sample Stratum 3 (*All Other Measures*)	4	19.0%	60.7%
Nonresidential, Five Largest Projects	1	14.3%	56.7%
Nonresidential Sample Stratum 1 (*Pre-Rinse Sprayers*)	0	0%	0.0%
Nonresidential Sample Stratum 2 (*All Other Measures*)	7	30.4%	-2.3%

Again, as noted above, the 95/5 confidence level was not mandated by the Settlement Agreement, and it is more stringent than the industry-standard levels of 90% confidence and 10% precision. Moreover, we calculated our original sample-size estimates for each sample stratum, whereas the results of interest pertain to the entire sample rather than the individual strata (the reason for stratifying the sample was to ensure that a broad range of measure types would be included, but we report the weighted combined results for each entire sample).

While we believe that it nevertheless is desirable to have a reasonable sample of as many measure types as possible to allow us to determine whether there are any systematic sources of error, it is not necessary to adhere to the original method for determining sample size.

As shown in Table , we used the 2006 error rates to re-calculate the estimated three-year sample sizes, along with those for the 2007 verification. In contrast to the case with the therm savings audit, the paper trail audit should apply to all measure types, prescriptive as well as calculated.

We first computed sample sizes separately for calculated and prescriptive measures[6], using both 95/5 and 95/10 confidence/precision levels. We also calculated the sample sizes for each sample as a whole, using pooled error rates across the calculated and prescriptive measures for each group. We did this to identify the minimum sample size needed for each group, irrespective of the type of measure.

As expected, a 95/5 confidence/precision level would necessitate larger residential and nonresidential samples than we obtained in the 2006 verification (99 vs. 72 and 67 vs. 46, respectively). The 2007 limited-income sample would be smaller than for the 2006 verification (27 vs. 64) because the documentation error rate for that group was relatively small. In fact, the estimated three-year pooled sample for the limited-income group (81) was only slightly greater than was obtained in the 2006 verification (64); to ensure that each year's verification would include at least one-third of the three-year pooled total, we indicated that the 95/5 sample size for the 2007 limited-income paper-trail audit would be at least 27. When the 95/10 standard is applied, the pooled 2007 sample sizes for all three groups are much smaller than those obtained in the 2006 verification (23 vs. 72, 7 vs. 64, and 16 vs. 46).

Based on the above considerations, it was possible to produce results with acceptable levels of confidence and precision—nearly as high as originally planned, at least at the entire-group levels—by drawing and examining samples that are not much larger than those examined in the 2006 verification.

[6] As noted above, none of the measures in the Limited-Income were prescriptive.

Table 3.4: Revised Sample Size Estimates for Paper Trail Audit

GROUP	ESTIMATED[1] THREE-YEAR POPULATION	2006 DATA		SAMPLE SIZE ESTIMATES			
		SAMPLE SIZE[2]	ERROR RATE[2,3]	USING 95/10 STANDARD CONFIDENCE/PRECISION LEVEL		USING 90/10 STANDARD CONFIDENCE/PRECISION LEVEL	
				THREE-YEAR	2007[4]	THREE-YEAR	2007[4]
RESIDENTIAL							
Residential – Calculated	6,331	41	29.2%	302	131	78	(26)
Residential – Prescriptive	3,990	31	16.1%	197	83	51	(17)
Residential Sample – Combined [5]	**10,320**	**72**	**23.6%**	**270**	**99**	**69**	**(23)**
LIMITED INCOME							
Limited-Income Sample – Combined [5]	**1,524**	**64**	**5.9%**	**81**	**(27)**	**21**	**(7)**
NONRESIDENTIAL							
Nonresidential – Calculated	935	23	30.4%	241	109	75	26
Nonresidential – Prescriptive	1,019	23	0%	15	(5)	4	(1)
Nonresidential Sample – Combined [5]	**1,953**	**46**	**15.2%**	**180**	**67**	**48**	**(16)**

[1] The three-year strata populations were estimated by multiplying the estimated three-year population for each group by the proportion each stratum contributed to the 2006 sample.

[2] Sizes and error rates of the sample strata were determined by re-assigning the 2006 measures to the currently defined strata and performing counts within the new strata.

[3] To calculate sample size when the error rate was 0%, an error rate of 1.0% was substituted, as using the 0% rate would have produced a sample size of 0.

[4] The 2007 sample sizes were calculated by subtracting the 2006 sample size from the estimated three-year sample size and dividing by two; however, this produced very small 2007 sample sizes for several strata that had very high error rates and, hence, larger-than-necessary 2006 samples. In those cases, we conservatively set the estimated 2007 sample sizes at one-third of the estimated three-year sizes; the sample sizes for those strata are shown in parentheses.

[5] We calculated sample sizes that apply the 95/5 and 95/10 confidence/precision levels to the calculated measures in the Residential, Limited-Income, and Nonresidential groups as a whole, collapsed across strata. We used the pooled error rate for calculated measures for each group. We calculated the pooled 2007 sample sizes by subtracting the 2006 group-level sample sizes from the estimated three-year pooled sample sizes and divided by two; however, in several cases, this produced very small samples for 2007. In those cases, we conservatively set the estimated pooled 2007 sample sizes at one-third of the estimated three-year pooled sizes; these are shown in parentheses.

Planned Sample Sizes for the Combined Paper-Trail and Savings Estimate Audit

Table shows the planned sample sizes for the 2007 verification by group. We arrived at these figures by combining the sample requirements for the savings estimate audit of the calculated measures with the paper-trail audit requirements of both calculated and prescriptive measures. The primary criterion was that each group should, at a minimum, meet the 90/10 confidence/ precision standard for both the paper-trail and savings estimate audit.

Table 3.5: Revised Planned Sample Sizes

GROUP	THREE-YEAR	2007	COMMENT
RESIDENTIAL			
Residential – Calculated	231	80	Achieves 95/10 confidence/precision for therm savings audit, >95/10 for paper trail audit
Residential – Prescriptive	51	17	Achieves 95/10 confidence/precision for paper trail audit
Residential Total	**282**	**97**	
LIMITED INCOME			
Limited-Income	182	61	Achieves 95/10 confidence/precision for therm savings audit, >95/10 for paper trail audit
NONRESIDENTIAL			
Nonresidential – Calculated	75	26	Achieves >95/5 confidence/precision for therm savings audit, 95/10 for paper trail audit
Nonresidential – Prescriptive	15	5	Achieves 95/10 confidence/precision for paper trail audit
Nonresidential Total	**90**	**31**	

The sample sizes for the calculated measures in the residential and limited-income groups were driven by the confidence/precision requirements of the therm savings audit. However, the sample size for the calculated measures in the nonresidential group was driven by the requirements of the paper-trail audit. As a result, the confidence/precision levels for the therm savings audit for this stratum are higher than for the others (>95/5 vs. 95/10).

We allocated the sample sizes within each group as shown in Table 3.6.

Table 3.6: Planned 2007 Sample Sizes by Stratum

STRATUM	2007	COMMENT
RESIDENTIAL		
Strat 1, Windows (calculated)	40	"Calculated" measures divided evenly between Stratum 1 and 2; combined in paper-trail and therm savings audit.
Strat 2, Insulation (calculated)	40	
Strat 3, High-Efficiency Furnace (prescriptive)	4	No variability in HE Furnace in 2006; combined with Stratum 4 in paper-trail audit; number of HE Furnace approximately equal to number of most common measure type in Stratum 4.
Strat 4, Other (prescriptive)	13	
Residential Total	**97**	
LIMITED-INCOME		
Strat 1, Insulation	15	All strata are calculated measures. Under-sampled Stratum 1 and 2 and over-sampled Stratum 3 and 4. Stratum 4 is largest stratum because it is comprised of several measure types.
Strat 2, Air Infiltration	15	
Strat 3, ENERGY STAR® Windows/Door	12	
Strat 4, Other	19	
Limited-Income Total	**61**	
NONRESIDENTIAL		
Nonresidential – Five Largest	5	N/A
Nonresidential – Calculated	26	No stratification within calculated measures
Nonresidential – Prescriptive	5	No stratification within prescriptive measures
Nonresidential Total	**31**	

Randomization

Within each customer type, we partitioned the list into the specified strata discussed above. Then we created an *SPSS* data set for each stratum. Within each stratum, we created a new variable that was populated with a different random number for each record (using a uniform distribution). We ordered each data set by the random variable, which randomized the order of the cases within that set. Then, within each data set, we selected the first *n* cases, where *n* was the specified sample size for that stratum.

We had determined that if a given customer was selected more than once, the duplicate *i* selections of that customer would be replaced with the next *i* records in that stratum. This occurred three times in the 2006 audit but did not occur in the 2007 audit.

VERIFICATION METHODOLOGY

The verification methodology for all three programs shared three common components:

1. Reviewing the paper documentation of the sampled cases to verify that the input data used to calculate the therms saved on a case-by-case method were correct;
2. Performing an engineering review of the assumptions that went into Avista's calculations of therm savings for the various measures; and
3. Independently calculating therm savings on a case-by-case basis, using either Avista's assumptions or other sets of assumptions resulting from the engineering review.

Generally speaking, the verification methodology for the 2007 audit did not differ from that for the 2006 audit. Any differences are indicated.

Review of Paper Documentation

Some differences existed among the programs and program strata in how measures were installed. These differences resulted in variances in the nature of the input data sources and how they were documented. We describe the procedures we followed in our review of paper documentation separately for each program (residential, limited-income, and nonresidential).

Residential Program

In the residential program, customers dealt directly with contractors for installation of measures. The customers recorded pertinent data about the measures on an Avista *Home Improvement Incentive Form* (rebate form) and submitted this form, together with invoices and other relevant documentation from the contractor, to Avista. Avista forwarded electronic copies of rebate forms, invoices, and other relevant documentation for the sample cases to Research Into Action.

Data Entry and Coding

For each sample stratum, we created an *Excel* workbook for recording details about the documentation received from Avista. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not the records, including an invoice, had been received; disposition codes; and notes describing any exceptions. In addition, each workbook included columns for recording the input data recorded for each case. Finally, each workbook had columns pre-coded with the Avista-supplied per-unit savings values or algorithms for calculating savings (as explained below) for each case. (In the event that our engineering review suggested different per-unit values or algorithms, we substituted these for those supplied by Avista.)

For each case, we reviewed all invoices and other documentation to confirm the information listed on the rebate form for the measure in question. For example, if the rebate form listed a 40-gallon, high-efficiency gas water heater with an Efficiency Factor (EF) of .63, we checked to see if the invoice and/or other documentation confirmed all of that information. Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. For the residential strata, the possible codes were:

> *1 = Invoice or other documentation confirms rebate form*
>
> *2 = Invoice does not provide sufficient information to confirm rebate form*
>
> *3 = Invoice contradicts rebate form*
>
> *4 = Measure was incorrectly coded in the Avista database*
>
> *5 = Does not qualify for a rebate*

We assigned a code of "1" if the invoice or other documentation provided sufficient details to compute therm savings based on Avista's criteria and confirmed the information provided on the rebate form. For example, if the measure was a 40-gallon high-efficiency water heater and the invoice or other material documented that measure, as well as either the EF or the model number (which could be used to determine the EF), and the EF met Avista's eligibility standard, then we assigned a code of "1". Similarly, if the measure was a high-efficiency furnace and the invoice or other materials documented that measure as well as the AFUE% or model number, and the AFUE% met Avista's eligibility standard, then we assigned a code of "1". Note that, even if the invoice did not document the EF or AFUE%, if we were able to obtain this information based on the model information, then we assigned a code of "1". In the case of insulation, the measure, area, and pre- and post- R-values were necessary.

For windows, it was necessary for the invoice to document the measure, as well as the area covered. However, we found that the invoice typically did not specify the direction that the windows faced. Therefore, our protocol was that if the invoice documented windows and it was possible to determine the total area of the windows, and if the total area on the rebate form did not exceed the total area on the invoice, then we assigned a code of "1".

We assigned a code of "2" if the invoice and other materials did not provide sufficient input data to confirm information on the rebate form. For example, if the invoice and other materials did not document the input data recorded on the rebate form, we assigned a code of "2". Similarly, if the invoice and supporting materials documented neither EF nor the model for a water heater, or did not document the model or AFUE% for a furnace, we assigned a code of "2". In the case of windows, we assigned a "2" if the area covered was not documented. For insulation, we assigned a "2" if the area, the existing R-value, or the final R-value was not documented.

If the invoice and/or other materials showed input data—such as the square feet of windows or insulation installed—that contradicted that shown on the rebate form, we assigned a code of "3". For the purposes of this audit, we defined "contradiction" as a difference such that the therm savings based on the value shown on the rebate form exceeds the therm savings based on the value documented in the input data by more than 5%.

For example, if the measure in question was windows or insulation, and the square footage recorded on the rebate form exceeded that recorded on the invoice or other documentation by more than 5%, we then assigned a disposition code of “3” (because the savings estimated from the rebate form exceeded by more than 5% the amount that would be estimated from the value on the invoice).

If the invoice or other documentation showed a measure other than what was recorded for that case in the Avista database, we assigned a code of “4”. Finally, we found a few cases in which the EF of a water heater or AFUE% of a furnace was not documented, but in which we were able to obtain this information from the manufacturer and found that the EF or AFUE% did not meet Avista’s eligibility standards even though a rebate had been issued. In these cases, we assigned a code of “5”.

Note that a code of “3”, “4”, or “5” did not necessarily mean that there was not sufficient documentation of input data, simply that those data may not have been correctly reported.

If the *Initial Disposition Code* was other than “1”, we recorded an explanation in the *Notes* column of the workbook.

Data Clarification

If the information on the supporting documentation was incomplete, we attempted to obtain the missing information by contacting Avista and/or the manufacturer, supplier, or dealer of the installed measure. For example, if the EF for a water heater was not documented, but the model number was, we contacted the manufacturer, supplier, or dealer to find out the EF for the listed model. Using the information obtained through these contacts, we assigned a *Final Disposition Code* to each case and updated the case notes.

Limited-Income Program

The limited-income program is non-prescriptive, so the analyses are performed and incentives offered on a site-specific basis. As noted above, CAPs directly install all measures in the limited-income program and record all input data either directly into software installed on notebook computers that they carry with them to the location of installation or onto paper forms. The customer neither completes a rebate form nor receives invoices or other supporting documentation from the installer, and little or no independent hard-copy documentation exists for any of the measures in this sample.

Avista forwarded to Research Into Action electronic copies of software screen captures or paper forms from the CAP agencies. All such documents were labeled *Invoice Form* and showed output data for the measure; in some cases, forms were included that showed input data that went into computing the output data.

Data Entry and Coding

As with the residential program, we created an *Excel* workbook to record details about the documentation we received for each case in the limited-income sample strata. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not the records had been received; disposition codes; and notes describing any exceptions. In addition, each workbook included columns for recording the input data recorded for each case, as well as columns pre-coded with the Avista-supplied per-unit values or algorithms for each measure.

Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. Disposition codes were defined so as to be consistent, to the degree possible, with the codes for the residential program. However, because of the way that measures were installed and documented in the limited-income program, the definitions of the first two codes are slightly different from those for the residential program. Moreover, the residential disposition code "3" – which indicates a data disagreement between the rebate form and other documentation – does not apply to the limited-income program, as typically there was no independent paper documentation other than the rebate form in this program. Thus, the possible codes for the limited-income strata were:

> *1 = Sufficient input data and no coding errors*
>
> *2 = Input data were not detailed*
>
> *4 = Measure was incorrectly coded in the Avista database*
>
> *5 = Does not qualify for rebate*

Our criteria for assigning a code of "1" were similar to those for the residential program, except that there was no criterion of independently confirming the information on the rebate form (since there typically was no independent documentation). Instead, the criteria were that the invoice form provide sufficient detail to compute therm savings, based on Avista's criteria, and to verify that the measure qualified for a rebate. For example, if the measure was a 40-gallon, high-efficiency water heater, and the invoice form documented that measure, as well as either the EF or the model number (which could be used to determine the EF), and the EF met Avista's eligibility standard, then we assigned a code of "1". Similarly, if the measure was a high-efficiency furnace, and the invoice documented that measure, as well as the AFUE% or model number, and the AFUE% met Avista's eligibility standard, then we assigned a code of "1". As with the cases in the residential program, even if the invoice did not document the EF or AFUE%, if we were able to obtain this information based on the model information, then we assigned a code of "1". For windows, it was necessary for the invoice to document the measure, as well as the area covered. In the case of insulation, the measure, area, and pre- and post- R-values were necessary.

Again, our criteria for assigning a code of "2" were similar to those for the residential program, except for the reference to confirming the information on the rebate form. Instead, the criteria were that the invoice form did not provide input data sufficient to compute therm savings or to verify that the measure qualified for a rebate. For example, if the invoice documented neither EF nor the model for a water heater, or it did not document the model or AFUE% for a furnace, we assigned a code of "2". In the case of windows, we assigned a "2" if the area covered was not documented. For insulation, we assigned a "2" if the area, the existing R-value, or the final R-value was not documented.

As indicated above, we did not assign a code of "3" to any of the cases in the limited-income program.

If the invoice form showed a measure other than what was recorded for that case in the Avista database, we assigned a code of "4". Finally, in a few cases the invoice did not document the EF of a water heater or AFUE% of a furnace, but we were able to obtain this information from the manufacturer, and thus found that the EF or AFUE% did not meet Avista's eligibility standards, even though a rebate had been issued. We assigned a code of "5" to these cases.

As with the residential program, a code of "4" or "5" did not mean that there was not sufficient documentation of input data, but only that those data may not have been correctly reported.

Data Clarification

If the *Initial Disposition Code* was other than "1", we recorded an explanation in the *Notes* column of the workbook. For all such cases, we contacted Avista to attempt to obtain additional information to clarify the cases' disposition. Based on the results of our efforts, we assigned a *Final Disposition Code* to each case, using the same coding scheme as for the initial disposition.

Nonresidential Program

The majority of the projects in the nonresidential program involved non-prescriptive, custom engineering projects. For these projects, Avista completed the individual energy calculations either in spreadsheet tools or through modeling programs. The only projects that were not custom were those that involved installation of pre-rinse sprayers; these were prescriptive-rebate projects with a set energy savings value per item.

For each custom engineering project, Avista forwarded electronic copies of the project evaluation report, the agreement, invoices, and other relevant documentation to Research Into Action. Information for the pre-rinse sprayers consisted of an *Excel* spreadsheet, also supplied to Research Into Action, that listed: number of sprayers installed; equipment manufacturer; location of the sprayer; pre- and post-GPM data; water temperature data; and additional notes as necessary. Invoices for the purchase of the sprayer were not provided.

Data Entry and Coding

For each group, we created an *Excel* workbook to record details about the documentation received from Avista. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not records had been received; disposition codes; and notes describing any exceptions.

Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. For the nonresidential strata, the possible codes were:

> *1 = Documentation reasonable*
>
> *2 = Documentation problematic*

The codes are somewhat different from those used in the 2006 audit. We changed the coding because we found that the range of documentation issues that we encountered, in both the 2006 and 2007 samples, do not fit neatly into a small selection of categories. Therefore, we assigned a code of “1” if the documentation provided sufficient detail to compute therm savings that we felt reasonably confident in using to evaluate Avista’s claimed savings. Sufficient documentation included data such as modeling inputs and/or outputs, baseline assumptions, and spreadsheet tools that allowed us to evaluate the project through our own use of models or spreadsheet, and to confirm the energy savings value reported by Avista.

We assigned a code of “2” if the documentation provided did not offer sufficient data to compute therm savings that we felt reasonably confident in using to evaluate Avista’s claimed savings. Even if we assigned a code of “2”, we nevertheless may have calculated estimates, but in such cases we do not necessarily recommend that our estimates be used instead of Avista’s claimed therms.

If the *Initial Disposition Code* was other than “1”, we recorded an explanation in the *Notes* column of the workbook.

Data Clarification

If the information in the supporting documentation was incomplete, we attempted to obtain the missing data by contacting Avista. For example, if the baseline assumptions used in the spreadsheet calculation of a project were not provided, we asked Avista for these assumptions. Using the information obtained, we assigned a *Final Disposition Code* to each case and updated the case notes.

Engineering Review

Residential Program

The engineering review of Avista's residential program consisted of a check against standard engineering practices, comparing Avista's reported energy savings to other utility DSM program offerings, and performing engineering calculations to verify savings on a measure-by-measure basis. We used Avista's assumptions and rebate qualifications for each measure (e.g., window U-value requirements, EF of water heaters) in the engineering review. We also evaluated them for appropriateness, such as by comparing them to code values for Washington and Idaho.

The following outlines the review methods for each measure in the program:

- **High-Efficiency Furnace and Gas Boiler:** The review included the use of ENERGY STAR®'s online calculator[7] for the regions in Avista's Washington and Idaho territory, along with values used by other utility companies for similar baseline and retrofit requirements, adjusted for heating-degree-days.
- **High-Efficiency Water Heater (40- and 50-gallon):** The review included engineering calculations using Avista's Energy Factor (EF) qualifications and a comparison with other utility company reported values for similar baseline and retrofit requirements.
- **High-Efficiency Tankless Water Heater:** The review included engineering calculations using a baseline EF of 0.58 and a retrofit EF of 0.82 (typical for tankless water heaters), and a comparison with savings values reported by other utility companies and the California Database for Energy Efficient Resources (DEER).
- **Ceiling/Attic/Floor/Wall/Duct Insulation Measures:** The review included engineering calculations based on the *modified heating-degree-day* method, using Avista's stated baseline and retrofit assumptions. We also used heating-degree-days for Spokane, Washington, and a seasonal equipment efficiency rating of 0.60 in the calculations.
- **New Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals*[8] method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of a new window. We used baseline and retrofit assumptions for U-factors, as stated by Avista, in the analysis. We also used heating-degree-days for Spokane, Washington, and a seasonal equipment efficiency rating of 0.60 in the review.

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7 See the ENERGY STAR® website: http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammablethermostat.xls.

8 *2005 ASHRAE Handbook Fundamentals*, Section 27.21, "Residential Calculations Examples," Equation 40.

- **Replacement Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals* method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of a replacement window. We used baseline and retrofit assumptions for U-factors, as stated by Avista, in the analysis. We also used heating-degree-days for Spokane, Washington, and a seasonal equipment efficiency rating of 0.60 in the calculations.
- **Programmable Thermostats:** The review included running ENERGY STAR®'s online calculator for programmable thermostats, using all available locations in Avista's Washington and Idaho service territory, and averaging the savings results across all regions. We discounted the ENERGY STAR® savings value to 25%, based on Energy Information Administration (EIA) surveys, which reported that only 25% of installed programmable thermostats are correctly programmed.[9]
- **ENERGY STAR® Homes.** The review included a comparison of deemed values used by other utility companies (Rocky Mt. Power and UniSource Energy Services) for Energy-Star homes. We compared the baseline and retrofit assumptions, as well as heating degree days in each region.

Limited-Income Program

All of the projects in the limited-income program were custom projects. Therefore, our engineering review of the limited-income program consisted of a check against standard engineering practices. We used baseline and retrofit values reported for each measure (e.g., window U-values, insulation R-values) in the engineering review.

The following outlines the review methods for each measure in the program:

- **Air Infiltration:** The review included calculating heating energy savings achieved by heating less infiltrated outside air to the desired inside air temperature. Air change rates before and after infiltration reductions were used to capture the associated heating energy savings. The assumptions and inputs used in the calculations were taken from customer files provided by Avista or from standard engineering manuals' practices.
- **ENERGY STAR® Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals* method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of ENERGY STAR® windows.

9 *A Look at Residential Energy Consumption in 1997*, DOE/EIA-0632 (97), Energy Information Administration.

Baseline and retrofit values for each customer were provided by Avista and used in the analysis.

- **ENERGY STAR® Doors:** A review of the measure was not completed because no such measure was selected in the sample.
- **High-Efficiency Furnace:** The review included the use of ENERGY STAR®'s online calculator for the regions in Avista's Washington and Idaho territory, along with values used by other utility companies for similar baseline and retrofit requirements, adjusted for heating-degree-days.
- **High-Efficiency Water Heater (40- and 50-gallon):** The review included engineering calculations using Avista's Energy Factor (EF) qualifications and a comparison with other utility company reported values for similar baseline and retrofit requirements.
- **High-Efficiency Tankless Water Heater:** The review included engineering calculations using a baseline EF of 0.58 and a retrofit EF of 0.80 (typical for tankless water heaters), and a comparison with savings values reported by other utility companies and the California DEER database.
- **Ceiling/Attic/Floor/Wall/Duct Insulation Measures:** The review included engineering calculations based on the modified heating-degree-day method. Baseline and retrofit values for each customer were provided by Avista and used in the analysis.
- **Health and Human Safety:** These measures typically fell under one of the categories already provided and the methodology used to evaluate the energy savings was the same as provided for each measure type (e.g., air infiltration reduction).

Nonresidential Program

For the engineering review of the Avista nonresidential programs, we carried out a project-by-project analysis of the measures installed and the energy savings reported. As part of the evaluation, we reviewed the engineering calculations, modeling simulations, and assumptions that Avista used for each project, along with a check against standard engineering practices, in order to determine the accuracy of the methodologies used to determine energy savings. We performed separate engineering calculations and modeling simulations to verify accuracy if we deemed it necessary. For our engineering evaluation for pre-rinse sprayers, we completed an evaluation of Avista's metering data study, completed in 2007, for a sample of installed units.

Calculation of Therm Savings

Residential Program

As a check of Avista's therm savings estimates, we used the Avista-supplied per-unit savings values or algorithms and the input data recorded on the rebate form to compute therm savings for each case.[10]

Avista supplied the following prescriptive therm savings:

- **High-Efficiency Gas Furnace (≥ 90% AFUE):** 72 therms
- **High-Efficiency Water Heater, 50-Gallon (≥ .60 EF):** 8 therms
- **High-Efficiency Water Heater, 40-Gallon (≥ .62 EF):** 11 therms
- **High-Efficiency Water Heater, Tankless (≥ .65 EF):** 11 therms
- **Ceiling/Attic Insulation (minimum R-10 increase):** .042 therms/square foot/R-10 added
- **Wall/Floor Insulation (minimum R-10 increase):** .209 therms/square foot/R-10 added
- **Duct Insulation (R-10 increase):** 2.8 therms per linear foot
- **New Windows (U-factor at least .35):** .42 therms per square foot
- **Replacement Windows (U-factor at least .35):** .83 therms per square foot
- **Programmable Thermostat:** 31 therms
- **ENERGY STAR® homes:** 197 therms

For each case in each sample stratum, we computed the difference between Avista's estimate of therm savings and ours. We excluded cases for which the documentation did not provide sufficient data to compute an estimate, as specified above. However, we included cases with final disposition codes of "3" (invoice and/or other documentation contradicts the rebate form) or "4" (incorrectly coded) if we had sufficient data to compute an estimate; we also included cases with a final disposition code of "5" (not qualified), assigning a value of "0" saved therms. The

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10 In the 2006 audit, we reported that we substituted the per-unit savings values from our engineering analysis when they differed from Avista's values. This occurred only for one measure—high-efficiency tankless water heaters. For the current audit, including the combined 2006-2007 data, we have decided to use the Avista values for all measures. As our engineering analyses typically provide for a higher value than the one Avista uses, this is a more conservative approach.

reasoning was that these cases provide appropriate information regarding Avista's computations of therm savings on a case-by-case basis. Note, however, that they also are included in our paper-trail analysis, which shows the percentage of cases with documentation problems.

Limited-Income Program

For the limited-income sample, we calculated savings on a measure-by-measure basis using either Avista's assumptions and methods (if confirmed in our engineering review), or our own proposed ones.

For each case, in each sample stratum, we computed the difference between Avista's estimate of therm savings and ours. We excluded cases for which the documentation did not provide sufficient data to compute an estimate. However, we included cases with final disposition codes of "3" (invoice and/or other documentation contradicts the rebate form) or "4" (incorrectly coded) if we had sufficient data to compute an estimate; we also included cases with a final disposition code of "5" (not qualified), assigning a value of "0" saved therms. The reasoning was that these cases provide appropriate information regarding Avista's computations of therm savings on a case-by-case basis. Since we performed this analysis simply as a check of Avista's computations, not to provide alternative estimates of therm savings, including these cases is proper. Note, however, that they also are included in our paper-trail analysis, which shows the percent of cases with documentation problems.

Nonresidential Program

The nonresidential *Five Largest Projects* and Stratum 2 (*All Other Measures*) are custom projects, in which the calculated energy savings are based on the conditions of the baseline and retrofit system. In the data analysis for these groups, we recalculated the therm savings for all cases, based on the results of our engineering analysis; in most cases, this did not involve a "check" of Avista's computation for the project. Stratum 1 (*Pre-Rinse Sprayers*) involved a pre-negotiated energy savings value per unit (sprayer) and, therefore, was the only nonresidential group that involved a check of Avista's assumed therm value and recorded data. For this group, we used an Avista-supplied value of 44 therms per sprayer and the input data (number of sprayers per location) recorded in Avista's tracking spreadsheet to compute therm savings for each case. For each case, in all three strata, we computed the difference between Avista's estimate of therm savings and ours.

Unlike the residential and limited-income cases, we did not exclude cases based on disposition code (see above, p. 29). However, we noted cases in which documentation issues resulted in audit estimates that should not be used to evaluate Avista's claimed savings.

DATA ANALYSIS AND PRESENTATION

Paper-Trail Analysis

Our paper-trail analysis for all programs consisted of computing the percent of cases in each residential stratum with each final disposition code, along with 90% confidence intervals (CIs).

Therm Savings Analysis

For each stratum, we calculated the mean, standard deviation, and mean standard error of the case-by-case difference between Avista's estimated therm savings and our calculation of the saved therm. We used the standard errors to compute 90% CIs around the mean differences.

Weighting Data for Combined Results

As in the 2006 audit, before we combined the data from the various strata we assigned weights to each stratum to account for the fact that the population-to-sample ratio differed among them. We did this for both the paper-trail audit and the savings estimate audit.

For each disposition, the formula for determining the weighted *n* was:

$$(n_1 * w_1) + (n_2 * w_2) + (n_3 * w_3) + (n_4 * w_4)$$

where:

n_1, n_2, n_3, **and** n_4 = **the number of cases with disposition** x **in Stratum 1, 2, 3, and 4**

w_1, w_2, w_3, **and** w_4 = **the weights of Stratum 1, 2, 3, and 4**

Weights were calculated as:

$$(N_i / n_i) / (N_{1-4} / n_{1-4})$$

where:

N_i = **the population for Stratum *i***

n_i = **the sample size for Stratum *i***

N_{1-4} = **the combined population for all strata**

n_{1-4} = **the combined sample size for all strata**

Similarly, in the therm savings analysis, we applied weights to each stratum mean before combining the strata.

Combining 2006 and 2007 Results

We also report data for the combined 2006 and 2007 samples. Since we redefined the sample strata for the 2007 audit, we re-stratified the 2006 audit data using the 2007 audit definitions. In addition, before we combined data from the 2006 and 2007 audits, we applied weights to account for the fact that the population-to-sample ratio for each stratum differed by year.

4 RESULTS

We present the results separately for the residential, limited-income, and nonresidential programs. For each program, the results for the documentation review are followed by those for the engineering review and evaluation of Avista's savings estimates. Results are shown for the 2007 audit and the combined 2006-2007 program years. (The individual data for each project for program year 2007 are presented in Table A.1 through Table A.3 in Appendix A.)

RESIDENTIAL PROGRAM

The following describes the results of the documentation review and analysis of estimated savings for the residential program. For both the 2007 program year and the combined 2006-2007 program years, the results are shown by stratum and across strata.

Documentation Review

4 Table 4.1 shows the summary final disposition data for the residential sample for program year 2007 and the combined weighted data for program years 2006 and 2007. The table shows, for each stratum as well as for the combined sample, the number and percentage of cases with each of five dispositions plus the 90% CIs around the percentages.

Final Dispositions for the Combined Sample and by Stratum

Across all strata, the input data were well documented for 81 of the 97 cases sampled for the 2007 audit. When weights are applied to the individual strata data to account for differences in sampling ratios, the weighted percent of cases with well-documented input is 83.5% (± 6.2%)[11], an increase from the 2006 audit. The weighted percentage across program years is 80.9% (± 5.0%). Conversely, 16 cases (16.5%) had documentation problems.

As in the 2006 audit, there were differences among the measure types in the rate of documentation problems. However, the wide confidence bands overlapped for all four strata. The differences were somewhat clearer in the combined 2006-2007 data. In these data, the rate of well-documented cases was clearly higher for the *furnaces/boilers* stratum and the *insulation* stratum than for the *other measures* stratum, which included water heaters and ENERGY STAR® homes (i.e., the 90% CIs for the first two strata did not overlap with that for the last stratum). The

[11] For the convenience of the reader, the 90% CI is expressed in the text as ± half the CI.

Table 4.1: Final Disposition of Sampled Residential Cases

DISPOSITION	2007 DATA			COMBINED 2006-2007 DATA (WEIGHTED)[1]		
	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)
STRATUM 1: WINDOWS (NEW AND REPLACEMENT)						
1 = Documentation supports input data	33	82.5	72.6 – 92.4	51	75.4	66.8 – 84.1
2 = Insufficient documentation	1	2.5	-1.5 – 6.5	7	11.3	4.9 – 17.6
3 = Documentation contradicts input data	5	12.5	3.9 – 21.1	8	11.9	5.4 – 18.4
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
5 = Measure does not qualify for rebate	1	2.5	-1.5 – 6.5	1	1.4	-1.0 – 3.7
TOTAL	40	100.0		67	100.0	
STRATUM 2: INSULATION						
1 = Documentation supports input data	35	87.5	78.9 – 96.1	47	86.6	79.0 – 94.2
2 = Insufficient documentation	2	5.0	-0.7 – 10.7	3	6.1	0.7 – 11.4
3 = Documentation contradicts input data	2	5.0	-0.7 – 10.7	2	2.5	-1.0 – 6.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	1	3.6	-0.6 – 7.7
5 = Measure does not qualify for rebate	1	2.5	-1.5 – 6.5	1	1.3	-1.2 – 3.7
TOTAL	40	100.0		54	100.0	
STRATUM 3: HIGH-EFFICIENCY FURNACES AND BOILERS						
1 = Documentation supports input data	6	85.7	64.0 – 107.4	30	92.3	84.4 – 100.1
2 = Insufficient documentation	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0

Continued

	2007 DATA			COMBINED 2006-2007 DATA (WEIGHTED)[1]		
DISPOSITION	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)
3 = Documentation contradicts input data	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
5 = Measure does not qualify for rebate	1	14.3	-7.4 – 36.0	1	7.7	-0.1 – 15.6
TOTAL	7	100.0		31	100.0	
STRATUM 4: HIGH-EFFICIENCY WATER HEATERS AND ENERGY STAR® HOMES						
1 = Documentation supports input data	7	70.0	46.2 – 93.8	9	51.7	31.8 – 71.5
2 = Insufficient documentation	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
3 = Documentation contradicts input data	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	4	25.3	8.0 – 42.6
5 = Measure does not qualify for rebate	3	30.0	6.2 – 53.8	4	23.0	6.3 – 39.8
TOTAL	10	100.0		17	100.0	
TOTALS[1]						
1 = Documentation supports input data	81	83.5	77.3 – 89.6	137	80.9	75.9 – 85.8
2 = Insufficient documentation	3	1.9	-0.4 – 4.2	10	6.6	3.5 – 9.8
3 = Documentation contradicts input data	7	7.2	2.9 – 11.5	10	6.5	3.4 – 9.6
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	5	1.7	0.1 – 3.4
5 = Measure does not qualify for rebate	6	7.3	3.1 – 11.8	7	4.3	1.8 – 6.9
TOTAL	97	100.0		169	100.0	

[1] To prevent confusion, raw (unweighted) counts are shown in the table. However, percentages were based on counts that were weighted to account for differences in the sampling ratios across strata and across program years.

[2] Percent totals do not always equal 100% due to rounding.

rate of well-documented cases in the *windows* stratum was between the others; its 90% CI overlapped that of *insulation* and *other measures* but not that of *furnaces/boilers*.

Types of Documentation Problems

The most frequent type of documentation problem in the 2007 audit was that the invoice provided information that contradicted the rebate form. This type of problem accounted for 43.8% (7 of 16) of the problem cases or about 7% of all cases (weighted results). Similar results were found regarding this type of problem in the 2006 audit. Across the two program years to date, this type of documentation error accounts for 6.7% of the problem cases.

In contrast with the 2006 audit, the second most common documentation issue for the 2007 program year was the finding that a measure should not have qualified for a rebate. This accounted for 37.5% (6 of 16) of the problem cases or about 7% of all cases (weighted results). In the combined 2006-2007 data, this problem type accounts for 4.8% of the documentation errors.

The one type of documentation problem that appeared to decrease relative to the 2006 audit was insufficient detail on the invoice and/or other documentation. This occurred in three cases, accounting for 18.8% of the problem cases and about 2% of all cases (weighted results). This contrasts with seven cases in the 2006 audit (41.2% of problem cases). In the combined data, this type of error accounts for 6.6% of the problem cases.

Table 4.2 shows details of the cases from all strata for which the final disposition was that the input data were not well documented. In five of the seven cases in which the invoice contradicted the rebate form, the square footage of installed windows that was recorded on the rebate form exceeded that verified by the invoice or by a call to the vendor by anywhere from 9% to over 150%. In two cases, the rebate form recorded an area covered by insulation that exceeded the square footage verified by the invoice—by 8% in one case and 25% in the other.

In two of the six cases in which a measure should not have qualified for a rebate, a high-efficiency 50-gallon water heater did not meet the minimum efficiency rating; in one case each, a high-efficiency boiler did not meet the efficiency criterion, installed windows were clear, not energy efficient, and a high-efficiency 50-gallon water heater was an electric-to-gas conversion. By contrast, the 2006 audit found only three cases in which the measure did not qualify for a rebate.

Of the three cases of insufficient detail on the invoice and/or other documentation, one involved windows and two involved insulation. In one case in which new windows were installed, no invoice was provided and we were unable to obtain an invoice from the vendor. In two cases of installation of ceiling/attic insulation, the invoice did not specify the area (in square feet) covered by the insulation; in one case the vendor was unable to provide the data, and in the other, the vendor did not return repeated calls to obtain the data.

Table 4.2: Residential Sample Cases with Documentation Problems

STRATUM	CASE ID	MEASURE TYPE	DISPOSITION	EXCEPTION
1	450082177	New windows	Insufficient detail	No invoice was provided. Unable to obtain invoice from vendor.
2	410093226	Ceiling/attic insulation	Insufficient detail	Invoice does not specify number of square feet covered. Vendor did not return repeat calls.
2	690043710	Ceiling/attic insulation	Insufficient detail	Invoice does not specify number of square feet covered. Vendor was not able to provide the data.
1	902365	New windows	Invoice contradicts rebate form	Invoice does not identify window direction. Total square feet documented on invoice is 60% that shown on rebate form.
1	1010248	New windows	Invoice contradicts rebate form	Square feet on rebate form exceeds square feet documented on invoice by 9%.
1	210039444	New windows	Invoice contradicts rebate form	Invoice does not identify window direction. Total square feet documented on invoice is 86% of total shown on rebate form.
1	1809816	New windows	Invoice contradicts rebate form	Invoice does not identify window direction. Total square feet documented on invoice is 74% of total shown on rebate form.
1	1010427	New windows	Invoice contradicts rebate form	Invoice does not identify window direction. Total square feet documented by vendor is 41% of total shown on rebate form.
2	770098626	Ceiling/attic insulation	Invoice contradicts rebate form	Square feet on rebate form exceeds maximum coverage calculated from invoice by 8%.
2	90053146	Wall/floor insulation	Invoice contradicts rebate form	Square feet of insulation documented on invoice was 25% of that shown on rebate form.
1	250109418	Replacement windows	Not qualified	Invoice indicated windows were clear
2	2012487	Ceiling/attic insulation	Not qualified	Measure was insulation under siding; does not qualify.
3	130070564	High efficiency boiler	Not qualified	AFUE < 85%
4	210103749	High efficiency 50G water heater	Not qualified	EF < .60
4	1112720	High efficiency 50G water heater	Not qualified	EF < .60
4	130047730	High efficiency 50G water heater	Not qualified	Electric to gas conversion

Engineering Review

As indicated in the report of the 2006 audit, the engineering review of Avista's residential program consisted of a check against standard engineering practices, comparing Avista's reported energy savings to other utility DSM program offerings, and performing engineering calculations to verify savings on a measure-by-measure basis.

Table 4.3 summarizes the results of our engineering evaluation for the 2006 residential program, with some updates for the 2007 audit. As can be seen, we made few modifications to our previous recommendations.

Our engineering evaluation of most measures produced per-unit estimates that were slightly at variance with Avista's, but in most cases not so much as to warrant replacing Avista's per-unit estimates with our own. The only exceptions were for high-efficiency water heaters. For continuous-flow (tankless) water heaters, our previous evaluation produced a per-unit estimate of at least 28 therms, the value that was then being reported by the California DEER database. Since Avista is increasing the minimum efficiency rating (EF) from 0.65 to 0.82 for the 2008 program year, we have increased our recommended saving to at least 52 therms[12] for that program year, based on published standards.[13]

For 40- and 50-gallon water heaters, our previous evaluation produced per-unit estimates of 11 and 16 therms, respectively, based on engineering calculations using the baseline and retrofit qualifications listed by Avista, with some assumptions about usage and water consumption; we have not modified these estimates, and continue to recommend that Avista use 8 and 11 therms, respectively.

No engineering review was performed for ENERGY STAR® Homes as part of the 2006 audit as there were no cases of this measure in the sample. The engineering review performed for the 2007 audit indicates that the heating-degree-days-adjusted value could be as high as 283 therms for this measure; however, we recommend that Avista continue using its current value of 197.

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12 The exact level of savings is based on the size of replaced storage tank. If a 50-gallon tank is replaced, up to 66 therms could be claimed. We cite 52 therms as a conservative minimum.

13 *Residential Deemed Savings, Efficiency, and Installation Standards for Arkansas Statewide QUICKSTART Programs*, Frontier Associates LLC, April 2, 2007.

Finally, duct insulation has been discontinued in Avista's residential program, so no savings are recommended for program year 2008.

Table 4.3: Summary of Engineering Evaluation for Residential Program

MEASURE	UNITS	SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	SAVINGS RECORDED IN AVISTA DATABASE	2006 AUDIT VERIFIED SAVINGS	RECOMMENDED SAVINGS FOR 2007 PROGRAM YEAR	2007 AUDIT VERIFIED SAVINGS[1]	RECOMMENDED SAVINGS FOR 2008 PROGRAM YEAR[1]
High-Efficiency Natural Gas Boiler	per measure	71.6	71.6	68.9	71.6	68.9	71.6
High-Efficiency Natural Gas Furnace	per measure	71.6	71.6	68.9	71.6	68.9	71.6
High-Efficiency Natural Gas Water Heater (40-Gallon)	per measure	11	11	11	8	11	8
High-Efficiency Natural Gas Water Heater (50-Gallon)	per measure	8	8	16	11	16	11
High-Efficiency Natural Gas Water Heater (Tankless)	per measure	11	11	28	28	≥52	≥52
Ceiling/Attic Insulation	per sq ft	0.042	0.042	0.041	0.042	0.041	0.042
Floor Insulation	per sq ft	0.209	0.209	0.205	0.209	0.205	0.209
Wall Insulation	per sq ft	0.209	0.209	0.205	0.209	0.205	0.209
New East/West-Facing Windows	per sq ft	0.42	0.42	0.51	0.42	0.51	0.42
New North-Facing Windows	per sq ft	0.42	0.42	0.51	0.42	0.51	0.42

MEASURE	UNITS	SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	SAVINGS RECORDED IN AVISTA DATABASE	2006 AUDIT VERIFIED SAVINGS	RECOMMENDED SAVINGS FOR 2007 PROGRAM YEAR	2007 AUDIT VERIFIED SAVINGS[1]	RECOMMENDED SAVINGS FOR 2008 PROGRAM YEAR[1]
New South-Facing Windows	per sq ft	0.42	0.42	0.51	0.42	0.51	0.42
Replace East/West-Facing Windows	per sq ft	0.83	0.83	0.89	0.83	0.89	0.83
Replace North-Facing Windows	per sq ft	0.83	0.83	0.89	0.83	0.89	0.83
Replace South-Facing Windows	per sq ft	0.83	0.83	0.89	0.83	0.89	0.83
Duct Insulation	per linear ft	2.8	2.8	2.79	2.8	--	--
Programmable Thermostat W/AC	per measure	31	31	33.43	31	33.43	31
ENERGY STAR® Homes	per measure	197	197	--	--	≤ 283	197

1 Only three changes have been made to this table since the 2006 audit. First, the recommended savings for High-Efficiency Natural Gas Water Heater (Tankless) is increased to 52 therms for program year 2008 because Avista is increasing the minimum efficiency rating (EF) from 0.65 to 0.82. Second, no engineering review was performed for ENERGY STAR® Homes as part of the 2006 audit as there were no cases of this measure in the sample. The engineering review performed for the 2007 audit indicates that the heating-degree-days-adjusted value could be as high as 283 therms for this measure; however, we recommend that Avista continue using its current value of 197. Third, duct insulation has been discontinued in Avista's residential program, so no savings are recommended for program year 2008.

Analysis of Avista's Savings Estimates

For each case, we subtracted our calculation of saved therms from Avista's estimates to yield a *difference score* for that case. Therefore, a positive number indicated that Avista's estimate exceeded our calculation and a negative number indicated that Avista's estimate was less than our calculation. The purpose of computing a difference score was to remove any variance associated with differences among measure types from the comparison of our estimates with Avista's estimates.

Table 4.4 summarizes the results for the difference scores for both the 2007 data and the combined 2006-2007 data. For each stratum, the table shows the 2007 and combined 2006-2007 mean difference between Avista's reported savings and our computed savings, the mean difference expressed as a percentage of Avista's estimate[14], the 90% confidence interval around the mean difference, and the minimum and maximum difference scores found within that stratum.

Finally, we computed the above summary statistics for the combined sample. As described above, we assigned weights that reflect the sampling ratio of each stratum before computed the mean, confidence interval, and difference percent across strata. The minimum and maximum values for the combined sample are simply the minimum and maximum values found across all strata.

In the presentation of these results, we deviate slightly from the stratification scheme that we described in Section 3, *Audit Methods*, and that we followed in the presentation of the documentation review results. Specifically, the sample we drew for Stratum 4, *All Other Measures*, consisted of nine high-efficiency water heaters and one case of ENERGY STAR® homes. (Similarly, only one case of ENERGY STAR® homes appeared in the 2006 sample.) The deemed values for these measures differ greatly (8 or 11 therms vs. 197 therms, respectively), and so the mean difference between Avista's and the audit's assigned therm savings may be difficult to interpret in a stratum that combines these measures. Therefore, in the presentation of these results, we have separated the results regarding the ENERGY STAR® homes from those regarding high-efficiency water heaters. Since there is only one case of this measure in each of

14 In the 2006 audits, we reported the difference expressed as a percentage of our estimate, rather than as a percentage of Avista's estimate. However, this prevents the computation of a percentage in instances in which we assigned a value of 0 saved therms (e.g., in the case of measures that should not have qualified for a rebate), since it is not possible to divide by 0. Therefore, the difference is expressed as a percentage of Avista's estimate, which was nonzero in all cases.

the program years to date, we do not show them separately in the table; however, we include them in the combined results and discuss them in the text.

Table 4.4: Comparison of Avista's Reported Residential Therm Savings with the Audit's Computations

STRATUM	2007 DATA				COMBINED 2006-2007 DATA (WEIGHTED)			
	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE
	VALUE	PERCENT			VALUE	PERCENT		
STRATUM 1: WINDOWS (NEW AND REPLACEMENT)	1.4	1.9	-4.8 – 7.5	-63 – 100	0.8	1.2	-2.8 – 4.3	-63 – 100
STRATUM 2: INSULATION	10.8	10.6	0.3 – 21.3	0 – 211	10.9	11.5	-3.6 – 25.3	0 – 280
STRATUM 3: HIGH-EFFICIENCY FURNACES AND BOILERS	10.3	16.7	-6.6 – 27.2	0 – 72	5.6	8.0	-3.6 – 14.7	0 – 72
STRATUM 4: HIGH-EFFICIENCY WATER HEATERS	2.7	42.1	0.6 – 4.7	0 – 8	2.0	28.9	0.2 – 3.9	-3 – 11
WEIGHTED MEAN	5.3	23.9	-0.8 – 11.5	-63 – 211	3.9	8.4	0.9 – 7.0	-63 – 280

Combined Sample

The weighted combined results of the 2007 audit showed a mean overestimation of 5.3 therms, representing a weighted mean excess of about 24%. In the combined 2006-2007 data, the mean overestimation was 3.9 therms, and the mean excess fell to about 8%. The 90% CI for the combined data was 0.9 to 7.0 therms. Thus, we can have 90% confidence that, across all measures for the combined 2006 and 2007 program years, Avista overestimated savings by a mean of no more than 7.0 therms and by as little as 0.9 therms per measure.

Stratum 1: Windows

For Stratum 1 (*Windows*), we found small differences between our computations and Avista's reported savings. The mean difference across all 2007 cases was 1.4, indicating that Avista's reported savings were, on the average, 1.4 therms higher than our computations. This represented a difference percent rate of just under 2%: that is, assuming that the audit's figures are correct, Avista over-reported therm savings by an average of one tenth of one percent for this stratum. Across the stratum, the actual difference score ranged from -63 therms (i.e., Avista underestimated savings by 63 therms) to 100 (i.e., Avista overestimated savings by 100 therms for at least one case).

Of 40 cases in this stratum, Avista's estimate was within one therm of the audit's computation in 23 cases. Nearly all of the cases with larger differences are attributable to a difference between the square feet of windows installed as shown on the rebate form and that documented on the invoice and/or other paperwork. One large difference (-100 therms) was the result of our assigning 0 therms in a case in which the installed windows were clear, not energy efficient, glass and so should not have qualified for a rebate.

The combined 2006-2007 data are very similar to the 2007 data, with a slightly smaller mean difference. The 90% CI for the combined data is -2.8 to 4.3. Thus, across all measures in this stratum—those sampled as well as those not sampled—it is very likely that Avista overestimated savings by a mean of no more than 4.3 therms and may have underestimated savings by a mean of up to 2.8 therms.

Stratum 2: Insulation

As

Table 4.4 shows, Avista's 2007 savings estimates for the *insulation* stratum exceeded the audit's calculations by a mean of 10.8 therms (a mean excess of about 11%), with differences ranging from 0 to an excess of 211 therms.

Almost all of the mean difference is attributable to just three cases. In two cases, the square footage of area insulated, as shown on the rebate form, far exceeded that documented in the invoice and/or other paperwork. In the third case, we assigned the measure a value of 0 saved therms as it turned out to be insulated siding, which should not have qualified for a rebate. Of the remaining cases, 34 showed no difference between Avista's estimate and the audit's calculation and one showed a difference of two therms.

The combined 2006-2007 data for this stratum again are very similar to the 2007 data. The 90% CI for the combined data is -3.6 to 25.3. This large CI resulted from a high degree of variation in values within the stratum. Thus, we can reject with 90% confidence that Avista's mean estimated savings across all measures in this stratum overestimated actual savings by more than 25.3 therms or underestimated them by more than 3.6 therms, but we cannot reject with the same level of confidence any value within that range.

Stratum 3: High-Efficiency Furnaces and Boilers

We sampled only four high-efficiency furnaces and three boilers for the 2007 audit, compared to 24 for the 2006 audit (see *"Refinement of Residential Stratification Plan for 2007 Audit"*, in Section 3, *Audit Methods*). We confirmed six of these seven prescriptive measures. For one boiler, however, the efficiency rating (AFUE%) fell slightly short of Avista's required minimum (84.7%, compared to a minimum of 85%). We therefore assigned a value of 0 therms to this measure, resulting in a difference of -72 therms from Avista's estimated savings. Over the seven cases in this stratum, this difference averaged to an excess of 10.3 therms or about 17%.

When the weighted 2006-2007 combined results are considered, and the impact of this one case is distributed across 31 cases, the mean overestimate falls to 5.7 therms, or 8%. The 90% CI for the combined data is - 3.6 to 14.7, indicating a high likelihood that Avista's mean estimate across all cases in this stratum ranged from an underestimate of 3.6 therms to an overestimate of 14.7 therms.

Stratum 4: Other Measures (High-Efficiency Water Heaters and ENERGY STAR® homes)

The fourth stratum consisted of nine cases with high-efficiency water heaters and one of ENERGY STAR® homes. As noted above, Table 4.4, above, shows the results just for the water heaters; we discuss the results for the ENERGY STAR® homes below.

For the 2007 audit, we confirmed the savings for 6 of the 9 water heaters. In three cases, we determined that the water heater should not have qualified for a rebate—in two of these instances, it did not meet the minimum efficiency requirement, and in the third, we discovered that it was an electric to gas conversion. Therefore, we assigned a value of 0 therms to each of those measures. The result was that Avista's savings estimates for water heaters exceeded the audit's by a mean of 2.7 therms. Given the relatively low deemed savings (8 or 11 therms) for water heaters, this represents a mean excess of about 42%.

In the combined 2006-2007 data, the mean difference between Avista's and the audit's assigned savings for water heaters showed a mean overestimate of 2.0 therms—a mean excess of about 29%. The 90% CI encompassed a mean overestimate as high as 3.9 therms and as low as 0.2 therms.

The 2006-2007 combined sample included two cases of ENERGY STAR® homes. In the 2006 audit, we found that the single case of this measure was an electric, not gas, installation; we confirmed the one case of this measure in the 2007 audit. This small sample is not sufficient to attempt any generalizations.

LIMITED-INCOME PROGRAM

Documentation Review

Table 4.5 shows summary final disposition data for the limited-income sample. This table shows for each stratum (*Insulation*, *Air Infiltration*, *ENERGY STAR® Windows and Doors*, and *High-Efficiency Furnaces and Water Heaters*), as well as for the combined sample: the number and percentage of cases (with 90% CIs) with each of the four dispositions available for the limited-income group. The table also shows weighted data for the combined 2007 sample, calculated with the same method as used for the residential program (see above), and weighted data for the combined 2006 and 2007 samples.

We were able to obtain sufficient documentation to perform analyses for all 61 cases. Across the combined 2006-2007 data, we were able to perform analyses for 99.0% (weighted) of the cases, with a 90% CI of about 97% to 101%.

Note that a disposition of ‘1’ does not mean that documentation was perfect. We encountered two cases in which it was necessary to assume baseline and retrofit assumptions and two cases in which we discovered that some test measurements had not been recorded correctly by the CAP agencies that performed them. These are shown in Table 4.6.

As noted in *Analysis of Avista’s Savings Estimates*, below, there was a large level of discrepancy (in this audit and in the previous year’s audit) between our calculated savings and Avista’s claimed savings for certain measures in this program. Some of it can be attributed to documentation issues like those listed in Table 4.6, but some cannot.

Table 4.5: Final Disposition of Sampled Limited-Income Cases

DISPOSITION	2007 DATA			COMBINED 2006-2007 DATA (WEIGHTED)[1]		
	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)
STRATUM 1: INSULATION						
1 = Sufficient input data and no coding errors	15	100.0	100.0 – 100.0	38	100.0	100.0 – 100.0
2 = Insufficient input data	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
TOTAL	15	100.0		38	100.0	
STRATUM 2: AIR INFILTRATION						
1 = Sufficient input data and no coding errors	15	100.0	100.0 – 100.0	37	100.0	100.0 – 100.0
2 = Insufficient input data	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
TOTAL	15	100.0		37	100.0	
STRATUM 3: ENERGY STAR® WINDOWS AND DOORS						
1 = Sufficient input data and no coding errors	12	100.0	100.0 – 100.0	15	100.0	100.0 – 100.0
2 = Insufficient input data	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
TOTAL	12	100.0		15	100.0	

DISPOSITION	2007 DATA			COMBINED 2006-2007 DATA (WEIGHTED)[1]		
	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)
STRATUM 4: HIGH-EFFICIENCY FURNACES AND WATER HEATERS						
1 = Sufficient input data and no coding errors	19	100.0	100.0 – 100.0	35	92.1	83.1 – 101.0
2 = Insufficient input data	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0		0.0	0.0 – 0.0
5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
TOTAL	19	100.0		35	100.0	
TOTALS[1]						
1 = Sufficient input data and no coding errors	61	100.0	100.0 – 100.0	125	99.0	97.2 – 100.7
2 = Insufficient input data	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
TOTAL	61	100.0		125	100.0	

[1] To prevent confusion, raw (unweighted) counts are shown in the table. However, percentages were based on counts that were weighted to account for differences in the sampling ratios across strata and across program years.

[2] Percent totals do not always equal 100% due to rounding.

Table 4.6: Limited-Income Sample Cases with Documentation Problems

CASE ID	STRATUM	MEASURE TYPE	COMMENTS
50040746	2	G AIR INFILTRATION	Pre- and post-CFM measurements from the fandoor test do not match the CFM listed on the input forms
570085190	2	G AIR INFILTRATION	Pre- and post-CFM measurements from the fandoor test do not match the CFM listed on the input forms
1128844	4	G HE FURNACE	Baseline and retrofit efficiencies had to be assumed, and were assumed using AVISTA assumptions for baseline equipment and residential program requirements for retrofit equipment
650075521	4	G HE FURNACE	Baseline and retrofit efficiencies had to be assumed, and were assumed using AVISTA assumptions for baseline equipment and residential program requirements for retrofit equipment
90090201	4	G HE 40-G WATER HEATER	Available documentation did not provide sufficient input to support the claimed savings, which exceeded the prescriptive amount
330018934	4	G HE 50-G WATER HEATER	Available documentation did not provide sufficient input to support the claimed savings, which exceeded the prescriptive amount

Analysis of Avista's Savings Estimates

The engineering evaluation for all measures of the limited-income program included a project-by-project analysis based on the inputs provided by the CAPs. For each case for which we were able to calculate energy savings, we computed a *difference score* and computed the percent by which Avista's claimed savings exceeded or fell below our calculation.

Table 4.7: Comparison of Avista's Reported Limited-Income Therm Savings with the Audit's Computations

STRATUM	2007 DATA				COMBINED 2006-2007 DATA (WEIGHTED)			
	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE
	VALUE	PERCENT			VALUE	PERCENT		
STRATUM 1: INSULATION	38.1	28.6	-21.3 – 97.5	-166.0 – 296.8	33.5	21.9	-1.7 – 68.8	-166.0 – 296.8
STRATUM 2: AIR INFILTRATION	6.2	7.4	-9.3 – 21.6	-83.4 – 48.5	11.3	14.1	3.4 – 19.2	-83.4 – 69.9
STRATUM 3: ENERGY STAR® DOORS AND WINDOWS	-28.5	-19.7	-62.4 – 5.4	-175.0 – 75.1	-4.2	-3.3	-38.3 - 29.9	-175.0 – 108.4
STRATUM 4: HIGH-EFFICIENCY FURNACES AND WATER HEATERS	10.1	15.5	-20.2 – 40.4	-68.8 – 243.1	13.3	27.8	0.2 – 26.4	-68.8 – 243.1
WEIGHTED MEAN	19.6	15.9	-12.1 – 51.4	-175.0 – 296.8	20.5	15.3	2.9 – 38.2	-175.0 – 296.8

summarizes the results for the difference scores for each stratum of the limited-income sample. As for the residential sample, it shows the mean difference score with its 90% confidence interval, the mean difference percentage, and the range of difference scores found within each stratum as well as for the entire 2007 sample and the combined 2006-2007 sample.

Combined Sample

As noted above, we found a large number of discrepancies between Avista's claimed savings and our estimates when comparing them on a case-by-case basis. However, the discrepancies are positive as well as negative. Across all cases, the weighted mean difference between Avista's reported savings and the audit's estimate for the 2007 sample was 19.6 therms (90% CI, -12 to 51), representing a mean overestimate of about 16%. For the combined 2006-2007 sample, the weighted mean difference was 20.5 therms (90% CI, 3 to 38), or a mean overestimate of about 15%.

Table 4.7: Comparison of Avista's Reported Limited-Income Therm Savings with the Audit's Computations

Stratum	2007 Data				Combined 2006-2007 Data (Weighted)			
	Mean Difference		90% Confidence Interval	Range	Mean Difference		90% Confidence Interval	Range
	Value	Percent			Value	Percent		
Stratum 1: Insulation	38.1	28.6	-21.3 – 97.5	-166.0 – 296.8	33.5	21.9	-1.7 – 68.8	-166.0 – 296.8
Stratum 2: Air Infiltration	6.2	7.4	-9.3 – 21.6	-83.4 – 48.5	11.3	14.1	3.4 – 19.2	-83.4 – 69.9
Stratum 3: ENERGY STAR® Doors and Windows	-28.5	-19.7	-62.4 – 5.4	-175.0 – 75.1	-4.2	-3.3	-38.3 - 29.9	-175.0 – 108.4
Stratum 4: High-Efficiency Furnaces and Water Heaters	10.1	15.5	-20.2 – 40.4	-68.8 – 243.1	13.3	27.8	0.2 – 26.4	-68.8 – 243.1
Weighted Mean	19.6	15.9	-12.1 – 51.4	-175.0 – 296.8	20.5	15.3	2.9 – 38.2	-175.0 – 296.8

Stratum 1: Insulation

This stratum had the greatest mean difference between Avista's claimed savings and the audit's findings, both for 2007 (38.1 therms, 29% overestimate) and in the combined 2006-2007 sample (33.5 therms, 22% overestimate). In the combined sample, the 90% CI for the mean difference was larger than for the sample as a whole: about -2 to 69 therms, reflecting the lower precision levels in the individual strata.

We did not have the calculations that the CAP agencies used to determine energy savings for these customers; we estimated savings from the input data provided to us, using the same analysis tool we used in the 2006 audit.

We encountered two cases in this stratum for which Avista claimed therms were unusually low and well below our estimates. Specifically, claimed savings were 0 and 2 therms, respectively, for cases 770080472 and 290078749, whereas our estimated savings for these two cases were 62 and 168 therms.

Stratum 2: Air Infiltration

Conversely, this stratum had the smallest mean discrepancy between Avista's claimed and our estimated savings: 6.2 therms (about 7% mean overestimate) for the 2007 sample, and 11.3 therms (14% mean overestimate) across the two program years. The 90% CI for the difference was about 3 to 19 therms.

Stratum 3: ENERGY STAR® Windows and Doors

This stratum showed the greatest mean underestimate of savings by Avista for the 2007 sample: a mean difference of -28.5 therms (20% mean underestimate). However, across the two program years, the mean difference was only -4.2 therms (3% mean underestimate), with a 90% CI of about -38 to 30 therms.

Stratum 4: High-Efficiency Furnaces and Water Heaters

Finally, this stratum showed moderate levels of discrepancy: a mean difference of 10.1 therms (16% overestimate) for 2007, and 13.3 therms (28% overestimate) across 2006-2007. The 90% CI of the difference was about 3 to 38 therms.

NONRESIDENTIAL PROGRAM

Documentation Review

The table shows that for four of the five largest projects we were able to obtain detailed documentation sufficient to calculate an independent estimate of savings against which we were confident in evaluating Avista's claimed savings. This is comparable to our experience in the previous audit, in which we were able to obtain detailed documentation for six of the seven largest projects. Thus, over the two program years, we have been able to calculate independent estimates that we considered reliable, for 10 of 12 large projects.

In the one case that we coded as "documentation problematic" (22479, LEED Certification), we were unable to obtain many details of the model used to generate Avista's estimate; in addition, other inputs that were provided appeared to be possibly inaccurate and were inconsistent with the documentation. There was an additional case for which, although we coded it as "documentation reasonable", we had some concerns about documentation (24825, HVAC). This was an extremely large facility (738,000 square feet) for which the eQUEST analysis seemed generally sound but for which there is reason to believe that Avista's claimed savings underestimated actual savings by a large amount.

As **Error! Not a valid bookmark self-reference.** further shows, we received complete documentation on all pre-rinse sprayer projects (Stratum 1), as in the previous audit. This was a direct-install measure, for which all data were recorded by Avista contractors in a spreadsheet and no other documentation was created.

For Stratum 2 (*Other Measures*), we obtained sufficient documentation to calculate a reliable estimate for 9 of 24 cases (34.6%). In contrast, we encountered 17 cases (65.4% of the sample) in which we did not obtain sufficient documentation to calculate estimates that we felt comfortable using to evaluate Avista's claimed savings. Across the two audited program years, we have judged the documentation in 24 of the 49 cases (49%) in this stratum to be problematic. The 90% CI suggests that between 35% and 63% of the cases in the database likely have problematic documenation.

Table 4.8: Final Disposition of Sampled Nonresidential Cases

DISPOSITION	2007 DATA			COMBINED 2006-2007 DATA (WEIGHTED)[1]		
	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)
FIVE LARGEST PROJECTS						
1 = Documentation reasonable	4	80.0	N/A	10	83.3	N/A
2 = Documentation problematic	1	20.0	N/A	2	16.7	N/A
TOTAL	5	100.0		12	100.0	
STRATUM 1: PRE-RINSE SPRAYERS						
1 = Documentation reasonable	5	100.0	100.0 – 100.0	28	100.0	100.0 – 100.0
2 = Documentation problematic	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
TOTAL	5	100.0		28	100.0	
STRATUM 2: OTHER MEASURES						
1 = Documentation reasonable	9	34.6	16.3 – 52.9	25	50.9	36.9 – 64.9
2 = Documentation problematic	17	65.4	47.1 – 83.7	24	49.1	35.1 – 63.1
TOTAL	26	100.0		49	100.0	
TOTALS[1]						
1 = Documentation supports input data	18	77.4	62.7 – 92.2	63	80.5	71.7 – 89.4
2 = Insufficient documentation	18	22.6	7.8 – 37.3	26	19.5	10.6 – 28.3
TOTAL	36	100.0		89	100.0	

[1] To prevent confusion, raw (unweighted) counts are shown in the table. However, percentages were based on counts that were weighted to account for differences in the sampling ratios across strata and across program years.

[2] Percent totals do not always equal 100% due to rounding.

shows summary final disposition data for the three nonresidential groups. Recall that, for the nonresidential program, we performed a census evaluation of the *Five Largest Projects* and a stratified random sample of the remaining projects. The two strata were: *Pre-Rinse Sprayers* and *Other Measures*. This table shows, for each group, the number and percentage of cases (with 90% confidence intervals) with each of three dispositions, and weighted data for the combined sample (excluding the five largest projects), calculated with the same method as for the residential program (see above).

The table shows that for four of the five largest projects we were able to obtain detailed documentation sufficient to calculate an independent estimate of savings against which we were confident in evaluating Avista's claimed savings. This is comparable to our experience in the previous audit, in which we were able to obtain detailed documentation for six of the seven largest projects. Thus, over the two program years, we have been able to calculate independent estimates that we considered reliable, for 10 of 12 large projects.

In the one case that we coded as "documentation problematic" (22479, LEED Certification), we were unable to obtain many details of the model used to generate Avista's estimate; in addition, other inputs that were provided appeared to be possibly inaccurate and were inconsistent with the documentation. There was an additional case for which, although we coded it as "documentation reasonable", we had some concerns about documentation (24825, HVAC). This was an extremely large facility (738,000 square feet) for which the eQUEST analysis seemed generally sound but for which there is reason to believe that Avista's claimed savings underestimated actual savings by a large amount.

As **Error! Not a valid bookmark self-reference.** further shows, we received complete documentation on all pre-rinse sprayer projects (Stratum 1), as in the previous audit. This was a direct-install measure, for which all data were recorded by Avista contractors in a spreadsheet and no other documentation was created.

For Stratum 2 (*Other Measures*), we obtained sufficient documentation to calculate a reliable estimate for 9 of 24 cases (34.6%). In contrast, we encountered 17 cases (65.4% of the sample) in which we did not obtain sufficient documentation to calculate estimates that we felt comfortable using to evaluate Avista's claimed savings. Across the two audited program years, we have judged the documentation in 24 of the 49 cases (49%) in this stratum to be problematic. The 90% CI suggests that between 35% and 63% of the cases in the database likely have problematic documenation.

Table 4.8: Final Disposition of Sampled Nonresidential Cases

DISPOSITION	2007 DATA			COMBINED 2006-2007 DATA (WEIGHTED)[1]		
	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)	NUMBER OF CASES	PERCENT[2]	90% CONFIDENCE INTERVAL (CI)
FIVE LARGEST PROJECTS						
1 = Documentation reasonable	4	80.0	N/A	10	83.3	N/A
2 = Documentation problematic	1	20.0	N/A	2	16.7	N/A
TOTAL	5	100.0		12	100.0	
STRATUM 1: PRE-RINSE SPRAYERS						
1 = Documentation reasonable	5	100.0	100.0 – 100.0	28	100.0	100.0 – 100.0
2 = Documentation problematic	0	0.0	0.0 – 0.0	0	0.0	0.0 – 0.0
TOTAL	5	100.0		28	100.0	
STRATUM 2: OTHER MEASURES						
1 = Documentation reasonable	9	34.6	16.3 – 52.9	25	50.9	36.9 – 64.9
2 = Documentation problematic	17	65.4	47.1 – 83.7	24	49.1	35.1 – 63.1
TOTAL	26	100.0		49	100.0	
TOTALS[1]						
1 = Documentation supports input data	18	77.4	62.7 – 92.2	63	80.5	71.7 – 89.4
2 = Insufficient documentation	18	22.6	7.8 – 37.3	26	19.5	10.6 – 28.3
TOTAL	36	100.0		89	100.0	

[1] To prevent confusion, raw (unweighted) counts are shown in the table. However, percentages were based on counts that were weighted to account for differences in the sampling ratios across strata and across program years.

[2] Percent totals do not always equal 100% due to rounding.

As was the case in the previous audit, the majority of the cases (14 of 17) with problematic documentation were Rooftop Service measures. Because we were unable to get information to clarify the assumptions used for these calculations, we used our own assumptions and came up with values significantly different from Avista's reported values. Although we were able to calculate estimates for these cases, since they are not directly comparable to Avista's claimed savings, we do not necessarily recommend that they be used instead of Avista's figures.

In addition to the 14 Rooftop Service measures, we encountered five other cases from this stratum for which certain aspects of the documentation were notable. For three of these (21824 and 22920, both HVAC; and 23959, Appliances), we indicated that documentation was "problematic" and so we do not necessarily recommend using our estimates over Avista's claimed savings. For two cases (22003 and 21450, both HVAC), we indicated that documentation was "reasonable" and so we recommend using our estimates

Table 4.9 summarizes our comments concerning documentation and the analyses that generated Avista's reported savings for the two "large" projects and the above five cases from the *Other Measures* stratum.

Engineering Review

As described above, the engineering evaluation for all measures of the nonresidential program, except pre-rinse sprayers, included a project-by-project analysis based on the assumptions stated in Avista's evaluation report. When sufficient documentation was provided, we recalculated energy savings using standard engineering methods or modeling simulations. When insufficient documentation was provided, the methodology used by Avista and the reported energy savings were evaluated for appropriateness.

The engineering evaluation for the pre-rinse sprayers included a check of Avista's reported savings value for accuracy and appropriateness. Avista's prescriptive energy savings of 44 therms per sprayer is based on a recent Measurement and Verification (M&V) study performed by Avista. The study included a representative sample of recent pre-rinse sprayer retrofits, and measured both pre- and post-retrofit usage. Our review found this savings value appropriate, perhaps even conservative.

Analysis of Avista's Savings Estimates

For each case for which we were able to calculate energy savings, we computed a *difference score*, as well as the absolute value of the difference score. We discuss the differences scores for the three nonresidential groups in the following subsections.

Table 4.9: Nonresidential Cases with Documentation Issues

APPNUM	GROUP	MEASURE	DISP.	COMMENTS
22479	Largest	LEED Certification	2	We created an eQUEST model and calibrated the annual gas usage to match the base case gas usage from Avista's HAP model. However, we did not have many of the details of the model (e.g., the geometry, layout, occupancy, and zoning). Using our eQUEST model, we ran an 8760 hourly analysis to compute the annual gas savings. The results indicated substantially lower savings than predicted by the HAP tool. This seems partly due to the heating hours and occupancy periods used in HAP, which appear too high and inconsistent with the documentation.
24825	Largest	HVAC	1	This was an extremely large facility (738,000 square feet). The eQUEST analysis seems generally sound, but we were not provided with documentation clarifying what changes were made from baseline analysis to retrofit. Default skylight settings cause a warning in eQUEST. Internal loads seem extremely low. eQUEST defaults are acceptable on many construction parameters, but we strongly suggest that actual operating schedule and temperature setpoints for facility be used, as these strongly affect energy consumption. No external documentation was provided for various inputs. We could not tell whether usage was calibrated with metered data. If not, this is another opportunity for error.
21824	Other	HVAC	2	The baseline model appears to have very high internal loads; demand control ventilation was not modeled correctly (it was done by manipulating infiltration). Analysis was redone using eQUEST.
22003	Other	HVAC	1	The existing analysis is an unusual mix of the UA method and bin analysis. The assumption for baseline efficiency seems somewhat low.
22920	Other	HVAC	2	The eQUEST analysis seems generally sound, but baseline and retrofit boiler efficiencies are not consistent in documentation: either from 75 to 84% or 74 to 85%, depending upon the source. It is acceptable to go with eQUEST defaults on many construction parameters, but we strongly suggest that actual operating schedule and temperature setpoints for facility be used, as these strongly affect energy consumption. We could not determine whether usage was calibrated with metered data. If not, this is another opportunity for error.
23959	Other	Appliances	2	It was unclear whether the new heater is a point-of-use (demand) heater or high efficiency tank heater. If point-of-use, then it is unlikely that one heater could meet the entire load for 32 rooms. In addition, demand water heaters are not usually insulated to R-30; standby losses are extremely negligible. Also it is unclear where estimation of the daily load for guest rooms comes from. We could not determine the occupancy of rooms (e.g. single, double).
24150	Other	HVAC	1	The analysis seems sound; certain model inputs could not be verified (due to lack of information); the approach is probably even conservative.

The Five Largest Projects

Results of our engineering review for the five largest nonresidential projects are presented in Table 4.10, along with the results for the largest projects from the 2006 program year.

Table 4.10: Comparison of Avista's Reported Nonresidential Therm Savings for the Largest Projects with the Audit's Computations

APPNUM	DESCRIPTION	AVISTA	AUDIT	DIFFERENCE
2007				
21320	HVAC	39,297	43,728	-4,431
24738	HVAC	36,059	50,775	-14,716
24825	HVAC	31,723	80,915	-49,192
22479	LEED Certification	49,553	10,243	39,310
23059	Shell	25,884	26,251	-367
			Mean	-5,879
2006				
19719	HVAC	54,332	15477	38,855
20608	HVAC	19,096	---	---
20933	HVAC	20,228	21,056	-828
21202	Resource Management	71,731	71,731	0
21310	HVAC	29,651	21,134	8,517
21314	HVAC	27,193	21,754	5,439
21542	HVAC	110,558	37,608	72,950
			Mean	17,848.5

On average, across the five large projects, our estimate was nearly 6,000 therms above Avista's, representing a mean underestimate by Avista of about 16%.

Across the two program years, the mean difference between Avista's claimed therms and our estimate is 8,685 therms, representing a mean overestimation by Avista of about 15% over the two-year period.

Summary descriptions of each of the five largest nonresidential projects are provided in Appendix B.

Sample Stratum 1: Pre-Rinse Sprayers

As Table 4.11 shows, there were no differences between Avista's reported savings for pre-rinse sprayers (Stratum 1) and our computations. As noted above, we accepted Avista's figure of 44 therms per sprayer, so the results shown in Table 4.11 for this stratum are simply a confirmation of Avista's accuracy in computing savings for projects involving pre-rinse sprayers.

Sample Stratum 2: Other Measures

Also shown in Table 4.11 is the analysis summary for *All Other Measures* (Stratum 2). Measures evaluated in this stratum included HVAC retrofits, shell measures, appliances, and rooftop services (also known as the *AirCare Plus* program). Across all projects, the mean difference between Avista's estimates and our independently computed estimates was 18.7 therms, indicating that Avista's estimates were, on average, less than 1% above ours. However, the 90% confidence interval for this mean was -770.7 to 808.0, indicating that the mean difference across all cases of these measures in the 2007 database could reflect an underestimate by Avista of as much as 771 therms per measure or an overestimate of as much as 808 therms per measure.

Table 4.11: Comparison of Avista's Reported Nonresidential Therm Savings with the Audit's Computations

STRATUM	2007 DATA				COMBINED 2006-2007 DATA (WEIGHTED)			
	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE
	VALUE	PERCENT			VALUE	PERCENT		
STRATUM 1: PRE-RINSE SPRAYERS	0.0	0.0	0.0 – 0.0	0.0 – 0.0	0.0	0.0	0.0 – 0.0	0.0 – 0.0
STRATUM 2: OTHER MEASURES	18.7	0.9	-770.7 – 808.0	-10,367 – 5,229	-15.2	-0.8	-443.4 – 413.0	-10,367 – 5,229
WEIGHTED TOTAL	6.4	0.2	-266.1 – 279.0	-10,367 – 5,229	-6.1	-0.3	-174.2 – 162.1	-10,367 – 72,950

Across both program years, the mean difference for this stratum was -15.2, indicating that Avista's reported savings were, on average, about 1% lower than our estimates. Again, however, a large 90% CI indicates that the difference across all measures in this stratum for these two program years could indicate a mean underestimate of as much as 443 therms or a mean overestimate of as much as 413 therms.

We also found insufficient documentation for the 13 rooftop service projects (*AirCare Plus*) that we reviewed in this stratum. The primary component of the *AirCare Plus* program under review was the *programmable thermostat modification and replacement (Rowcases 4 and 6),* as these were the only measures that resulted in gas (therms) savings. The calculated energy savings for these measures were difficult to reproduce based on the data that we were provided.

Nexant simulated each of these projects using the latest commercial version of eQUEST (version 3.61e). Nexant constructed six baseline models for each type of facility, based upon the stated parameters. This entailed separate models for 1) Typical Office, 2) Small Retail, 3) Large Retail, 4) Small Dining Area, 5) Large Dining Area, and 5) Fast Food Restaurant. The main parameters documented for each model included square footage, schedules (lighting, equipment, and occupancy), internal loads (occupancy density, sensible and latent heat gains, lighting power density, and equipment power density), infiltration, and thermal setpoints. Each AirCare Plus project has at least one and as many as seven RTUs which underwent modifications. Based upon the documented inputs for each RTU (which included setpoints and schedules for pre-maintenance as well as post-maintenance), parametric runs were performed for each RTU.

The results of the simulations indicate a large discrepancy between Avista's reported values and Nexant's estimated values. It should be noted however, that several crucial parameters are unknown, such as the heating capacity of the RTU, fan operating characteristics, actual conditioned area, and adjacent zones.

Although we were able to calculate estimates for these cases, since they are not directly comparable to Avista's claimed savings, we do not necessarily recommend that they be used instead of Avista's figures. We recommend that additional review be conducted of the *AirCare Plus* program.

5 CONCLUSIONS AND RECOMMENDATIONS

Avista's calendar year 2006 and 2007 natural gas residential, limited-income, and nonresidential programs are broad in nature, providing multiple opportunities to its customer base. In most cases, we found the projects to have well-documented records with sufficient supporting documentation.

Our audits of both the 2006 and 2007 program years confirmed the per-unit therm savings that Avista reported for the majority of the prescriptive measures in the residential program. The one exception is that our engineering review for the 2006 audit suggested a value of 28 therms for high-efficiency tankless water heaters, rather than 11 therms, which Avista reported. We noted that Avista has proposed to increase the deemed value to 60 therms for the 2008 program, based on an increase in the minimum efficiency requirement. Our engineering review supports the use of this value, depending on the mix of 40- and 50-gallon tanks that are replaced. (No tankless water heaters were found in the database of 2007 projects.)

In our previous audit, we confirmed Avista's use of 176 therms per unit for pre-rinse sprayers in the nonresidential program. Based on its own recent Measurement and Verification (M&V) study, Avista has drastically reduced its claimed savings for this measure to 44 therms per unit. We believe this to be conservative, but accept Avista's value.

The discrepancies between Avista's savings estimates and our computations varied widely in size. Some of the variance found in individual strata can be attributed to systematic sources that can be remedied. However, we were not able to account for much of the variance in the limited-income sample and for much of the nonresidential sample, as we did not receive information on the computation methods used for some of the measures.

The results revealed varying degrees of documentation issues among the programs and program strata. Part of the reason for the documentation problems and for our inability to review the computation methods for some measures is that Avista had to depend on several CAPs for this information. Below, we repeat our recommendations regarding CAPs; however, Avista is ultimately dependent on the CAPs' cooperation.

Following is a brief summary of the main problems we faced in verifying Avista's savings estimates. Below, we offer some recommendations for how Avista can improve documentation and its ability to carry out accurate engineering calculations in 2008.

SUMMARY OF VERIFICATION ISSUES

For the audit of the 2007 program, we found unresolved documentation problems in 16 of 97 cases in the 2007 residential sample. This represents a weighted mean of 16.5% of all cases, down somewhat from 24.5% in the 2006 residential sample. In the limited-income sample, none of the 61 cases had irresolvable documentation problems, representing a weighted mean of about 1% of cases (down from 5% in 2006).

By contrast, about two-thirds of the custom nonresidential projects (65.4%) had notable documentation problems, up from about 30% in 2006.

We were able to develop reliable estimates for four of the five largest nonresidential projects, compared to six of seven in the 2006 audit.

As in the previous audit, the above figures do not include a larger number of cases in each stratum for which we requested and received additional documentation from Avista to compute therm savings estimates. For example, the initial case-by-case documentation that we received from Avista for many of the limited-income cases (and which Avista had received from the CAPs) was insufficient to provide independent estimates of savings. We requested additional documentation from Avista and received it in all cases.

The most frequent documentation problems in the residential stratum of the 2007 sample were: 1) the invoice provided information (e.g., window size or amount of insulation installed) that contradicted the rebate form; 2) the measure should not have qualified for a rebate; and 3) the invoice and/or other documentation did not provide sufficient detail to check the input data on the rebate form. Similar types of problems were found in the 2006 sample.

For both of the two limited-income cases with notable documentation problems, the measure was incorrectly coded. Almost all of the documentation problems in the nonresidential program were an issue of lack of detailed or explicit input.

Insufficient documentation for a residential project meant that we could not adequately check Avista's estimated therm savings for that project. In such cases, we excluded that project from our case-by-case analysis of savings estimates. We did not exclude any limited-income measures from the savings analysis on the basis of insufficient documentation. The documentation problems we found in nonresidential projects did not prevent our calculating estimated savings; however, in several cases we noted that our results could not be used to evaluate Avista's estimates.

Among those projects for which we had sufficient input data to calculate savings estimates, we found large variations in the degree to which our calculations agreed with Avista's. When estimates were averaged over sample strata, the variability in size of discrepancies decreased. Nevertheless, they varied from a low of 0% (*Pre-Rinse Sprayers*) to a high of about 42% (residential program, *High-Efficiency Water Heaters*) in the 2007 sample, and from 0% to 28.9% (same strata) in the combined 2006-2007 data. In most 2007 sample strata and in the combined 2007 sample for all programs, the 90% confidence interval around the mean difference between Avista's estimate and our calculations encompassed zero difference; results were similar for the combined 2006-2007 sample.

Our review of the residential data used both Avista-supplied input data and Avista-supplied per-unit therm values or algorithms. Therefore, differences found between Avista's calculations and ours for that program reflect one of three possible sources: a) data entry errors; b) errors in calculation; or c) the use by Avista of input data, per-unit therm values, or algorithms other than those they provided to us. In most cases, the difference between Avista's estimate and ours appeared to come from Avista's having accepted input data on the rebate form (e.g., square feet of windows or of insulation that was not supported on the accompanying documentation.

Some discrepancy in savings claimed for windows may possibly be the result of variability in how window dimensions were calculated. We found sometimes that only a single set of dimensions (height and weight) was provided, which could have been either rough opening or frame size. If the customer used rough opening to calculate window dimensions, the resulting total size and, hence, claimed savings, would be overestimated somewhat. Although the difference would be small, it would contribute somewhat to error. Although we consider that this would contribute little to the overall level of discrepancy between Avista's claimed savings and our estimates, Avista may wish to consider, in addition to the other recommendations we list below, establishing more clear guidelines for calculating window dimensions.

We believe that implementation of the following recommendations will decrease both the amount of documentation error and the overall discrepancy between Avista's claimed savings and the audit's estimates.

RECOMMENDATIONS FOR IMPROVING ENGINEERING AND REPORTING ACCURACY

Residential Program

In the report of the 2006 audit, we suggested several actions for the residential program to increase accuracy of engineering calculations and reporting. We repeat those suggestions, in some cases with modifications, and offer some additional ones. We have divided our suggestions for the residential program into three groups: a) recommended savings levels; b) actions to improve documentation; and c) internal review procedures.

Recommended savings levels:

➡ **Increase the reported savings for high-efficiency continuous-flow (tankless) water heaters from 11 to at least 52 therms.** In the report for the 2006 program, we recommended that Avista increase the savings for this measure to at least 28 therms and re-evaluate the energy savings value based on qualifications that Avista may choose to specify for this measure (e.g., minimum Energy Factor). At the time of this evaluation, Avista's plan for the 2008 Residential program was to report savings of 60 therms, based on an increase to a minimum EF of .82. Our review suggested a savings of 52 therms, assuming replacement of a 40-gallon tank, and up to 66 therms if a 50-gallon tank is replaced. Thus, while we propose a minimum of 52 therms, Avista's planned use of 60 therms is reasonable, assuming replacement of a mix of 40- and 50-gallon tanks.

Recommended actions to improve documentation:

➡ **Request more detailed documentation from residential customers and their contractors submitting rebate requests.** In the previous audit, we recommended that Avista request that invoices and/or other documentation provide the following data: the number of square feet of installed windows facing each direction; the number of square feet of insulation used for each type of area insulated (i.e., walls, floors, ceiling/attic, etc.); the model number and AFUE% of high-efficiency furnaces and boilers; and the model number and EF of high-efficiency water heaters. We continue to recommend this action. Most applications submitted already included the requested information, and it is possible that many or most of those who omitted it did so because they were not aware of its importance. Requiring it would allow stricter review of rebate applications as they come in, resulting in reduced error in reported savings.

➡ **Provide outreach to vendors to educate them about what kind of information is needed on the invoices.** Although we did not systematic interview vendors, we found when we contacted them to resolve documentation issues that the majority were familiar with Avista and supported its energy efficiency programs. We believe, therefore, that vendors will respond positively to outreach efforts to achieve more consistent documentation.

Recommendations relating to internal review procedures:

➡ **Make the rebate form consistent with the way that measures are recorded in the customer service database or change the customer service database to be consistent with the rebate form.** The rebate form has lines to record information on north-facing, south-facing, east-facing, and west-facing windows; the customer service database, on the other hand, records data only on the basis of whether the window is north-facing, south-facing, or east-or-west-facing. A given project may have two records for east/west-facing windows: one for east-facing and one for west-facing. This makes it more difficult to review the input for accuracy.

➡ **Institute stricter review of rebate applications to ensure that the information on the invoices and/or other documentation is completely consistent with that listed on the rebate forms.** If the information on the rebate form is not thoroughly documented, contact the customer, contractor, and/or manufacturer to obtain the additional needed information and document that information on a separate form for inclusion in the files and later review. Not only would this help to ensure better accuracy of input data, but it also would help ensure that rebates are not given for measures that do not meet Avista's program standards.

➡ **Identify furnace, boiler, and water heater models that do and do not meet minimum efficiency requirements.** Either provide a list of models that do or do not qualify, which vendors and customers can examine or use such a list to check against incoming rebate applications. Possibly pre-code the customer service database to flag records with non-qualifying models.

➡ **Institute an internal system for checking data entry accuracy to ensure that incorrect measure types are not recorded in rebate records.** For example, check lists of newly entered records against the hard-copy rebate forms.

➡ **Institute a system for reviewing the entire database on a regular basis to identify and report therm values that are inconsistent with the measure.** In both the residential and limited-income samples, about 2% (weighted) of measures were incorrectly coded. Prescriptive measures that are incorrectly coded could easily be identified by comparing the savings entered for the measure against the savings standard. Such discrepancies could then be resolved and would not show up in an audit.

➡ **Review rules and procedures for assigning or calculating therms in the database to ensure that they are consistent with engineering-established rules and procedures.**

Limited-Income Program

We repeat the following recommendations to increase the accuracy of engineering calculations and reporting for the limited-income measures:

➡ **Review the calculation methodologies used by all CAPs to ensure that there is consistency across the various agencies and that energy savings are being calculated correctly**.

➡ **Request that all necessary baseline information be recorded and maintained by the agencies.** This will permit greater accuracy for future evaluations or checks that Avista may choose to do throughout the year. We found multiple cases for which important baseline information – such as insulation square feet, house volume, R-values, and U-factors – was not recorded in the customer files and had to be requested separately.

Nonresidential Program

Regarding the nonresidential program, we repeat the following recommendations to increase the accuracy of engineering calculations and reporting:

➡ **Increase documentation of baseline and retrofit equipment, including model numbers, efficiencies, and shell information.** This will allow for more accurate verification of reported energy savings values.

➡ **For pre-rinse sprayers, retain the invoice for the purchase of the rebated units.**

➡ **Complete a separate evaluation of PECI's *AirCare Plus* program to determine the accuracy of reported energy savings.**

VERIFICATION RECOMMENDATIONS

The confidence intervals around the mean differences between Avista's estimates and ours remain somewhat wide, even across the combined 2006-2007 data. Hence, the precision of estimate of Avista's error (relative to our calculations) was low. Therefore, to ensure accuracy and precision of claims going forward, we repeat the following recommendation:

➡ **Consider conducting further analysis of the 2007 data before adjusting Avista's savings reports based on the results of this audit.** It would be reasonable to have Avista either correct the database behind the reports and have those reports re-verified, or to expand the audit sample on those strata for which the variances between Avista's reports and our estimates were the largest to provide a higher level of confidence and precision for the recommended adjustments.

APPENDICES

APPENDIX A: CASE-BY-CASE RESULTS

APPENDIX B: FIVE LARGEST NONRESIDENTIAL PROJECTS

A CASE-BY-CASE RESULTS

RESIDENTIAL PROGRAM

Table A.1: Case-by-Case Results for Residential Program

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
STRATUM 1 (*WINDOWS*)					
250109418	G NEW E/W FACING WINDOWS	5	100	0	100
570103547	G NEW E/W FACING WINDOWS	1	114	110	4
730103964	G NEW E/W FACING WINDOWS	1	71	71	0
170096666	G NEW NORTH FACING WINDOWS	1	45	45	0
450096382	G NEW NORTH FACING WINDOWS	1	43	43	0
730099205	G NEW NORTH FACING WINDOWS	1	110	110	0
640593	G REPLC E/W FACING WINDOWS	1	57	107	-50
902365	G REPLC E/W FACING WINDOWS	3	116	70	46
1010248	G REPLC E/W FACING WINDOWS	3	57	53	4
1100553	G REPLC E/W FACING WINDOWS	1	134	135	-1
10058093	G REPLC E/W FACING WINDOWS	1	87	88	-1
10098464	G REPLC E/W FACING WINDOWS	1	33	33	0
50101779	G REPLC E/W FACING WINDOWS	1	134	135	-1
130019678	G REPLC E/W FACING WINDOWS	1	108	114	-6
170102118	G REPLC E/W FACING WINDOWS	1	22	23	-1
210039444	G REPLC E/W FACING WINDOWS	3	49	44	5
210095159	G REPLC E/W FACING WINDOWS	1	37	38	-1
250029773	G REPLC E/W FACING WINDOWS	1	9	9	0
250106035	G REPLC E/W FACING WINDOWS	1	62	79	-17
330073965	G REPLC E/W FACING WINDOWS	1	64	127	-63
330104627	G REPLC E/W FACING WINDOWS	1	64	64	0
370004701	G REPLC E/W FACING WINDOWS	1	55	55	0
					Continued

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
370024438	G REPLC E/W FACING WINDOWS	1	67	66	1
370104699	G REPLC E/W FACING WINDOWS	1	45	64	1
450103766	G REPLC E/W FACING WINDOWS	1	269	293	-24
450104855	G REPLC E/W FACING WINDOWS	1	42	42	0
770042729	G REPLC E/W FACING WINDOWS	1	341	341	0
770077733	G REPLC E/W FACING WINDOWS	1	72	73	-1
1809816	G REPLC NORTH FACING WINDOWS	3	137	101	36
2501240	G REPLC NORTH FACING WINDOWS	1	27	27	0
2521063	G REPLC NORTH FACING WINDOWS	1	59	59	0
90036387	G REPLC NORTH FACING WINDOWS	1	11	12	-1
210105923	G REPLC NORTH FACING WINDOWS	1	63	63	0
450082177	G REPLC NORTH FACING WINDOWS	2	286		
730009786	G REPLC NORTH FACING WINDOWS	1	34	34	0
1010427	G REPLC S FACING WINDOWS	3	45	19	26
1304539	G REPLC S FACING WINDOWS	1	7	7	0
10032460	G REPLC S FACING WINDOWS	1	25	25	0
10110915	G REPLC S FACING WINDOWS	1	43	44	-1
690105505	G REPLC S FACING WINDOWS	1	100	101	-1
STRATUM 2 (*INSULATION*)					
818909	G INS - CEIL/ATTIC	1	40	40	0
1120809	G INS - CEIL/ATTIC	1	71	71	0
1611797	G INS - CEIL/ATTIC	1	50	50	0
1618060	G INS - CEIL/ATTIC	1	40	40	0
1819186	G INS - CEIL/ATTIC	1	48	48	0
2012487	G INS - CEIL/ATTIC	5	76	0	76
2401897	G INS - CEIL/ATTIC	1	49	49	0
50098623	G INS - CEIL/ATTIC	1	36	36	0
90063925	G INS - CEIL/ATTIC	1	28	28	0
90082345	G INS - CEIL/ATTIC	1	50	50	0
170102792	G INS - CEIL/ATTIC	1	48	48	0
290098926	G INS - CEIL/ATTIC	1	46	46	0

Continued

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
290100491	G INS - CEIL/ATTIC	1	45	45	0
330039815	G INS - CEIL/ATTIC	1	63	63	0
330103865	G INS - CEIL/ATTIC	1	32	32	0
410093226	G INS - CEIL/ATTIC	2	66		
450051398	G INS - CEIL/ATTIC	1	122	122	0
450073257	G INS - CEIL/ATTIC	1	38	38	0
450101648	G INS - CEIL/ATTIC	1	98	98	0
490099973	G INS - CEIL/ATTIC	1	50	50	0
570068423	G INS - CEIL/ATTIC	1	71	71	0
570070462	G INS - CEIL/ATTIC	1	47	47	0
690043710	G INS - CEIL/ATTIC	2	32		
690083912	G INS - CEIL/ATTIC	1	84	84	0
690088948	G INS - CEIL/ATTIC	1	67	67	0
730087620	G INS - CEIL/ATTIC	1	45	45	0
770098626	G INS - CEIL/ATTIC	3	28	26	2
1304539	G INS - FLOOR	1	75	75	0
210094205	G INS - FLOOR	1	255	255	0
250109186	G INS - FLOOR	1	223	223	0
690012320	G INS - FLOOR	1	151	151	0
826687	G INS - WALL	1	25	25	0
90053146	G INS - WALL	3	282	71	211
90096656	G INS - WALL	1	346	346	0
210086578	G INS - WALL	1	191	191	0
290104103	G INS - WALL	1	374	374	0
450093242	G INS - WALL	1	217	217	0
570046914	G INS - WALL	1	203	82	121
570102581	G INS - WALL	1	492	492	0
690096414	G INS - WALL	1	84	84	0
					Continued

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
STRATUM 3 (*FURNACES/BOILERS*)					
827101	G HE FURNACE	1	72	72	0
250050451	G HE FURNACE	1	72	72	0
450097090	G HE FURNACE	1	72	72	0
610033739	G HE FURNACE	1	72	72	0
170026002	G HE BOILER	1	72	72	0
570092576	G HE BOILER	1	72	72	0
130070564	G HE BOILER	5	72	0	72
90110207	E STAR HOMES	1	197	197	0
1002154	G HE WH 40G	1	11	11	0
1611094	G HE WH 40G	1	11	11	0
210104187	G HE WH 40G	1	11	11	0
2400928	G HE WH 50G	1	8	8	0
250108153	G HE WH 50G	1	8	8	0
450006577	G HE WH 50G	1	8	8	0
210103749	G HE WH 50G	5	8	0	8
1112720	G HE WH 50G	5	8	0	8
130047730	G HE WH 50G	5	8	0	8

LIMITED INCOME PROGRAM

Table A.2: Case-by-Case Results for Limited-Income Program

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
STRATUM 1 (INSULATION)					
370065566	G INS - CEIL/ATTIC		197	236	-39
2545868	G INS - CEIL/ATTIC		244	39	205
450079399	G INS - WALL		164	179	-15
690095215	G INS - WALL		135	148	-13
370047443	G INS - CEIL/ATTIC		466	236	230
1224570	G INS - FLOOR		73	212	-139
730060565	G INS - CEIL/ATTIC		372	75	297
10078121	G INS - FLOOR		83	74	9
690093567	G INS - CEIL/ATTIC		168	20	148
10095781	G INS - FLOOR		7	20	-13
826887	G INS - CEIL/ATTIC		75	119	-44
290078749	G INS - DUCT		2	168	-166
690078482	G INS - WALL		191	209	-18
490080502	G INS - CEIL/ATTIC		390	197	193
770080472	G INS - CEIL/ATTIC		0	62	-62
STRATUM 2 (AIR INFILTRATION)					
330096551	G AIR INFILTRATION		175	131	44
330063253	G AIR INFILTRATION		107	80	27
210103112	G AIR INFILTRATION		113	196	-83
490069605	G AIR INFILTRATION		20	27	-7
290067981	G AIR INFILTRATION		90	67	23
370088734	G AIR INFILTRATION		80	80	-41
827855	G AIR INFILTRATION		33	33	-20
490075311	G AIR INFILTRATION		195	195	48
650091938	G AIR INFILTRATION		162	162	41
290078749	G AIR INFILTRATION		7	11	-4
					Continued

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
50040746	G AIR INFILTRATION		90	67	23
650021131	G AIR INFILTRATION		56	42	14
570085190	G AIR INFILTRATION		72	53	19
1716754	G AIR INFILTRATION		49	75	-26
770097042	G AIR INFILTRATION		92	58	34
STRATUM 3 (ENERGY STAR® WINDOWS AND DOORS)					
410084077	G ENERGY STAR WINDOWS		279	401	-122
740957	G ENERGY STAR WINDOWS		119	55	64
1332240	G ENERGY STAR DOORS		24	92	-68
1224570	G ENERGY STAR WINDOWS		287	212	75
90055315	G ENERGY STAR DOORS		66	89	-23
290064106	G ENERGY STAR WINDOWS		13	13	0
410064696	G ENERGY STAR WINDOWS		44	39	5
650036327	G ENERGY STAR WINDOWS		45	65	-20
690095537	G ENERGY STAR DOORS		55	80	-25
490099116	G ENERGY STAR WINDOWS		375	550	-175
827855	G ENERGY STAR DOORS		66	53	13
10101669	G ENERGY STAR DOORS		22	89	-67
STRATUM 4 (FURNACES/WATER HEATERS)					
650075521	G HE FURNACE		298	105	193
330101145	G HE FURNACE		72	101	-29
450108853	G HE FURNACE		75	141	-66
826887	G HE FURNACE		184	119	65
690074383	G HE FURNACE		72	141	-69
2119686	G HE FURNACE		72	105	-33
450100133	G HE FURNACE		72	105	-33
50032298	G HE FURNACE		75	107	-32
170088691	G HE FURNACE		50	119	-69
1128844	G HE FURNACE		348	105	243
90090201	G HE WH 40G		25	8	17
290086632	G HE WH 40G		11	8	3
					Continued

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
1508613	G HE WH 40G		11	8	3
1609944	G HE WH 50G		8	11	-3
330018934	G HE WH 50G		25	11	14
1109368	G HE WH 50G		8	11	-3
370047443	G HE WH 50G		8	11	-3
1706937	G HE WH 50G		8	11	-3
10092900	G HE WH 50G		8	11	-3

NONRESIDENTIAL PROGRAM

Table A.3: Case-by-Case Results for Nonresidential Program

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
FIVE LARGEST					
22479	LEED Certification		49553	10243	39310
21320	HVAC		39297	43728	-4431
24738	HVAC		36059	50775	-14716
24825	HVAC		31723	80915	-49192
23059	Shell		25884	26251	-367
STRATUM 1 (PRE-RINSE SPRAYERS)					
25295	Pre-Rinse Sprayer		44	44	0
24929	Pre-Rinse Sprayer		44	44	0
25166	Pre-Rinse Sprayer		44	44	0
24882	Pre-Rinse Sprayer		44	44	0
24072	Pre-Rinse Sprayer		44	44	0
STRATUM 2 (ALL OTHER)					
23959	Appliances		124	205	-81
22920	HVAC		3755	3866	-111
22003	HVAC		1427	11794	-10367
25628	HVAC		2439	3235	-796
21824	HVAC		966	2742	-1776
22939	HVAC		273	124	149
24106	HVAC		203	163	40
22796	HVAC		12524	9883	2641
24422	HVAC		6337	6337	0
24150	HVAC		11494	11494	0
26030	Rooftop Service		1814	544	1270
26144	Rooftop Service		390	242	148
26283	Rooftop Service		103	103	0
25477	Rooftop Service		573	231	342

Continued

ID #	MEASURE	FINAL DISPOSITION CODE	THERMS		AVISTA MINUS AUDIT
			AVISTA	AUDIT	
25496	Rooftop Service		87	149	-62
26255	Rooftop Service		1220	7	1213
25254	Rooftop Service		777	14	763
25250	Rooftop Service		37	74	-37
26011	Rooftop Service		93	157	-64
25480	Rooftop Service		556	58	498
26226	Rooftop Service		751	838	-87
26238	Rooftop Service		389	444	-55
26237	Rooftop Service		1895	433	1462
25269	Rooftop Service		6403	1174	5229
24867	Shell		905	735	170
22457	Shell		235	239	-4

B FIVE LARGEST NONRESIDENTIAL PROJECTS

24825 – SPOKANE VALLEY MALL

This is an extremely large facility, comprising approximately 738,000 square feet. The eQUEST analysis seems generally sound, but it appears that many default settings were used within eQUEST, which could be problematic for a facility of this size.

The default skylight settings caused a warning in eQUEST, as the number of skylights exceeds the maximum allowed. The internal loads seem extremely low. There was no external documentation of many critical components, such as the actual HVAC systems, zoning and internal loads. It is acceptable to go with eQUEST defaults on many construction parameters, but strongly suggest that actual operating schedule and temperature setpoints for the facility be used, as these strongly affect energy consumption.

The baseline eQUEST model (as supplied) over-predicts the actual energy consumption. Consequently, scaling factors (less than 0.2) must be applied to the output to get results close to the actual consumption. Nexant made minor revisions to the model, and reanalyzed this project using a more recent version of eQUEST. Nexant calculated the savings to be significantly larger than that reported by Avista. Because of the large deviation in estimated savings, and because there were a large number of unknown parameters, Nexant recommends that the Avista value be used.

24738 – SARANAC BUILDING

This is a new construction project which was seeking LEED certification. The project was analyzed using eQUEST by an ESCO. There are several energy savings features in the proposed design which result in savings over the baseline model. The main source of gas savings was the use of a ground source heat pump system instead of the baseline HVAC system.

The existing eQUEST analysis seems generally sound, but baseline model indicates electric heating, which doesn't seem to correspond with other documentation. The largest source of error comes from the determination of the baseline HVAC system. Per ASHRAE 90.1-2004, the baseline system should be PVAV with hot water gas fired boiler (not electric reheat or furnace as analyzed by the ESCO). Also, the building shell had a few problems (e.g. exterior walls are missing on a portion of roof) and efficiency ratings of heat pumps seem overly optimistic. It is also suggested that actual operating schedule and temperature setpoints for the facility be used, as these strongly affect energy consumption; these could not be verified from the documentation.

Nexant made modifications to the models and recalculated the savings to be 50,775 therms (compared to 36,059 as reported by Avista).

23059 – (NAME WITHELD, NO RELEASE SIGNED)

The analysis was originally performed using a customized spreadsheet developed by Avista for shell measures. The project consisted of upgraded wall and ceiling insulation for a manufacturing facility.

Nexant re-analyzed the project using its own customized spreadsheet, which entailed an hourly bin analysis using the UA method. Nexant calculated gas therm savings very close to Avista's reported gas savings (about 1% higher than Avista's value).

21320 – ODESSA MEMORIAL HOSPITAL

This project was originally evaluated by an ESCO using eQUEST version 3.54. In ECM 1, several changes to the envelope were made, consisting of wall and window upgrades. In ECM 2, several mechanical upgrades were evaluated, including a high efficiency condensing gas boiler, new air handlers, a new DDC control system, and a high efficiency hot water heater.

Nexant reviewed the eQUEST input files and found the models to be solid and consistent with the documentation. However, because Nexant used a more current version of eQUEST (version 3.61e) than originally used, the results are slightly different. It should be noted that the savings are based on the difference between the design and the current Washington *code* requirements, not the *actual* use. Nexant estimates the savings to be 43,728 therms over the modified baseline, compared to 39,297 therms, as reported by Avista.

22479 – SPOKANE CONVENTION CENTER

This is a new construction project which was seeking LEED certification. The project was analyzed using Carrier's HAP model by an ESCO. There are several gas and electric energy savings features in the proposed design, which result in kWh and therms savings over the baseline model.

Several HAP model output reports were provided, showing energy consumption before and after various measures. In addition, many of the input parameters were summarized in the LEED documentation. Curiously, the baseline model was based upon ASHRAE 90.1-1999 prescriptive requirements, while it seems as if the 2004 version would have been more applicable.

The key measures evaluated are demand controlled ventilation, domestic hot water reduction (low flow faucets), higher efficiency hot water heaters, a higher efficiency boiler, along with other measures.

For the review, Nexant created an eQUEST model and calibrated the annual gas usage to match the base case gas usage provided by Avista's HAP model. However, because we did not have many of the details of the model (such as the geometry, layout, occupancy, and zoning), our calibration procedure is partially incomplete. Using our eQUEST model, we ran an 8760 hourly analysis to compute the annual gas savings. The results indicated that the savings would be substantially less than that predicted by the HAP tool. This seems to be partly due to the heating hours and occupancy periods used in HAP, which appear too high and not consistent with the documentation. Nexant estimates that the savings would be 10,243 therms, as opposed to 49,553 therms reported by Avista.

research/into/action inc

Final Report

Independent Third-Party Verification of Natural Gas DSM Energy Savings, 2006 through 2008: Washington and Idaho Programs

Funded By: Avista Utilities

Prepared By: research/into/action inc

Jane S. Peters, Ph.D. Ryan E. Bliss **Research Into Action, Inc.**	and	Lynn Roy Ryan Long, Patrick Kearns **Nexant, Inc.**

February 28, 2009

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We also wish to thank Laurie Lago of Business Service Bureau for her able assistance in production of the final report.

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TABLE OF CONTENTS

TABLES AND FIGURES

ES EXECUTIVE SUMMARY

Avista Utilities (Avista) operates a variety of energy efficiency programs with its residential, limited-income, and nonresidential customers. These programs have the potential to create significant energy savings for Avista's customers, as well as to enable Avista to achieve the gas Demand Side Management (DSM) goals required under an approval agreement for a three-year natural gas decoupling pilot.

Avista must verify achievement of its DSM goals on an annual basis by an independent third-party assessment for the calendar years 2006 through 2008. Research Into Action, together with its subcontractor, Nexant, Inc., has performed the independent verification audit for 2006 through 2008. The verification was done through a combination of engineering evaluations of the estimated impacts of actions involved in the programs, together with an audit of the program documentation, to determine whether or not the savings and costs were applied to the measures appropriately.

We used common and accepted data sampling and analysis methods to examine multiple strata within each customer group[1], with the goal of obtaining sufficient statistical power to produce estimates of audit measurements with a minimum precision of ±10%, at a confidence of 90%, over the three-year course of the evaluation.

The verification methodology for all three programs shared three common components:

1. Reviewing the paper documentation of the sampled cases to verify that the input data used to calculate the therms saved on a case-by-case method were correct;
2. Performing an engineering review of the assumptions that went into Avista's calculations of therm savings for the various measures; and
3. Independently calculating therm savings on a case-by-case basis, using either Avista's assumptions or other sets of assumptions resulting from the engineering review.

Specific details of the methodology for each program reflected differences among the programs and program strata in how measures were taken.

1 For the 2007 and 2008 audits, we modified the stratification plan that we had followed for the 2006 audit. In combining the 2006-2008 results, we used the new stratification. This is described in detail in Section 3, *Audit Methods*.

DOCUMENTATION REVIEW

For program year 2008, the documentation review was able to obtain sufficient documentation for the majority (209 of 222) of projects. Table ES.1 shows the number of documentation problems within each program, along with the percentage of all projects in that program that had documentation problems, for 2008 and the combined 2006-2008 data.

Table ES.1: Frequency of Documentation Problems by Group

GROUP	PROJECTS WITH UNRESOLVED DOCUMENTATION PROBLEMS			
	2008		2006-2008	
	COUNT	%	COUNT	%[1]
Residential Program	5	3.9	34	11.8
Limited-Income Program	0	0.0	2	0.4
Nonresidential Program – Census of Largest Projects	5	45.5	7	30.4
Nonresidential Program – Sampled Projects	14	45.5	38	27.2

[1] With the exception of the "Largest Projects" stratum of the nonresidential program, the percentages shown are weighted to account for different sampling ratios across strata and program years (see Chapter 3, *Audit Methods*). However, the counts shown in this table are raw counts.

In the residential program, three types of documentation error each accounted for roughly equal percentages of program records across the three program years. These were documentation that was insufficient to confirm the claimed savings; documentation that produced savings values that contradicted (exceeded) the claimed savings; and documentation that showed that the measure in question did not actually qualify for a rebate. Based on the sampled data, weighted to account for differences in sampling ratios, we estimate that these three types of documentation error together accounted for 10% of records.[2] The measure was incorrectly coded on an additional 1.8% of records.

As seen above, we encountered few unresolved documentation problems in the limited-income program. The counts of documentation problems for the residential and limited-income programs, shown in the above table, do not include a larger number of cases in each sample for which we requested and received additional documentation from Avista.

The nonresidential program had a higher percentage of documentation problems than the others. Most of these problems consisted in the inability to obtain some of the inputs used to generate

[2] Previously, we reported that the first type of error—insufficient documentation—was most frequent, but that was based on raw, unweighted, counts. When the strata were weighted to account for different sampling ratios, this type of error was no more frequent than the others mentioned.

the model behind Avista's estimates. By far, the majority of these cases were rooftop services projects from the *AirCare Plus* program. We were able to calculate estimates for these and some other projects for which we had limited input data, but we do not necessarily recommend that Avista use our estimates rather than their own, as the estimates are not comparable. We continue to recommend that additional review be conducted of the *AirCare Plus* program.

In addition to the above documentation problems identified in the sample, we identified several records in the residential program's database, not selected for the sample, that were miscoded. The identified records accounted for about 0.5% of the 2008 database, which does not substantially affect the rate of miscoding estimated from the sample.

We offer some recommendations in the *Conclusions and Recommendations* chapter for how Avista can improve documentation.

ENGINEERING REVIEW AND ANALYSIS OF ENERGY SAVINGS

Our analysis of Avista's reporting energy savings found variances between Avista's savings estimates and our computations in all three programs for 2008 and the combined 2006-2008 data. Table ES.2 shows the mean differences between Avista's reported therm savings and our computations for 2008 sample and across the three program years.

Table ES.2: Variances Between Avista's Reported Savings and Audit Results by Group

GROUP	MEAN DIFFERENCE BETWEEN AVISTA'S REPORT AND AUDIT RESULTS			
	2008		2006-2008	
	THERMS	PERCENT	THERMS	PERCENT
Residential Program	-0.2	-0.2	3.2	4.3
Limited-Income Program	30.7	23.7	23.6	17.5
Nonresidential Program – Largest Projects	1,058	4.2	4,872	15.8
Nonresidential Program – Sampled Projects	738.8	79.5	204.1	20.5

As Table ES.2 shows, we found that the mean level of discrepancy between Avista's claimed savings and our computations differed among the programs. The following outlines our findings from the engineering review and analysis for each program (residential, limited-income, and nonresidential).

Findings for the Residential Program

As part of our 2006 audit, we performed an engineering review of Avista's residential program that consisted of a check against standard engineering practices. We compared Avista's reported energy savings to other utility DSM program offerings and performed engineering calculations to verify savings on a measure-by-measure basis.

For the audit of the 2007 and 2008 program years, we determined whether any of our previous recommendations should be revised based on new information either reported by Avista or found in the literature. We also performed engineering reviews on newly identified measures.

The main findings regarding the residential program were:

- ➡ **During the 2006 audit, we arrived at per-unit therm savings that were close to Avista-reported values for most of the prescriptive measures in the residential program.** Although there were some variances, in most cases they were not so great as to justify recommending a different value from the one that Avista uses. For subsequent audits, we made few modifications to our previous recommendations.
- ➡ **For two of the prescriptive measures – high-efficiency 40-gallon and 50-gallon water heaters – we previously recommended higher per-unit reported savings than the ones that Avista reported.** In the 2006 report, we recommended some changes, but still accepted Avista's values as reasonable. For the 2008 program, Avista followed our recommended values.
- ➡ **For high-efficiency continuous-flow (tankless) water heaters, we previously recommended higher per-unit reported savings than the ones that Avista reported.** Avista increased its per-unit claimed savings for that measure for the 2008 program year based on an increase in the minimum efficiency rating, and we have accepted the new value as reasonable.
- ➡ **Across all measure types and program years, the weighted differences between Avista's values and the audit's values were relatively small (3.2 therms, 4.3%).** The mean difference was much smaller for 2008 (-0.2 therms, -0.2%) than we found previously, suggesting an improvement in rebate application review procedures.
- ➡ **Across the three program years, the precision of the mean difference in estimated savings was about 3.5% of Avista's mean estimate.** This well surpassed the requirement of 10% precision (at 90% confidence).

Findings for the Limited-Income Program

The engineering evaluation of Avista's limited-income program consisted of a customer-by-customer analysis based on the inputs provided in the CAP reports.

- ➡ **For 2008, the number of sampled cases with large discrepancies between the claimed savings and the audit's estimated savings was greater than in the previous years' audits.** This produced a larger mean discrepancy for 2008 (30.7 therms, 23.7%)

than was found previously—the three-year mean was 23.6 therms. We are unable to account for this large difference.

- ➡ **The 90% confidence interval around the mean discrepancy was large in all years owing to the general high level of variability.** Therefore, we cannot conclude with a high level of confidence that the actual level of error within the 2008 population was greater than in previous years. The primary finding is the overall high level of variability and the relatively high mean level error.
- ➡ **Across the three program years, the precision of the difference between Avista's estimated savings and the audit's estimates was 10.4% (at 90% confidence).**

Findings for the Nonresidential Program

The engineering review of Avista's nonresidential program consisted of project-by-project analyses based on the inputs and assumptions provided by Avista, along with a check against standard engineering practices. In the case of pre-rinse sprayers, which were included in the 2006 and 2007 programs, but not in the 2008 program, the engineering review consisted of an evaluation of Avista's metering data study completed in 2007 for a sample of installed units. The following summarizes our findings for the nonresidential program:

- ➡ **The review of the 11 largest projects resulted in energy savings that were within 10% of Avista's reported values for five projects and they were within 20% of Avista's values for eight projects.** Across the three program years, our results were within 20% of Avista's for 13 of 23 large projects. The likely reason for the large differences in energy savings in the other projects was the unavailability of some assumptions used by Avista to calculate energy savings, which resulted in the use of our own engineering assumptions in our models.
- ➡ **The review of the measures in the sampled custom measures stratum (HVAC, shell, rooftop service, and appliances) resulted in values that were within 20% of Avista's reported values in about three-fifths of the cases.** The largest differences were in a few HVAC projects and several rooftop services projects. We evaluated the rooftop service projects using eQuest and the assumptions provided to us by PECI. There were significant differences in our values and Avista's reported values due to the lack of clarifying information provided by PECI and because we modeled the savings in eQuest as opposed to PECI's own modeling tool. We had similar difficulties in evaluating rooftop service projects in the 2006 and 2007 audits.
- ➡ **In addition to calculating the mean difference between the audit's estimates and Avista's estimates, we used two other methods to calculate the mean difference.** The methods were based on how we treated cases in which our estimate was based on incomplete data. Expectedly, accepting Avista's estimates for those cases decreased the calculation of Avista's mean overestimate of savings. Substituting a randomly generated

number between our estimate and Avista's estimate (under the assumption that, with more input, we would have calculated an estimate that was closer to Avista's) actually increased the calculation of Avista's mean overestimate of savings for 2008 and had no substantial impact on the 2006-2008 figure.

➡ **Across the three program years, the precision of the difference between Avista's estimated savings and the audit's estimates ranged from about 13% to 18% (at 90% confidence).** The value depended on which method we used to calculate the mean difference between the audit's and Avista's estimates.

➡ **For the 2006 and 2007 programs, we accepted the prescriptive per-unit savings of 44 therms for Stratum 1 (*Pre-Rinse Sprayers*), but noted that this may be conservative.**

➡ **For the 2008 program, we noted a wide variation in estimated energy savings for prescriptive demand controlled ventilation (a new prescriptive measure).** The variation was based upon the analysis tool used. We believe that Avista adopted a reasonably conservative approach to this measure but recommend that it be investigated further for accuracy.

RECOMMENDATIONS

Avista accepted all our previous recommended changes in claimed savings for particular measures. Further, the results of the 2008 audit suggest that Avista has improved documentation and internal review and Avista has made modified how it records and tracks application data for some measures, making verification easier and possibly more accurate. We repeat recommendations that Avista may not yet have fully implemented, in some cases with modifications.

Residential Program

➡ **Request more detailed documentation from residential customers and their contractors submitting rebate requests.**

➡ **Provide outreach to vendors to educate them about what kind of information is needed on the invoices.**

➡ **Continue to improve review of rebate applications to ensure that the information on the backup documentation is completely consistent with that listed on the rebate forms.**

➡ **Identify furnace, boiler, and water heater models that do and do not meet minimum efficiency requirements and provide this information to vendors or customers or use it to review incoming applications.**

- ➡ **Institute an internal system for checking data entry accuracy to ensure that incorrect measure types are not recorded in rebate records.**
- ➡ **Institute a system for reviewing the entire database on a regular basis to identify and report therm values that are inconsistent with the measure.**
- ➡ **Continue to review rules and procedures for assigning or calculating therms in the database to ensure that they are consistent with engineering-established rules and procedures.**

Limited-Income Program

- ➡ **Review the calculation methodologies used by all CAPs to ensure that there is consistency across the various agencies and that energy savings are being calculated correctly.**
- ➡ **Request that all necessary baseline information be recorded and maintained by the agencies.**

Non-Residential Program

- ➡ **Increase documentation of baseline and retrofit equipment, including model numbers, efficiencies, and shell information.**
- ➡ **Complete a separate evaluation of PECI's *AirCare Plus* program to determine the accuracy of reported energy savings.**
- ➡ **Further investigate the prescriptive values assigned for demand controlled ventilation.**

1 INTRODUCTION

In February 2007, Avista Utilities (Avista) received approval for a three-year natural gas decoupling pilot, under which it must achieve certain gas Demand Side Management (DSM) goals (i.e., energy savings, expressed in therms) in order to be able to recover tracked margin. The savings are achieved through a variety of residential, limited-income, and nonresidential programs that Avista has undertaken. Avista must verify achievement of its DSM goals on an annual basis by an independent third-party assessment for each of the three years of the pilot.

Avista chose Research Into Action, Inc., to carry out the verification. Together with its subcontractor, Nexant, Inc., Research Into Action has performed independent verification audits for the calendar years 2006 through 2008. The verifications were done through a combination of engineering evaluations of the estimated impacts of actions involved in the programs, together with audits of the program documentation, to determine whether or not savings and costs were applied to measures appropriately.

The audits were based on desk review of the paper trail, with possible telephone contacts or in-person visits, of samples drawn separately for residential, limited-income, and nonresidential customer categories. The purpose of the audits was to determine whether or not Avista's savings estimates in each case are reasonable. Specifically, we set out to answer the following questions:

1. Were the input data that Avista used to calculate therm savings on a case-by-case basis adequately supported by invoices and related documentation?
2. Were Avista's methods for estimating therm savings for the various measures installed justified from an engineering standpoint?
3. Assuming adequate estimation methods and input data, were Avista's calculations of savings on a case-by-case basis accurate?

In August 2007 and July 2008, Research Into Action submitted reports to Avista detailing the results of the audit of year 2006 and 2007 programs, respectively. The reports described: Avista's residential, limited-income, and nonresidential energy efficiency incentive programs; the audit methods used; the results of the audit; and our recommendations to Avista, based on the audit results.

The current report covers the audit of the 2008 programs as well as cumulative 2006-08 results. It includes the descriptions of the Avista programs and audit methods as well as the 2008 and cumulative results. Based on the results of the 2006 audit, we made some changes to the sampling method for the 2007 and 2008 audits, which we describe in the appropriate section of this report.

2 AVISTA UTILITIES ENERGY EFFICIENCY PROGRAMS

Since 2006, Avista Utilities has implemented energy efficiency incentive programs with its residential, limited-income, and nonresidential gas customers. The programs provide rebates for a variety of energy efficiency measures carried out at customers' homes and businesses. For the calendar years 2006, 2007 and 2008, Avista's customer service database recorded completed installations of 17,830 residential measures, 1,777 limited-income residential measures, and 2,128 nonresidential measures that resulted in therm savings. The details of how each program is implemented vary among the three customer categories and, to some degree, among measure types within certain customer categories.

RESIDENTIAL PROGRAM

The residential program provides rebates to residential customers for prescriptive energy efficiency improvements for a range of gas measures. These measures, along with their eligibility criteria, assumptions, and prescriptive therm savings are shown in Table 2.1. Any changes that have been made since 2006 to any of the foregoing are discussed in table notes.

Table 2.1: Eligibility Criteria and Assumptions for Computing Savings for Residential Measures

MEASURE	ELIGIBILITY CRITERIA	BASELINE / ASSUMPTIONS	THERM SAVINGS
High-Efficiency Gas Furnace	Minimum Annual Fuel Utilization Efficiency (AFUE) of 90%	Federal minimum AFUE (78%)	123[1]
High-Efficiency Gas Boiler	Minimum AFUE of 90%	Federal minimum (80%)	123[2]
High-Efficiency 40-Gallon Water Heater	Minimum Efficiency Factor (EF) of .62	.59 to .62	8[3]
High-Efficiency 50-Gallon Water Heater	Minimum EF of .60	.58 to .60	9[4]
High-Efficiency Tankless Water Heater	Minimum EF of .82	(not specified)	60[5]
Ceiling/Attic Insulation	Existing insulation less than R-22; a minimum increase of R-10; installed only in areas that separate conditioned from unconditioned areas of the residence	R15 to R25	.09 per square foot[6]
Floor or Wall Insulation	Existing insulation less than R-11; minimum increase of R-10; installed only in areas that	R5 to R15	.31 per square foot[6]

MEASURE	ELIGIBILITY CRITERIA	BASELINE / ASSUMPTIONS	THERM SAVINGS
	separate conditioned from unconditioned areas of the residence		
Duct Insulation (Discontinued in 2007)	Minimum increase of R-10; installed on heating ducts in unconditioned areas	Average 2 square feet per linear foot	2.8 per linear foot
New Windows (Discontinued in 2008)	Minimum U-factor of .35	U-factor .55 or higher	.42 per square foot of window installed[7]
Replacement Windows	Minimum U-factor of .35	U-factor .55 or higher	.83 therms per square foot of window installed
Programmable Thermostat	7-day programmable	(not specified)	31
Fireplace Damper	Standard damper	(not specified)	76
Ground Source Heat Pump (Added in 2008)	Minimum 13.6 HSPF	(not specified)	787
ENERGY STAR® Homes	Certified as ENERGY STAR®	(not specified)	197
ENERGY STAR® Clothes Washer (Added in 2008)	Certified as ENERGY STAR®	(not specified)	9
ENERGY STAR® Dishwasher (Added in 2008)	Certified as ENERGY STAR®	(not specified)	5

1 Avista claimed 72 therms for this measure in 2006 and 2007. In 2008, Avista increase the therm savings to 123 based on an updated analysis of annual heating BTU consumption requirements, primarily driven by a change in area of heat loss for the shell to include floor space, which was not included previously. As noted in the Results chapter, below, our engineering review confirmed the new value of 123 therms.

2 Avista claimed 72 therms for this measure in 2006 and 2007. In 2008, Avista increase the therm savings to 123 based on an updated analysis of annual heating BTU consumption requirements, primarily driven by a change in area of heat loss for the shell to include floor space, not included previously. Avista also increased the minimum AFUE% from 85% to 90% in 2008.

3 Avista claimed 11 therms for this measure in 2006 and 2007. In 2006 and 2007, our audit verified 11 therms but recommended that 8 therms be claimed. Avista changed the claimed savings to 8 therms for the 2008 program.

4 Eight therms were claimed for this measure in the 2006 and 2007 programs. In 2006 and 2007, our audit verified 16 therms but recommended that 11 therms be claimed. Avista changed the claimed savings to 9 therms for the 2008 program.

5 Eleven therms were claimed for this measure in the 2006 and 2007 programs (with a minimum Efficiency Factor of .65). In 2006, our audit verified 28 therms for this measure and recommended that 28 therms be claimed. In 2007, our audit verified at least 52 therms for this measure and recommended that at least 52 therms be claimed. Avista changed the claimed savings to 60 therms for the 2008 program, and increased the minimum Efficiency Factor to .82.

6 Avista claimed .042 therms per square foot of qualifying ceiling/attic insulation installed and .209 therms per square foot of qualifying floor/wall insulation installed (not .042 or .209 therms per square foot per R-10 added, as reported in the 2006 report). In 2008, Avista increased these to .09 and .31 therms, respectively. The increase was based on a review of records from prior program years that showed that average existing insulation levels were lower than had been assumed and that, on average, more than the minimum R-10 was being added.

7 The original table reported that the claimed savings for new windows was calculated as .24 therms per square foot, but review of the data reported (for both 2006 and 2007) indicated that the claimed savings actually was calculated as .42 therms per square foot, and this figure was supported by our engineering review. Therefore, we have altered this table to show that claimed savings were calculated as .42 therms per square foot of window installed.

In the residential customer program, customers deal directly with contractors for installation of measures. The customers record pertinent data about the measures on an Avista *Home Improvement Incentive Form* (rebate form) and submit this form, together with invoices and other relevant documentation from the contractor, to Avista. If the installation meets Avista's eligibility criteria, Avista issues a rebate to the customer.

LIMITED-INCOME PROGRAM

The limited-income program provides rebates to limited-income residential customers for energy efficiency improvements for the following gas measures:

- Air infiltration
- ENERGY STAR® windows
- ENERGY STAR® doors
- High-efficiency furnace
- High-efficiency 40-gallon water heater
- High-efficiency 50-gallon water heater
- High-efficiency tankless water heater
- Ceiling/attic insulation
- Floor or wall insulation
- Duct insulation

To qualify for an energy audit through the limited-income program, customers must attend a workshop to learn about saving energy and are provided low-cost/no-cost tips. After attending the workshop, customers then receive an in-home assessment and a Community Action Program (CAP) agency determines cost-effective measures for installation, based on existing equipment, the shell, and so forth.

One salient characteristic of the limited-income program is that, while there are recommended or suggested guidelines for the installation of measures, the analyses are performed and the incentives are offered on a site-specific basis. Thus, the minimum required efficiencies that apply to some measures in the residential program—such as water heaters and furnaces (see above)—do not necessarily apply in the limited-income program.

The reasoning for this was that the assumptions differed for the residential and limited-income programs. For the residential program, Avista assumed that customers receiving a rebate were replacing a system on or near burnout and that they would need to buy at least a code replacement water heater.

For the limited income program, the assumption was that customers often would replace an inefficient, but still functional, system before burnout, so replacement with a new system would provide a higher savings potential, even with a lower efficiency level. Furthermore, Avista assumed that many limited-income customers in manufactured housing may not have the ability to install a higher efficiency system in the available space.

A second salient characteristic of the limited-income program, which affects the verification methodology, is that all measures in this program are directly installed by CAP agencies. Therefore, the customer neither completes a rebate form nor receives invoices or other supporting documentation from the installer. Instead, CAP installers record all input data (including pre-existing conditions as relevant), either directly into software installed on notebook computers that they carry with them to the location of installation or onto paper forms. The software or paper forms that are used vary among CAPs. With some minor exceptions, no independent hard-copy documentation exists for any of the measures in this group.

NONRESIDENTIAL PROGRAM

The nonresidential program provides rebates for energy efficiency improvements for the following customized gas measures:

- Appliances
- Heating, ventilation, and air conditioning (HVAC)
- LEED certification
- Shell
- Rooftop service

In addition, the nonresidential program has offered various measures with prescriptive gas savings. In 2006 and 2007, the program offered prescriptive incentives for pre-rinse sprayers. In 2008, the program offered prescriptive incentives for food service equipment, steam trap replacement, and demand controlled ventilation. These accounted for about 5% of the total number of projects and a much smaller percentage of the total savings for the nonresidential program.

The procedures for implementing measures and claiming rebates differ for the various measure types. For rebate applications involving pre-rinse sprayers, Avista hired contractors who installed the measures directly. For rooftop service, Avista hires contractors who perform an audit. In both cases, contractors record relevant data about the installation (including pre-existing conditions) directly into software installed on a notebook computer. Little or no additional paper documentation is created for these measures.

For the rebate applications involving lighting, motors, food service and other prescriptive measures, and commercial HVAC variable frequency drive equipment, the customer can purchase and install the measure and submit a rebate form and invoices to Avista.

Avista offers a third-party shell measure for multifamily dwellings. For this measure, the third-party contractor approaches the property owner and directly installs the measure in all units.

The program for the remaining measure types is site specific, in which customers receive an analysis from Avista prior to ordering and installing equipment, which estimates energy savings and potential incentive. Avista enters into an *Energy Efficiency Agreement* with each customer, which states that they can be reimbursed upon completion of the project, based on project costs and type of equipment installed. The customers sign this agreement and either hire a contractor to install the measure or install it themselves. Upon completion of the project and receipt of invoices, Avista energy efficiency engineers post-verify the installation. If the installation is verified and meets Avista's eligibility criteria, Avista issues a rebate.

3 AUDIT METHODS

We used data sampling and analysis methods that are common and accepted in evaluation research. The sampling methods, described in detail below, examined multiple strata within each customer group. The data analysis, described in the next section, combined an engineering review of Avista's therm-savings calculation methods, a review of the documentation submitted with each record in the samples to determine whether the input data that Avista used to calculate therm savings were accurate, and a data review to evaluate the accuracy of Avista's calculated savings.

SAMPLING METHODOLOGY

The primary consideration that informed our sampling approach was that each sample should have sufficient statistical power to produce estimates of audit measurements with good precision and confidence levels over the three-year course of the evaluation. In the report of the 2006 audit, we indicated a goal of achieving ±5% and 95% confidence. These levels were based on the assumption of a very low rate of documentation error. However, based on the results of the 2006 audit, achieving these highly stringent precision/confidence levels would require significantly larger samples. Since these levels go beyond industry standards (typically ±10% precision and 90% confidence) and were not mandated by WUTC, we have relaxed them slightly to ±10% precision and 95% confidence.

Thus estimates of measurements that are expressed as a proportion or percentage of the sample (e.g., percentage of the sample for which the input data recorded on the rebate forms were confirmed by accompanying documentation) should be accurate within plus-or-minus 10 percentage points. Estimates of the degree of error in Avista's calculation of therm savings should be accurate within ±10% of the mean Avista-calculated therm savings.

A second important consideration was that to each sample should include the broadest possible range of measure types. An initial review of the distribution of the population of measure types within each program revealed that a few measure types accounted for a large percentage of measures taken, while several other measure types each accounted for very low percentages. A simple random sample of such a population would have been dominated by the high-frequency measures, and some low-frequency measures might not even be sampled.

We used a stratified sampling approach to prevent such an occurrence. As described below, we divided each population of measures into several strata, with the highest-frequency measure types each constituting their own strata, and one stratum comprised of all low-frequency measures. The high-frequency measure types were sampled from their own strata so that they would not dominate the overall sampling. Even with stratification, it was possible that some low-frequency measure types would not be included, but excluding very low-frequency measure types should have little impact on the results.

The following describes our methodology for each customer type, as it was initially developed for the 2006 audit as well as any subsequent refinements.

Residential Program

For each program year, Avista provided Research Into Action with a data file with a separate record for each residential measure. The data file showed the following information for each measure:

- ➡ Customer ID
- ➡ Measure type (code and description)
- ➡ Entry date
- ➡ Customer rebate amount ($)
- ➡ Estimated kWh savings
- ➡ Estimated therm savings

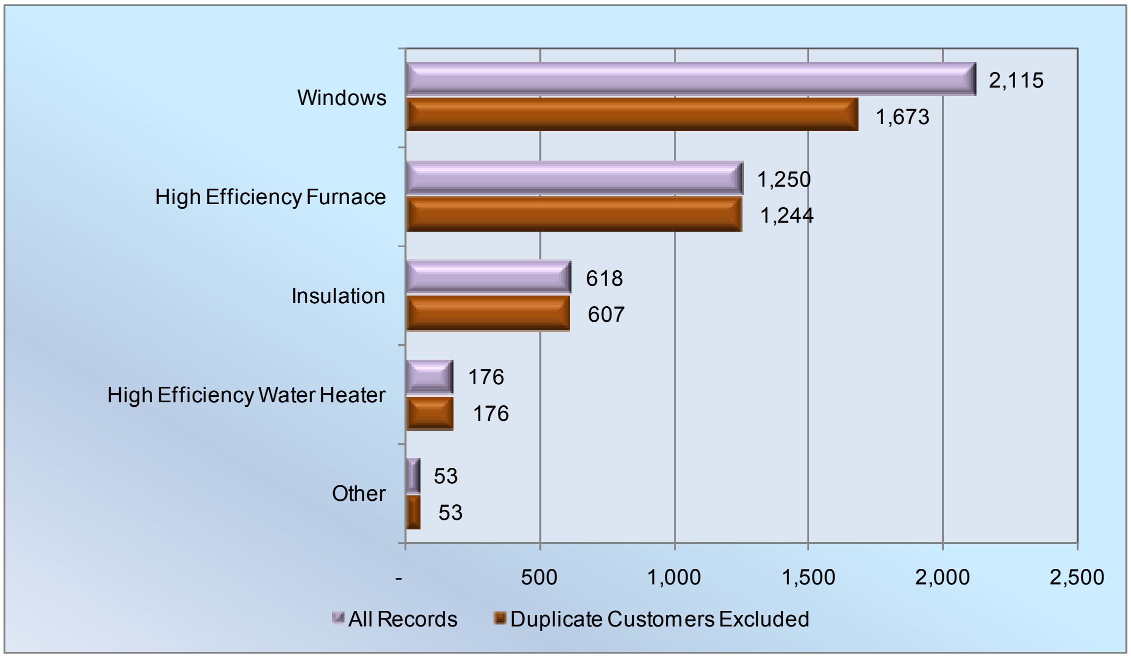
Initial Identification of Residential Strata for 2006 Audit

We found that some measures were installed at many residences while others were installed at a few. However, the overall distribution of measure types was similarly skewed regardless of whether we counted a single case or multiple cases of each measure type for a given customer (see Figure 3.1, next page**Error! Reference source not found.**).

The most frequent single measure type was high-efficiency furnaces, with approximately 30% of the cases. Replacement windows together made up about 44% of the cases. The remaining measure types made up about 26% of the cases. Therefore, we identified three strata from which to sample: *High-Efficiency Furnaces*, *Replacement Windows*, and *All Other Measures*.[3]

[3] Names of strata are designated with initial caps and italics. When not used to identify a stratum, measure names are in plain font.

Figure 3.1: Frequency Count of Residential Program Codes: All Cases Counted and Duplicate Customers Excluded



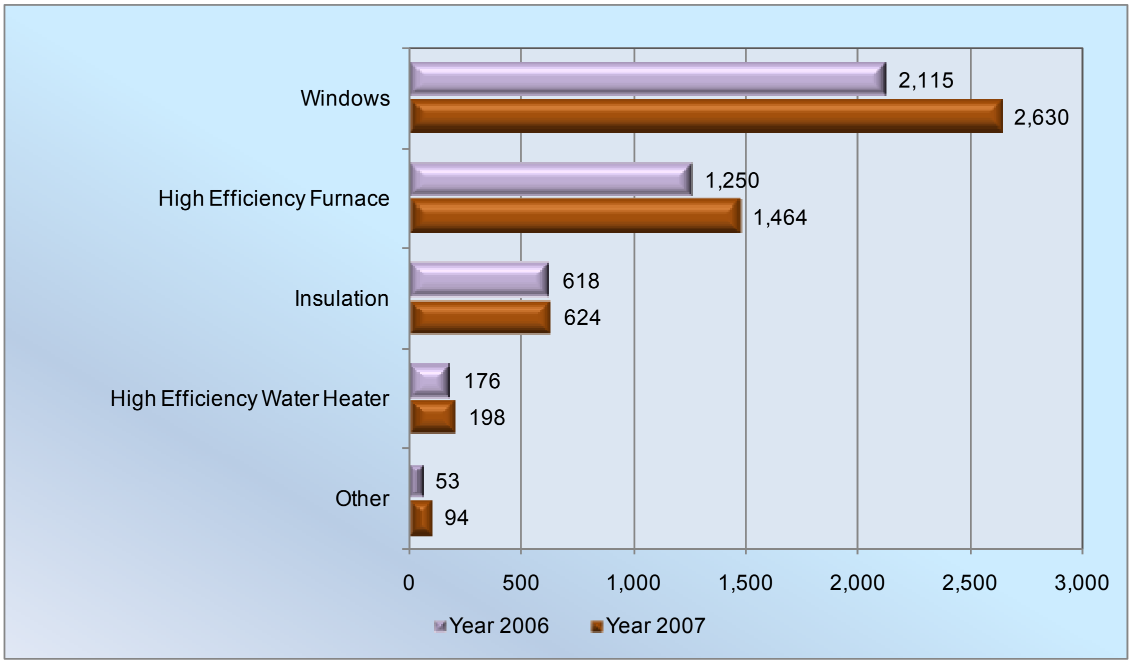
Refinement of Residential Stratification Plan for 2007 and 2008 Audits

The distribution of measure types in the 2007 program was similar to that for 2006 (see Figure 3.2, next page). However, for a variety of reasons, we decided to modify the stratification plan for the 2007 and 2008 audits somewhat to include four strata rather than three.

First, in the 2006 verification, *Replacement Windows* was a single stratum and new windows were included with *All Other Measures*. The method for calculating therm savings is similar for both types of windows (the difference is only in the coefficient that is applied) and so the potential sources of error for these measure types are very similar. This argues for combining these two measure types into a single stratum. By taking new windows out of the *All Other Measures* stratum, a larger number of other measure types can be included in that division.

Second, the *All Other Measures* stratum in the 2006 verification included insulation measures together with a variety of prescriptive and non-prescriptive measures. Given that insulation measures constitute a substantial portion of total measures, it seems reasonable to sample them as a separate stratum.

Figure 3.2: Frequency Distribution of Residential Measure Types Year 2006 and Year 2007



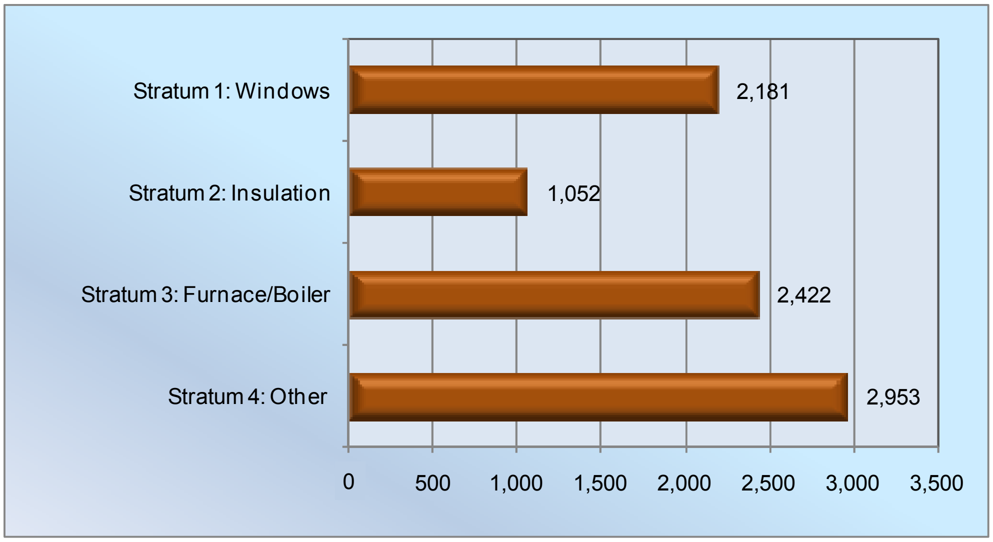
Third, and finally, high-efficiency furnaces are a prescriptive measure and so data-entry error is the only source of variation in the amount of claimed savings. In fact, there was no error at all recorded for that measure in the 2006 audit. Even though it accounts for a large percentage of cases, it accounts for a small percentage of the error in savings estimation. Some cases of this measure should still be included in the documentation review; however, it seems reasonable that it should consist of a smaller percentage of the residential sample than previously represented.

Based on the above considerations, we stratified the 2007 and 2008 residential data as follows:

- ➡ Stratum 1: *New and Replacement Windows*
- ➡ Stratum 2: *Insulation*
- ➡ Stratum 3: *High-Efficiency Furnaces and Boilers*
- ➡ Stratum 4: *All Other Measures*

Two new prescriptive measures introduced in 2008—ENERGY STAR® clothes washer and ENERGY STAR® dishwasher—were included in Stratum 4. These measures turned out to be very popular, which greatly increased the size of that stratum (see Figure 3.3). Although this meant that Stratum 4 was disproportionately represented by these two new measures in 2008, we decided that changing the stratification again would unnecessarily complicate sampling and analysis.

Figure 3.3: Frequency Distribution of 2008 Residential Measure Types



The size of each stratum is explained below.

Limited-Income Program

For each program year, Avista provided Research Into Action with a data file containing records of limited-income residential measures from its customer service database. The data file showed the following data for each measure:

- Customer ID
- Measure type (code and description)
- Entry date
- Customer cost ($)
- Customer rebate amount ($)
- Estimated kWh savings
- Estimated therm savings

Initial Identification of Limited Income Strata for 2006 Audit

The limited-income list had characteristics similar to the residential list: a large number of cases with multiple measures per customer and a highly unequal distribution of cases across measure type. In this case, air infiltration accounted for approximately 29% of the cases; insulation measures (ceiling, floor, and wall) accounted for about 49%; and all other measures made up about 22%.

As with the residential category, the distribution of measure types was similarly skewed regardless of whether only a single case or multiple cases of a measure type were counted for a given customer (graphics not included). Following the reasoning for the residential group, we identified three strata from which to sample: *Air Infiltration*, *Insulation*, and *All Other Measures*.

Refinement of Limited-Income Stratification Plan for 2007 and 2008 Audits

As with the residential program, the distribution of measure types in the 2007 limited-income program was similar to that for 2006. The 2006 verification found moderate levels of error in claimed therms for both insulation and air infiltration; as they continue to constitute more than two-thirds of the entire limited-income pool, we decided to continue sampling each as separate strata.

However, for the 2007 and 2008 verifications, we decided to sample the remaining measures in two strata rather than one. One stratum includes ENERGY STAR® windows and ENERGY STAR® doors. The other stratum includes the remaining measures (high-efficiency furnaces, 40- and 50-gallon high-efficiency water heaters, and programmable thermostats), each of which constitutes a small proportion of the measures.

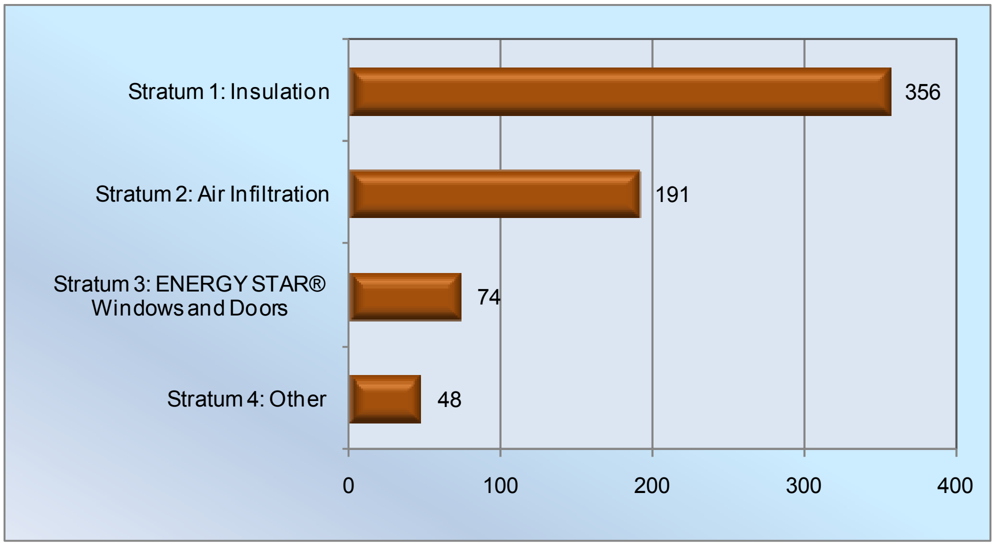
By dividing the sample into four strata instead of three, we were able to sample fewer of the insulation and air infiltration measures and therefore were able to include more of the others.

Therefore, we stratified the 2007 and 2008 limited-income data as follows:

- Stratum 1: *Insulation*
- Stratum 2: *Air Infiltration*
- Stratum 3: *ENERGY STAR® Windows and Doors*
- Stratum 4: *All Other Measures*

Figure 3.5 shows the distribution of measures across the above strata for the 2008 limited-income program.

Figure 3.5: Frequency Distribution of 2008 Limited Income Measure Types



Nonresidential Program

For each program year, Avista provided Research Into Action with a data file containing a separate record for each nonresidential project. The data file showed the following information for each record:

- Application number
- Measure type
- Building type
- Estimated therm savings
- Date created
- Phase (completed for all measures)
- State (Washington or Idaho for all measures)

Initial Identification of Nonresidential Strata for 2006 Audit

The size of reported savings (therms) was highly positively skewed, with a small number of measures representing extremely high reported savings. Therefore, the largest projects were singled out and evaluated as one stratum, separately from the random sample.[4]

We examined the remaining 644 projects for dependencies between measure type and project type, as such dependencies might influence the method of sample selection. A cross-tabulation showed a clear tendency for pre-rinse sprayer to be associated with food service (Table 3.1). However, other than the fact that rooftop service was somewhat underrepresented in office buildings relative to other measure types, there were no other clear relationships between measure type and project type.

Table 3.1: Measure Type by Project Type

PROJECT TYPE	MEASURE TYPE						
	APPLIANCE	HVAC	LEED CERTIFICATION	PRE-RINSE SPRAYER	ROOFTOP SERVICE	SHELL	Total
Agricultural	0	4	0	0	0	4	**8**
Church	0	1	0	0	0	0	**1**
Food Service	4	8	0	245	15	3	**275**
Government	4	21	2	57	7	12	**103**
Health Care	0	1	0	8	1	0	**10**
Hospitality	1	13	0	16	3	8	**41**
Manufacturing	1	6	0	0	0	5	**12**
Office	2	42	0	4	12	34	**94**
Residential	0	1	0	0	0	4	**5**
Retail	4	19	0	8	45	19	**95**
TOTAL	**16**	**116**	**2**	**338**	**83**	**89**	**644**

Pre-rinse sprayers accounted for a very large number of total measures and represented a fairly narrow band of reported savings sizes (although there was some variability). The other measure types appeared to be distributed more-or-less similarly across the building types.

On the basis of this, we treated pre-rinse sprayers (the most common measure type and highly concentrated in food service, the most common building type) as a second stratum and all other

4 Technically speaking, these five projects did not constitute a sample; they constituted the entire population of the stratum identified as the largest projects.

measures as a third stratum. Separating pre-rinse sprayers out from the other measures prevented them from dominating the overall sample.

Therefore, the data collection approach for nonresidential customers consisted of a census of one stratum (the *Five largest Measures*) and random samples of two other strata: *Pre-Rinse Sprayers* and *All Other Measures*.

We found three cases in which the same application number was found on two records; in all other cases, there was only one record per application number. In all three cases, the two records with the same application both had identical information (i.e., same measure type, building type, estimated therm savings, and so forth), with one exception: the date that the record was created was different by one day for one set of duplicate application numbers. We notified Avista of the duplications and requested the record files associated with those three application numbers to determine, on a case-by-case basis, whether the two records with the same application number represented separate measures or whether they were the same measure recorded twice. None of the six records with duplicated application numbers was randomly drawn for the survey. We did not identify any similar cases in the 2007 or 2008 data.

Refinement of Nonresidential Stratification Plan for the 2007 and 2008 Audits

The only substantial difference between the 2006 and subsequent audits of nonresidential data was in the number of “largest” projects selected for evaluation. The difference related to the locations of an observable break in the distribution of claimed therms in the data. For the 2006 audit, there was an observable break in the distribution after the seventh-largest projects (i.e., a noticeably larger difference between the seventh- and eighth-largest than between the sixth- and seventh-largest projects), so we selected the seven largest projects. For the 2007 audit, the break was between the fifth- and sixth-largest projects, so we selected the five largest projects.

The situation was complicated for the 2008 audit. As explained in more detail below, an abbreviated timeline for completing the audit necessitated selecting projects for the first three quarters of 2008 separately from the final quarter. This allowed us to begin the audit of the first set of projects during the final quarter of 2008. To be certain that we examined at least the six largest projects, we identified the six largest from the first three quarters. Later, when the fourth quarter data became available, we identified another five projects that were at least as large as the smallest of the six that we identified earlier. This resulted in a total of 11 large projects. In fact, there was an observable break in the distribution of size of these projects between the fifth- and sixth-largest, and the size range of the five largest was comparable to the range of the largest drawn for the 2006 and 2007 audits, while the remaining six project fell below the size range seen in 2006 and 2007.

Otherwise, we sampled from two other strata. One stratum was made up solely of projects with prescriptive measures. However, we redefined this stratum somewhat. In 2006 and 2007, it had been entirely comprised of pre-rinse sprayers offered with a prescriptive rebate. However, Avista discontinued that measure in 2008 and instead offered a variety of other prescriptive measures.

Even though relatively few rebates applications were submitted for these prescriptive measures in 2008, we continued to treat prescriptive measures as a separate stratum to maintain consistency across program years. The difference is that this stratum was comprised only of pre-rinse sprayers in 2006 and 2007 and of other prescriptive measures in 2008. Since all were prescriptive measures, however, the only variance should be in the documentation of the installation.

The other stratum consisted of all projects with non-prescriptive, custom measures that were not selected as part of the "largest projects" stratum. They were all site-specific and were largely comprised of rooftop service, HVAC, and shell measures. A very small number of miscellaneous project types (12 projects) were not sufficiently frequent to justify creating a separate stratum.

Based on the above considerations, we stratified the nonresidential data as follows:

- Stratum 1: *Largest Projects*
- Stratum 2: *Prescriptive Measures*
- Stratum 3: *All Other Measures*

Sample Size Determination

Prior to the 2006 verification, we calculated sample sizes to yield precise estimates for both the paper train audit and the check of Avista's calculated therm savings for the completed three-year verification. We determined the sample size for each year by dividing the three-year sample size by three.

Also as noted above, our initial sample size estimates were based on a desire to achieve very high levels of confidence and precision, combined with assumptions of very low rates of documentation error, which turned out to be incorrect. The following describes how we revised sample-size estimates based on error rates obtained during the 2006 verification, to achieve confidence and precision levels that still meet or exceed industry standards.

Sample Size Determination for the Audit of Avista's Savings Estimates

The formula for calculating the sample size for the audit of Avista's calculations for a particular group includes the standard deviation of the differences between Avista's and the audit's estimated therm savings across all measures within that group. Prior to the 2006 verification, this value was not known, so it was necessary to estimate it.

In most cases, the 2006 verification results showed greater variance (larger standard deviations) than was anticipated. This meant that larger samples would be needed to achieve the 95/5 level of confidence and precision than we originally had set for this evaluation. In fact, the sample sizes needed would be impractical and cost-prohibitive to achieve in the 2007 and 2008 verifications. However, as noted above, the 95/5 confidence level was not mandated by the

Settlement Agreement, and it is more stringent than the industry-standard levels of 90% confidence and 10% precision.

We re-calculated revised sample sizes using the standard deviations of the differences between Avista's and the audit's savings estimates from the 2006 data. We re-calculated both the estimated three-year sample sizes along with those for the 2007 verification.

In contrast to the approach taken previously, the new sample size calculations for the audit of savings estimates considered only measures that require some computation to arrive at the therm savings, such as windows or insulation (where the savings is calculated as some number of therms per square foot of window or insulation installed), as opposed to purely prescriptive measures, such as furnaces or water heaters (where each unit has the same therm savings). We continued to sample prescriptive measures as part of the paper-trail audit and compared the savings recorded for each of those measures against Avista's prescribed savings (see below). However, since the only source of variance in those measures would be data-entry error (not calculation error), we did not consider them part of the savings estimates audit.

To compute the sample sizes for the calculated measures, we used the pooled standard deviations across those strata with calculated measures within each group. The results are shown in Table 3.2. Even using the 95/10 confidence/precision level, which is somewhat more stringent than the industry-standard 90/10 level, the re-calculated sample size estimates are smaller than the sample sizes for the 2006 verification for the limited-income and nonresidential samples (61 vs. 68 and 5 vs. 23, respectively), while that for the residential group is only somewhat larger than for the 2006 verification.

The required sample size for the nonresidential group is very small, despite a large standard deviation of the Avista-audit differences. This is because these projects generally had very large savings and so the margin of error was proportionately large. Thus, while the standard deviation of the differences between Avista's and the audit's estimates was larger than in the other strata, it was small in comparison to the margin of error and, therefore, a relatively small sample delivers good precision. As explained below, however, the requirements of the paper-trail audit resulted in a much larger sample for the nonresidential group than that shown in Table 3.2.

Table 3.2: Revised Sample Size Estimates for Therm Savings Audit – Calculated Measures Only

GROUP	ESTIMATED[1] THREE-YEAR POPULATION	2006 ESTIMATED[2] STANDARD DEVIATION OF AVISTA AUDIT DIFFERENCE	2006 DATA		SAMPLE SIZE ESTIMATE			
			Sample Size	Standard Deviation of Avista Audit Difference[3]	Using 95/10 Standard Confidence/Precision Level		Using 90/10 Standard Confidence/Precision Level	
					Three-Year	2007, 2008[4]	Three-year	2007, 2008[4]
Residential Sample	6,331	6.9	72	59.9	231	83	163	(55)
Limited-Income Sample	1,525	23.2	68	85.7	182	(61)	134	(45)
Nonresidential[5]	935	209.5	23	285.0	14	(5)	10	(4)

1 The three-year populations were estimated by multiplying the 2006 populations (excluding duplicate records for a given customer) for each group by three; comparison of 2006 and 2007 data indicated similar levels of calculated measures when duplicate records were removed from each population.

2 These estimated standard deviations were used to approximate the sample sizes for the 2006 verification; the method used to generate them is described in the Final Report for the 2006 verification.

3 The standard deviation for the Residential sample was computed as a pooled standard deviation across those strata that were comprised only of calculated measures: Stratum 1 (New and Replacement Windows) and Stratum 3 (Insulation).

4 The 2007 and 2008 sample sizes were calculated by subtracting the 2006 sample size from the estimated three-year sample size and dividing by two; however, this produced very small 2007 and 2008 sample sizes for strata comprised of prescriptive measures as well as for some other measure types with very low error rates, which had resulted in larger-than-necessary 2006 samples. In those cases, we conservatively set the estimated 2007 and 2008 sample sizes at one-third of the estimated three-year sizes; the sample sizes for those strata are shown in parentheses.

5 Note that the required sample size for this group is very small, despite the fact that the standard deviation of the Avista audit differences was quite large. This is because the projects in this stratum generally had very large savings and so the margin of error was proportionately large. Thus, while the standard deviation of the differences between Avista's and the audit's estimates was larger than in the other strata, it was small in comparison to the margin of error, and therefore a relatively small sample delivers good precision.

Sample Size Determination for the Paper-Trail Audit

In originally calculating the sample size for the paper-trail audit, we assumed that Avista's inputs would be adequately documented in at least 95% of the cases. As Table 3.3 shows, we found no documentation errors in four of the eight strata. However, the rate of documentation error in the other four strata ranged from about 14% to 37%, which was much larger than that used to generate the estimated three-year sample sizes. This affects the sample size required for the 95/5 level of confidence/precision.

Table 3.3: Documentation Error and Mean Error of Savings Estimation by Group, 2006 Verification

GROUP	DOCUMENTATION ERROR		MEAN ESTIMATION ERROR (As Percent of Total)
	COUNT	PERCENT OF PROJECTS IN STRATUM	
Residential Stratum 1 (*High-Efficiency Furnaces*)	0	0.0%	0.0%
Residential Stratum 2 (*Replacement Windows*)	8	33.3%	8.4%
Residential Stratum 3 (*All Other Measures*)	9	37.5%	29.4%
Limited-Income Stratum 1 (*Air Infiltration*)	0	0.0%	20.1%
Limited-Income Stratum 2 (*Insulation*)	0	0.0%	17.6%
Limited-Income Stratum 3 (*All Other Measures*)	4	19.0%	60.7%
Nonresidential, Stratum 1 (*Largest Projects*)	1	14.3%	56.7%
Nonresidential Stratum 2 (*Pre-Rinse Sprayers*)	0	0.0%	0.0%
Nonresidential Stratum 3 (*All Other Measures*)	7	30.4%	-2.3%

Again, as noted above, the 95/5 confidence level was not mandated by the Settlement Agreement, and it is more stringent than the industry-standard levels of 90% confidence and 10% precision. Moreover, we calculated our original sample-size estimates for each stratum, whereas the results of interest pertain to the entire sample rather than the individual strata (the reason for stratifying the sample was to ensure that a broad range of measure types would be included, but we report the weighted combined results for each entire sample).

While we believe that it nevertheless is desirable to have a reasonable sample of as many measure types as possible to allow us to determine whether there are any systematic sources of error, it is not necessary to adhere to the original method for determining sample size.

As shown in Table 3.4, we used the 2006 error rates to re-calculate the estimated three-year sample sizes, along with those for the 2007 and 2008 verifications. In contrast to the case with the therm savings audit, the paper trail audit should apply to all measure types, prescriptive as

Table 3.4: Revised Sample Size Estimates for Paper Trail Audit

GROUP	ESTIMATED[1] THREE-YEAR POPULATION	2006 DATA		SAMPLE SIZE ESTIMATES			
		SAMPLE SIZE[2]	ERROR RATE[2,3]	USING 95/10 STANDARD CONFIDENCE/PRECISION LEVEL		USING 90/10 STANDARD CONFIDENCE/PRECISION LEVEL	
				THREE-YEAR	2007, 2008[4]	THREE-YEAR	2007, 2008[4]
RESIDENTIAL							
Residential – Calculated	6,331	41	29.2%	302	131	78	(26)
Residential – Prescriptive	3,990	31	16.1%	197	83	51	(17)
Residential Sample – Combined [5]	**10,320**	**72**	**23.6%**	**270**	**99**	**69**	**(23)**
LIMITED INCOME							
Limited-Income Sample – Combined [5]	**1,524**	**64**	**5.9%**	**81**	**(27)**	**21**	**(7)**
NONRESIDENTIAL							
Nonresidential – Calculated	935	23	30.4%	241	109	75	26
Nonresidential – Prescriptive	1,019	23	0%	15	(5)	4	(1)
Nonresidential Sample – Combined [5]	**1,953**	**46**	**15.2%**	**180**	**67**	**48**	**(16)**

1 The three-year strata populations were estimated by multiplying the estimated three-year population for each group by the proportion each stratum contributed to the 2006 sample.

2 Sizes and error rates of the sample strata were determined by re-assigning the 2006 measures to the currently defined strata and performing counts within the new strata.

3 To calculate sample size when the error rate was 0%, an error rate of 1.0% was substituted, as using the 0% rate would have produced a sample size of 0.

4 The 2007 and 2008 sample sizes were calculated by subtracting the 2006 sample size from the estimated three-year sample size and dividing by two; however, this produced very small 2007 and 2008 sample sizes for several strata that had very high error rates and, hence, larger-than-necessary 2006 samples. In those cases, we conservatively set the estimated 2007 and 2008 sample sizes at one-third of the estimated three-year sizes; the sample sizes for those strata are shown in parentheses.

5 We calculated sample sizes that apply the 95/5 and 95/10 confidence/precision levels to the calculated measures in the Residential, Limited-Income, and Nonresidential groups as a whole, collapsed across strata. We used the pooled error rate for calculated measures for each group. We calculated the pooled 2007 and 2008 sample sizes by subtracting the 2006 group-level sample sizes from the estimated three-year pooled sample sizes and divided by two; however, in several cases, this produced very small samples for 2007 and 2008. In those cases, we conservatively set the estimated pooled 2007 and 2008 sample sizes at one-third of the estimated three-year pooled sizes; these are shown in parentheses.

well as calculated. We first computed sample sizes separately for calculated and prescriptive measures[5], using both 95/5 and 95/10 confidence/precision levels. We also calculated the sample sizes for each sample as a whole, using pooled error rates across the calculated and prescriptive measures for each group. We did this to identify the minimum sample size needed for each group, irrespective of the type of measure.

As expected, a 95/5 confidence/precision level would necessitate larger residential and nonresidential samples than we obtained in the 2006 verification (99 vs. 72 and 67 vs. 46, respectively). The 2007 and 2008 limited-income samples would be smaller than for the 2006 verification (27 vs. 64) because the documentation error rate for that group was relatively small. In fact, the estimated three-year pooled sample for the limited-income group (81) was only slightly greater than was obtained in the 2006 verification (64); to ensure that each year's verification would include at least one-third of the three-year pooled total, we indicated that the 95/5 sample size for the 2007 and 2008 limited-income paper-trail audits would be at least 27. When the 95/10 standard is applied, the pooled 2007 and 2008 sample sizes for all three groups are much smaller than those obtained in the 2006 verification (23 vs. 72, 7 vs. 64, and 16 vs. 46).

Based on the above considerations, it was possible to produce results with acceptable levels of confidence and precision—nearly as high as originally planned, at least at the entire-group levels—by drawing and examining samples that are not much larger than those examined in the 2006 verification.

Planned Sample Sizes for the Combined Paper-Trail and Savings Estimate Audit

Table 3.5 shows the planned sample sizes for the 2007 and 2008 verifications by group. We arrived at these figures by combining the sample requirements for the savings estimate audit of the calculated measures with the paper-trail audit requirements of both calculated and prescriptive measures. The primary criterion was that each group should, at a minimum, meet the 90/10 confidence/ precision standard for both the paper-trail and savings estimate audit.

The sample sizes for the calculated measures in the residential and limited-income groups were driven by the confidence/precision requirements of the therm savings audit. However, the sample size for the calculated measures in the nonresidential group was driven by the requirements of the paper-trail audit. As a result, the confidence/precision levels for the therm savings audit for this stratum are higher than for the others (>95/5 vs. 95/10).

We allocated the sample sizes within each group as shown in Table 3.6.

[5] As noted above, none of the measures in the Limited-Income were prescriptive.

Table 3.5: Revised Planned Sample Sizes

GROUP	SAMPLE SIZE		COMMENT
	THREE-YEAR	ONE-YEAR	
RESIDENTIAL			
Residential – Calculated	231	80	Achieves 95/10 confidence/precision for therm savings audit, >95/10 for paper trail audit
Residential – Prescriptive	51	17	Achieves 95/10 confidence/precision for paper trail audit
Residential Total	**282**	**97**	
LIMITED INCOME			
Limited-Income	182	61	Achieves 95/10 confidence/precision for therm savings audit, >95/10 for paper trail audit
NONRESIDENTIAL			
Nonresidential – Calculated	75	26	Achieves >95/5 confidence/precision for therm savings audit, 95/10 for paper trail audit
Nonresidential – Prescriptive	15	5	Achieves 95/10 confidence/precision for paper trail audit
Nonresidential Total	**90**	**31**	

Table 3.6: Planned 2007 and 2008 Sample Sizes by Stratum

STRATUM	SAMPLE SIZE	COMMENT
RESIDENTIAL		
Stratum 1, Windows (calculated)	40	"Calculated" measures divided evenly between Stratum 1 and 2; combined in paper-trail and therm savings audit.
Stratum 2, Insulation (calculated)	40	
Stratum 3, High-Efficiency Furnace (prescriptive)	4	No variability in HE Furnace in 2006; combined with Stratum 4 in paper-trail audit; number of HE Furnace approximately equal to number of most common measure type in Stratum 4.
Stratum 4, Other (prescriptive)	13	
Residential Total	**97**	
LIMITED-INCOME		
Stratum 1, Insulation	15	All strata are calculated measures. Under-sampled Stratum 1 and 2 and over-sampled Stratum 3 and 4. Stratum 4 is largest stratum because it is comprised of several measure types.
Stratum 2, Air Infiltration	15	
Stratum 3, ENERGY STAR® Windows/Door	12	
Stratum 4, Other	19	

STRATUM	SAMPLE SIZE	COMMENT
Limited-Income Total	**61**	continued
NONRESIDENTIAL		
Stratum 1, Largest Projects	5	N/A
Stratum 2, Calculated	26	No stratification within calculated measures
Stratum 3, Prescriptive	5	No stratification within prescriptive measures
Nonresidential Total	**31**	

Randomization

Within each customer type, we partitioned the list into the specified strata discussed above. Within each stratum, we created a new variable that was populated with a different random number for each record (using a uniform distribution). We ordered each data set by the random variable, which randomized the order of the cases within that set. Then, within each data set, we selected the first *n* cases, where *n* was the specified sample size for that stratum.

VERIFICATION METHODOLOGY

The verification methodology for all three programs shared three common components:

1. Reviewing the paper documentation of the sampled cases to verify that the input data used to calculate the therms saved on a case-by-case method were correct;
2. Performing an engineering review of the assumptions that went into Avista’s calculations of therm savings for the various measures; and
3. Independently calculating therm savings on a case-by-case basis, using either Avista’s assumptions or other sets of assumptions resulting from the engineering review.

Generally speaking, the verification methodology for the 2007 and 2008 audits did not differ from that for the 2006 audit. Any differences are indicated.

Review of Paper Documentation

Some differences existed among the programs and program strata in how measures were installed. These differences resulted in variances in the nature of the input data sources and how they were documented. We describe the procedures we followed in our review of paper documentation separately for each program (residential, limited-income, and nonresidential).

Residential Program

In the residential program, customers dealt directly with contractors for installation of measures. The customers recorded pertinent data about the measures on an Avista *Home Improvement Incentive Form* (rebate form) and submitted this form, together with invoices and other relevant documentation from the contractor, to Avista. Avista forwarded electronic copies of rebate forms, invoices, and other relevant documentation for the sample cases to Research Into Action.

Data Entry and Coding

For each sample stratum, we created an *Excel* workbook for recording details about the documentation received from Avista. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not the records, including an invoice, had been received; disposition codes; and notes describing any exceptions. In addition, each workbook included columns for recording the input data recorded for each case, such as R-values for insulation or U-factor for windows, as well as the therm savings claimed in Avista's database. Finally, each workbook had columns for recording the therm savings determined by the audit (as explained below) for each case.

For each case, we reviewed all invoices and other documentation to confirm the information listed on the rebate form for the measure in question. For example, if the rebate form listed a 40-gallon, high-efficiency gas water heater with an Efficiency Factor (EF) of .63, we checked to see whether the invoice and/or other documentation confirmed all of that information. Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. For the residential strata, the possible codes were:

1 = Invoice or other documentation confirms rebate form

2 = Invoice does not provide sufficient information to confirm rebate form

3 = Invoice contradicts rebate form

4 = Measure was incorrectly coded in the Avista database

5 = Does not qualify for a rebate

We assigned a code of "1" if the invoice or other documentation provided sufficient details to compute therm savings based on Avista's criteria and confirmed the information provided on the rebate form. For example, if the measure was a 40-gallon high-efficiency water heater and the invoice or other material documented that measure, as well as either the EF or the model number (which could be used to determine the EF), and the EF met Avista's eligibility standard, then we assigned a code of "1". Similarly, if the measure was a high-efficiency furnace and the invoice or other materials documented that measure as well as the AFUE% or model number, and the AFUE% met Avista's eligibility standard, then we assigned a code of "1". Note: if the invoice did not document the EF or AFUE%, we assigned a code of "1" if we were able to obtain this information based on the model information. In the case of insulation, the measure, area, and pre- and post- R-values were necessary.

For windows, it was necessary for the invoice to document the measure, as well as the area covered. In 2006 and 2007, different measure codes were used for windows facing different directions, which were listed separately on the rebate form. Documenting a particular window measure required documenting the direction of windows installed. However, we found that the invoice typically did not specify the direction that the windows faced. Therefore, our protocol was that if the invoice documented windows and a) it was possible to determine the total area of the windows and b) the total area recorded on the rebate form did not exceed the total area documented on the invoice, then we considered the measure verified and assigned a code of “1”.

In 2008, a single measure code was used for all new windows regardless of direction and a different single measure code was used for all replacement windows regardless of direction. All windows installed under a single project, therefore, were listed as a single measure on the rebate form, and so it was no longer necessary to document the direction the window faced.

We assigned a code of “2” if the invoice and other materials did not provide sufficient input data to confirm information on the rebate form. For example, if the invoice and other materials did not document the input data recorded on the rebate form, we assigned a code of “2”. Similarly, if the invoice and supporting materials documented neither EF nor the model for a water heater, or did not document the model or AFUE% for a furnace, we assigned a code of “2”. In the case of windows, we assigned a “2” if the area covered was not documented. For insulation, we assigned a “2” if the area, the existing R-value, or the final R-value was not documented.

We assigned a code of “3” if the invoice and/or other materials showed input data—such as the square feet of windows or insulation installed—that contradicted that shown on the rebate form. For the purposes of this audit, we defined “contradiction” as a difference such that the therm savings based on the value shown on the rebate form exceeds the therm savings based on the value documented in the input data by more than 5%.

For example, if the measure in question was windows or insulation, and the square footage recorded on the rebate form exceeded that recorded on the invoice or other documentation by more than 5%, we then assigned a disposition code of “3” (because the savings estimated from the rebate form exceeded by more than 5% the amount that would be estimated from the value on the invoice).

We assigned a code of “4” if the invoice or other documentation showed a measure other than what was recorded for that case in the Avista database.

Finally, we assigned a code of “5” if we found that the measure did not qualify for a rebate. This occurred in a few cases in which the EF of a water heater or AFUE% of a furnace was not documented, but in which we were able to obtain this information from the manufacturer and the EF or AFUE% did not meet Avista’s eligibility standards even though a rebate had been issued.

Note that a code of "3", "4", or "5" did not necessarily mean that there was not sufficient documentation of input data, but simply that those data may not have been correctly reported.

If the *Initial Disposition Code* was other than "1", we recorded an explanation in the workbook.

Data Clarification

If the information on the supporting documentation was incomplete, we attempted to obtain the missing information by contacting Avista and/or the manufacturer, supplier, or dealer of the installed measure. For example, if the EF for a water heater was not documented but the model number was, we contacted the manufacturer, supplier, or dealer to find out the EF for the listed model. Using the information obtained through these contacts, we assigned a *Final Disposition Code* to each case and updated the case notes.

Limited-Income Program

The limited-income program is non-prescriptive, so the analyses are performed and incentives offered on a site-specific basis. As noted above, CAPs directly install all measures in the limited-income program and record all input data either directly into software installed on notebook computers that they carry with them to the location of installation or onto paper forms. The customer neither completes a rebate form nor receives invoices or other supporting documentation from the installer, and little or no independent hard-copy documentation exists for any of the measures in this sample.

Avista forwarded to Research Into Action electronic copies of software screen captures or paper forms from the CAP agencies. All such documents were labeled *Invoice Form* and showed output data for the measure; in some cases, forms were included that showed input data that went into computing the output data.

Data Entry and Coding

As with the residential program, we created an *Excel* workbook to record details about the documentation we received for each case in the limited-income sample strata. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not the records had been received; disposition codes; and notes describing any exceptions. In addition, each workbook included columns for recording the input data recorded for each case, including the Avista-claimed therm savings, as well as a column for recording the therm savings determined by the audit.

Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. Disposition codes were defined so as to be consistent, to the degree possible, with the codes for the residential program. However, because of the way that measures were installed and documented in the limited-income program, the definitions of the first two codes are slightly different from those for the residential program. Moreover, the residential disposition code "3" –

which indicates a data disagreement between the rebate form and other documentation – does not apply to the limited-income program, as typically there was no independent paper documentation other than the rebate form in this program. Thus, the possible codes for the limited-income strata were:

1 = Sufficient input data and no coding errors

2 = Input data were not detailed

3 [This disposition not assigned]

4 = Measure was incorrectly coded in the Avista database

5 = Does not qualify for rebate

We assigned a code of "1" based on criteria similar to those for the residential program, except that there was no criterion of independently confirming the information on the rebate form (since there typically was no independent documentation). Instead, the criteria were that the invoice form should provide sufficient detail to compute therm savings, based on Avista's criteria, and to verify that the measure qualified for a rebate. For example, if the measure was a 40-gallon, high-efficiency water heater, and the invoice form documented that measure as well as either the EF or the model number (which could be used to determine the EF), and the EF met Avista's eligibility standard, then we assigned a code of "1". Similarly, if the measure was a high-efficiency furnace, and the invoice documented that measure, as well as the AFUE% or model number, and the AFUE% met Avista's eligibility standard, then we assigned a code of "1". As with the cases in the residential program, even if the invoice did not document the EF or AFUE%, if we were able to obtain this information based on the model information, then we assigned a code of "1". For windows, it was necessary for the invoice to document the measure, as well as the area covered. In the case of insulation, the measure, area, and pre- and post- R-values were necessary.

We assigned a code of "2" based on criteria similar to those for the residential program, except for the reference to confirming the information on the rebate form. Instead, the criteria were that the invoice form did not provide input data sufficient to compute therm savings or to verify that the measure qualified for a rebate. For example, if the invoice documented neither EF nor the model for a water heater, or it did not document the model or AFUE% for a furnace, we assigned a code of "2". In the case of windows, we assigned a "2" if the area covered was not documented. For insulation, we assigned a "2" if the area, the existing R-value, or the final R-value was not documented.

We did not assign a code of "3" to any of the cases in the limited-income program, as explained above.

We assigned a code of "4" if the invoice form showed a measure other than what was recorded for that case in the Avista database.

Finally, we assigned a code of "5" if the measure did not qualify for a rebate. As in the residential program, this occurred in a few cases in which the invoice did not document the EF of a water heater or AFUE% of a furnace but we were able to obtain this information from the manufacturer and found that the EF or AFUE% did not meet Avista's eligibility standards, even though a rebate had been issued.

As with the residential program, a code of "4" or "5" did not mean that there was not sufficient documentation of input data, but only that those data may not have been correctly reported.

Data Clarification

If the *Initial Disposition Code* was other than "1", we recorded an explanation in the workbook. For all such cases, we contacted Avista to attempt to obtain additional information to clarify the cases' disposition. Based on the results of our efforts, we assigned a *Final Disposition Code* to each case, using the same coding scheme as for the initial disposition.

Nonresidential Program

Projects in the nonresidential program included both non-prescriptive, custom engineering projects and prescriptive-rebate projects with a set energy savings value per item. For the custom projects, Avista completed the individual energy calculations either in spreadsheet tools or through modeling programs.

For each custom engineering project, Avista forwarded electronic copies of the project evaluation report, the agreement, invoices, and other relevant documentation to Research Into Action. Information for the pre-rinse sprayers consisted of an *Excel* spreadsheet, also supplied to Research Into Action, that listed: number of sprayers installed; equipment manufacturer; location of the sprayer; pre- and post-GPM data; water temperature data; and additional notes as necessary. Invoices for the purchase of the sprayer were not provided.

Data Entry and Coding

For each group, we created an *Excel* workbook to record details about the documentation received from Avista. Each workbook included columns for recording, on a case-by-case basis: the customer identification number (ID); the measure that was installed; whether or not records had been received; disposition codes; and notes describing any exceptions.

Based on the initial review of the documents, we assigned an *Initial Disposition Code* to each case. For the nonresidential strata, we assigned only two disposition codes:[6]

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6 For the 2006 audit, we attempted to use a coding system that was closer to the ones we used for the residential and limited-income programs. However, we found that the range of documentation issues that we

continued…

1 = Documentation reasonable

2 = Documentation problematic

We assigned a code of "1" if the documentation provided sufficient detail to compute therm savings that we felt reasonably confident in using to evaluate Avista's claimed savings. Sufficient documentation included data such as modeling inputs and/or outputs, baseline assumptions, and spreadsheet tools that allowed us to evaluate the project through our own use of models or spreadsheet, and to confirm the energy savings value reported by Avista.

We assigned a code of "2" if the documentation provided did not offer sufficient data to compute therm savings that we felt reasonably confident in using to evaluate Avista's claimed savings. Even if we assigned a code of "2", we nevertheless may have calculated estimates, but in such cases we do not necessarily recommend that our estimates be used instead of Avista's claimed therms.

If the *Initial Disposition Code* was other than "1", we recorded an explanation in the workbook.

Data Clarification

If the information in the supporting documentation was incomplete, we attempted to obtain the missing data by contacting Avista. For example, if the baseline assumptions used in the spreadsheet calculation of a project were not provided, we asked Avista for these assumptions. Using the information obtained, we assigned a *Final Disposition Code* to each case and updated the case notes.

Engineering Review

Residential Program

The engineering review of Avista's residential program consisted of a check against standard engineering practices, comparing Avista's reported energy savings to other utility DSM program offerings, and performing engineering calculations to verify savings on a measure-by-measure basis. We used Avista's assumptions and rebate qualifications for each measure (e.g., window U-value requirements, EF of water heaters) in the engineering review. We also evaluated them for appropriateness, such as by comparing them to code values for Washington and Idaho.

We performed the initial review of each measure during the program year when the measure was first identified in the sample. As described in Chapter 4, we repeated the review for some

encountered tended to be project-specific and did not fit neatly into a limited set of categories. Therefore, we simplified the coding system as described above.

measures in response to new information, changes in baseline assumptions or efficiency standards reported by Avista, or other similar changes.

The following outlines the review methods for each measure in the program:

- **High-Efficiency Furnace and Gas Boiler:** The review included the use of ENERGY STAR®'s online calculator[7] for the regions in Avista's Washington and Idaho territory, along with values used by other utility companies for similar baseline and retrofit requirements, adjusted for heating-degree-days.
- **High-Efficiency Water Heater (40- and 50-gallon):** The review included engineering calculations using Avista's Energy Factor (EF) qualifications and a comparison with other utility company reported values for similar baseline and retrofit requirements.
- **High-Efficiency Tankless Water Heater:** The review included engineering calculations using a baseline EF of 0.58 and a retrofit EF of 0.82 (typical for tankless water heaters), and a comparison with savings values reported by other utility companies and the California Database for Energy Efficient Resources (DEER).
- **Ceiling/Attic/Floor/Wall/Duct Insulation Measures:** The review included engineering calculations based on the *modified heating-degree-day* method, using Avista's stated baseline and retrofit assumptions. We also used heating-degree-days for specific cities where insulation measures were installed and a seasonal equipment efficiency rating of 0.60 in the calculations.
- **New Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals*[8] method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of a new window. We used baseline and retrofit assumptions for U-factors, as stated by Avista, in the analysis. We also used heating-degree-days for specific cities where insulation measures were installed and a seasonal equipment efficiency rating of 0.60 in the review.
- **Replacement Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals* method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of a replacement window. We used baseline and retrofit assumptions for U-factors, as stated by Avista, in the analysis. We also used heating-

7 See the ENERGY STAR® website: http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammablethermostat.xls.

8 *2005 ASHRAE Handbook Fundamentals*, Section 27.21, "Residential Calculations Examples," Equation 40.

degree-days for specific cities where insulation measures were installed and a seasonal equipment efficiency rating of 0.60 in the calculations.

- **Programmable Thermostats:** The review included running ENERGY STAR®'s online calculator for programmable thermostats, using all available locations in Avista's Washington and Idaho service territory, and averaging the savings results across all regions. We discounted the ENERGY STAR® savings value to 25%, based on Energy Information Administration (EIA) surveys, which reported that only 25% of installed programmable thermostats are correctly programmed.[9]
- **ENERGY STAR® Homes.** The review included a comparison of deemed values used by other utility companies (Rocky Mt. Power and UniSource Energy Services) for Energy-Star homes. We compared the baseline and retrofit assumptions, as well as heating degree days in each region.
- **High-Efficiency Clothes Washer.** The review of this measure included the use of ENERGY STAR®'s online calculator[10] for the estimated annual natural gas usage for conventional clothes washers, along with a comparison of the baseline Modified Energy Factor (MEF) of 1.26 to the replacement clothes washer MEF.
- **High-Efficiency Dishwasher.** The review of this measure included the use of ENERGY STAR®'s online calculator[11] for the estimated annual natural gas usage for conventional dishwashers, along with a comparison of the baseline Energy Factor (EF) of 0.45 to the replacement dishwasher EF.

Limited-Income Program

All of the projects in the limited-income program were custom projects. Therefore, our engineering review of the limited-income program consisted of a check against standard engineering practices. We used baseline and retrofit values reported for each measure (e.g., window U-values, insulation R-values) in the engineering review.

The following outlines the review methods for each measure in the program:

- **Air Infiltration:** The review included calculating heating energy savings achieved by heating less infiltrated outside air to the desired inside air temperature. Air change rates

9 *A Look at Residential Energy Consumption in 1997*, DOE/EIA-0632 (97), Energy Information Administration.

10 See the ENERGY STAR® website: http://www.energystar.gov/index.cfm?c=clotheswash.pr_clothes_washers CalculatorConsumerClothesWasher.xls.

11 See the ENERGY STAR® website: http://www.energystar.gov/index.cfm?c=dishwash.pr_dishwashers CalculatorConsumerDishwasher.xls.

before and after infiltration reductions were used to capture the associated heating energy savings. The assumptions and inputs used in the calculations were taken from customer files provided by Avista or from standard engineering manuals' practices.

- **ENERGY STAR® Windows:** The review of this measure included engineering calculations based on a decrease in air infiltration (using the *2005 ASHRAE Fundamentals* method for infiltration reduction) and conduction (using the *modified heating-degree-day* method) due to the installation of ENERGY STAR® windows. Baseline and retrofit values for each customer were provided by Avista and used in the analysis.
- **ENERGY STAR® Doors:** A review of the measure was not completed because no such measure was selected in the sample.
- **High-Efficiency Furnace:** The review included the use of ENERGY STAR®'s online calculator for the regions in Avista's Washington and Idaho territory, along with values used by other utility companies for similar baseline and retrofit requirements, adjusted for heating-degree-days.
- **High-Efficiency Water Heater (40- and 50-gallon):** The review included engineering calculations using Avista's Energy Factor (EF) qualifications and a comparison with other utility company reported values for similar baseline and retrofit requirements.
- **High-Efficiency Tankless Water Heater:** The review included engineering calculations using a baseline EF of 0.58 and a retrofit EF of 0.80 (typical for tankless water heaters), and a comparison with savings values reported by other utility companies and the California DEER database.
- **Ceiling/Attic/Floor/Wall/Duct Insulation Measures:** The review included engineering calculations based on the modified heating-degree-day method. Baseline and retrofit values for each customer were provided by Avista and used in the analysis.
- **Health and Human Safety:** These measures typically fell under one of the categories already provided and the methodology used to evaluate the energy savings was the same as provided for each measure type (e.g., air infiltration reduction).

Nonresidential Program

For the engineering review of the Avista nonresidential programs, we carried out a project-by-project analysis of the measures installed and the energy savings reported. As part of the evaluation, we reviewed the engineering calculations, modeling simulations, and assumptions that Avista used for each project, along with a check against standard engineering practices, in order to determine the accuracy of the methodologies used to determine energy savings. We performed separate engineering calculations and modeling simulations to verify accuracy if we deemed it necessary.

As noted earlier, prescriptive incentives for several new food service measures were introduced in 2008. The sample applications included prescriptive applications for demand controlled ventilation (DCV), vent hoods, gas fryers, and gas combination ovens. Nexant evaluated assumptions, methods, and calculations for each of these measures, utilizing pertinent resources from the Food Service Technology Center (FSTC) and the Regional Technical Forum (RTF). For other prescriptive measures, Nexant consulted other sources such as Database for Energy Efficient Resources (DEER) and calculators provided by EnergyStar

Calculation of Therm Savings

Residential Program

As a check of Avista's therm savings estimates, we independently calculated therm savings for each record using the input data recorded on the rebate form as verified or revised through our audit of the accompanying documentation. If our engineering review of residential measures supported Avista's prescribed per-unit savings values or recommended a higher per-unit value, we used the Avista value. If our engineering review recommended a lower per-unit value, we used that.

For each case in each sample stratum, we computed the difference between Avista's estimate of therm savings and ours. We excluded cases for which the documentation did not provide sufficient data to compute an estimate, as specified above. However, we included cases with final disposition codes of "3" (invoice and/or other documentation contradicts the rebate form) or "4" (incorrectly coded) if we had sufficient data to compute an estimate; we also included cases with a final disposition code of "5" (not qualified), assigning a value of "0" saved therms. The reasoning was that these cases provide appropriate information regarding Avista's computations of therm savings on a case-by-case basis. Note, however, that they also are included in our paper-trail analysis, which shows the percentage of cases with documentation problems.

Limited-Income Program

For the limited-income sample, we calculated savings on a measure-by-measure basis. We used Avista's assumptions and methods if confirmed in our engineering review; if our engineering review did not confirm Avista's assumptions and methods, we substituted our own proposed ones.

For each case, in each sample stratum, we computed the difference between Avista's estimate of therm savings and ours. We excluded cases for which the documentation did not provide sufficient data to compute an estimate. However, we included cases with final disposition codes of "3" (invoice and/or other documentation contradicts the rebate form) or "4" (incorrectly coded) if we had sufficient data to compute an estimate; we also included cases with a final disposition code of "5" (not qualified), assigning a value of "0" saved therms. The reasoning was that these cases provide appropriate information regarding Avista's computations of therm savings on a case-by-case basis. Since we performed this analysis simply as a check of Avista's computations, not to provide alternative estimates of therm savings, including these cases is proper. Note, however, that they also are included in our paper-trail analysis, which shows the percent of cases with documentation problems.

Nonresidential Program

The nonresidential Stratum 1 (*Largest Projects*) and Stratum 3 (*All Other Measures*) are custom projects, in which the calculated energy savings are based on the conditions of the baseline and retrofit system. In the data analysis for these groups, we recalculated the therm savings for all cases, based on the results of our engineering analysis; in most cases, this did not involve a "check" of Avista's computation for the project. Stratum 2 (*Prescriptive Measures*) involved a pre-negotiated energy savings value per item and, therefore, was the only nonresidential group that involved a check of Avista's assumed therm value and recorded data. For this group, we used an Avista-supplied value per unit and the input data (number of units per location) recorded in Avista's tracking spreadsheet to compute therm savings for each case. For each case, in all three strata, we computed the difference between Avista's estimate of therm savings and ours.

Unlike the residential and limited-income cases, we did not exclude cases based on disposition code. However, we noted cases in which documentation issues resulted in audit estimates that should not be used to evaluate Avista's claimed savings.

DATA ANALYSIS AND PRESENTATION

Paper-Trail Analysis

Our paper-trail analysis for all programs consisted of computing the percent of cases in each residential stratum with each final disposition code, along with 90% confidence intervals (CIs).

Therm Savings Analysis

For each stratum, we calculated the mean, standard deviation, and mean standard error of the case-by-case difference between Avista's estimated therm savings and our calculation of the saved therm. We used the standard errors to compute 90% CIs around the mean differences.

Weighting Data for Combined Results

As in the 2006 and 2007 audit, before we combined the data from the various strata we assigned weights to each stratum to account for the fact that the population-to-sample ratio differed among them. We did this for both the paper-trail audit and the savings estimate audit.

For each disposition, the formula for determining the weighted *n* was:

$$(n_1 * w_1) + (n_2 * w_2) + \ldots + (n_z * w_z)$$

where:

n_1, n_2, … and n_z = the number of cases with disposition x in Stratum 1, 2, … to z

w_1, w_2, … and w_z = the weights of Stratum 1, 2, … to z

Weights were calculated as:

$$(N_i / n_i) / (N_{1-4} / n_{1-z})$$

where:

N_i = the population for Stratum *i*

n_i = the sample size for Stratum *i*

N_{1-z} = the combined population for all strata

n_{1-z} = the combined sample size for all strata

Similarly, in the therm savings analysis, we applied weights to each stratum mean before combining the strata.

Combining 2006, 2007, and 2008 Results

We also report data for the combined 2006, 2007, and 2008 samples. Since we redefined the sample strata for the 2007 audit, we re-stratified the 2006 audit data using the 2007 (and 2008) audit definitions. In addition, before we combined the data across the three years of the audit, we applied weights to account for the fact that the population-to-sample ratio for each stratum differed by year.

4 RESULTS

We present the results separately for the residential, limited-income, and nonresidential programs. For each program, the results for the documentation review are followed by those for the engineering review and evaluation of Avista's savings estimates. Results are shown for the 2008 audit and the combined 2006-2008 program years. (The individual data for each project for program year 2008 are presented in Table A.1 through Table A.3 in Appendix A.)

RESIDENTIAL PROGRAM

The following describes the results of the documentation review and analysis of estimated savings for the residential program for both the 2008 program year and the combined 2006-2008 program years.

Database Review

During preparation of the sample weights for the 2008 residential audit, we identified several database records, not selected for the sample, that were classed as gas measures but showed no therm savings or that showed therm savings that were inconsistent with the prescribed amount. We brought these to the attention of Avista's database manager, who reviewed the records and provided explanations.

A total of 43 such records were identified. The following issues were identified:

- **One (1) record identified as "Electric ENERGY STAR® home – gas only" showed no therm savings.** Avista's database manager verified that this record was miscoded: it was an electric-only measure and should not have been identified as "gas only." No therm savings were claimed.
- **Nine (9) records identified as "Gas high-efficiency tankless water heater" showed no therm savings.** Avista's database manager verified that these records were miscoded and should have been recorded as "All electric window replacement." No therm savings were claimed.
- **Five (5) records identified as "Electric new high-efficiency ground pump", six (6) identified as "Electric to ground heat pump conversion", and 22 identified as "Gas ENERGY STAR® home – gas only" showed a range of therm savings.** Avista's database manager verified that these records were miscoded and should have been recorded as gas window measures with the claimed therms as recorded.

Avista's database manager reported correcting the database for all of the above cases. The identified records accounted for about 0.5% of the 2008 database. This was a significantly lower rate of misclassification than that identified in the sample, as reported below. Therefore, it is likely that the general rate of misclassification of records does not substantially exceed that reported below.

Documentation Review

Table 4.1 shows the summary final disposition data for the residential sample for program year 2008 and the combined weighted data for program years 2006 through 2008. The table shows the number and percentage of cases with each of five dispositions plus the 90% CIs around the percentages. The table shows the raw, or unweighted, number of cases with each disposition. However, the percentages shown in the table are weighted to account for differences in the sampling ratios across sample strata and across program years.[12]

Table 4.1: Final Disposition of Sampled Residential Cases

YEAR	DISPOSITION	2008 DATA		
		NUMBER OF CASES[1]	PERCENT	90% CONFIDENCE INTERVAL (CI)
2008	1 = Documentation supports input data	106	96.1	95.8 - 96.4
	2 = Insufficient documentation	1	0.2	0.2 - 0.3
	3 = Documentation contradicts input data	3	1.5	1.3 - 1.7
	4 = Measure was incorrectly coded	1	2.1	1.9 - 2.3
	5 = Measure does not qualify for rebate	0	0.0	0.0 - 0.0
	TOTAL	111	100.0	
2006-2008 (Weighted)	1 = Documentation supports input data	247	88.2	87.9 - 88.4
	2 = Insufficient documentation	11	3.0	2.9 - 3.1
	3 = Documentation contradicts input data	12	3.4	3.3 - 3.5
	4 = Measure was incorrectly coded	4	1.8	1.8 - 1.9
	5 = Measure does not qualify for rebate	7	3.6	3.5 - 3.7
	TOTAL	280[2]	100.0	

1 For readability, raw (unweighted) counts are shown in the table. However, percentages were based on counts that were weighted to account for differences in the sampling ratios across strata and across program years.

2 The number of cases of each disposition sum to 280, not 281, because one case represented both disposition '3' and disposition '4'. If that case had been counted twice, the total would be 281.

12 Henceforth, all percentages discussed are based on weighted data unless otherwise specified.

Final Dispositions

For the 2008 sample, the input data were well documented for 106 of the 111 cases sampled. When weights are applied to the individual strata data to account for differences in sampling ratios, the weighted percent of cases with well-documented input is 96.1% (± 0.3%).[13] This represents an increase over that found in the 2007 audit (83.5%) and the 2006 audit (82.0%). The weighted percentage across program years is 88.2% (± 0.2%).

Summary data on final dispositions are shown for each stratum and each program year in Table B.1 in Appendix B.

Types of Documentation Problems

Only five documentation errors were identified in the 2008 residential sample. A total of 34 documentation errors were identified over the three-year audit.

Cases for which the invoice and/or other documentation provided insufficient detail to verify the therm savings recorded in Avista's database (disposition '2') accounted for 1 of the 5 cases with documentation errors in 2008 and 11 of 34 across the three-year audit. Seven of the 11 records were for windows installation in which the invoice did not provide details on window dimensions or size and it could not be obtained from the vendor. The other four were for insulation for which the invoice similarly did not document the amount of insulation installed and that information could not be obtained from the vendor. Based on the sample, we estimate that this type of error occurred in 0.2% of all 2008 records and 3.0% of all records across the three program years.

We uncovered three cases in which the invoice provided information that contradicted the rebate form (disposition '3') in 2008, and 12 cases across the three-year audit.[14] Eight of these cases were windows installation in which the therm savings claimed in Avista's database exceeded by at least 5% the savings that could be calculated from the documented square footage of windows installed. Four cases were insulation installation in which the therm savings claimed in Avista's database similarly were at least 5% greater than the savings that could be calculated from the documented square footage of insulation installed. We estimate that this type of error occurred in 1.5% of all 2008 records and 3.3% of all 2006-2008 records.

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13 For the convenience of the reader, the 90% CI is expressed in the text as ± half the CI.

14 In the 2006 report, three additional cases were reported as having documentation that contradicted the rebate form. All were cases of replacement windows. A review of all records indicating documentation errors, carried out for this final report, found that all three should have been classified as confirmed because the square footage of windows on the invoice, although differing somewhat from that shown on the rebate form, was within 5%. The IDs for these cases are 1214, 1787, and 2173.

We found one measure that was incorrectly coded (disposition ‘4’) in the 2008 audit and four, total, from 2006 through 2008.[15] All four cases were different: one was a high-efficiency 50-gallon water heater that was coded as a 40-gallon model; one was an all-electric ENERGY STAR® home that was coded as a gas measure; one was an ENERGY STAR® clothes washer that was coded as a dishwasher; and one was duct insulation that was miscoded as a fireplace damper. The last case—the miscoded duct insulation—also was counted as disposition ‘4’ because the number of therms claimed in Avista’s database exceeded the amount that could be determined from the documented amount of duct insulation for that case. The estimated rate of occurrence of this type of error is 2.1% for 2008 and 1.8% across the three program years.

There were no 2008 cases in which a measure should not have qualified for a rebate (disposition ‘5’), seven cases in the combined 2006-2007 data. In four cases, the measure was a water heater that did not meet the prescriptive efficiency standard. Each of the other three cases was different: one was replacement windows installation for which the windows did not meet the prescriptive efficiency standard; one was insulation installed under exterior siding, which does not qualify; and one was for a boiler that did not meet the prescriptive efficiency standard. The estimated rate of occurrence of this type of error across the three program years is 3.6%.

A description of each sampled residential case with disposition 2, 3, 4, or 5 is shown in Table C.1 in Appendix C.

Engineering Review

The engineering review of Avista’s residential program consisted of a check against standard engineering practices, comparing Avista’s reported energy savings to other utility DSM program offerings, and performing engineering calculations to verify savings on a measure-by-measure basis. The initial review was carried out on measures identified in the 2006 audit; it has been updated in subsequent years to account for newly identified measures, new information, or changes to existing measures.

Our engineering evaluation of most measures produced per-unit estimates that were slightly at variance with Avista’s, but in most cases not so much as to warrant replacing Avista’s per-unit estimates with our own. In some cases, Avista has revised its claimed therm savings for a measure based on new information, changes in efficiency standards, or some other reason. In such cases, we re-evaluated the claimed savings for the measure and generally agreed with

15 In the 2006 report, two additional cases were reported as having been incorrectly classified. In both cases, the rebate form indicated the measure was “High-Efficiency Water Heater 50-gallon” but the invoice stated that they were tankless water heaters. Subsequent discussion with Avista clarified that Avista used the same measure code for both measures, since they both had the same level of prescribed savings. Our engineering review accepted Avista’s prescribed savings for both the measures (but recommended a higher level of savings for the tankless water heaters), so there is no reason to consider these as misclassified. The IDs for these cases are 121 and ID 1083.

Avista's values. We also re-evaluated the claimed savings for a measure if new information because available for that measure, even if Avista did not change its claimed savings for it.

Table 4.2 summarizes the results of our engineering evaluations for the three program years. The following provides more detail on our engineering evaluation of each measure:

- **High-efficiency natural gas furnace and high-efficiency natural gas boiler:** In 2006 and 2007, Avista claimed 71.6 therms per unit for these measures, which our engineering review confirmed. In 2008, Avista increased the therm savings to 123 based on an updated analysis of annual heating BTU consumption requirements, primarily driven by a change in area of heat loss for the shell to include floor space, which was not included previously. In addition, Avista increased the minimum efficiency standard for the boiler measure to 90% to match that of the furnace measure. Our engineering review confirmed the new value of 123 therms for the furnace; the boiler was not identified in the 2008 sample, so our engineering review did not re-evaluate it.
- **High-efficiency natural gas water heater (40- and 50-gallon):** Avista claimed 11 and 8 therms, respectively, for these measures in 2006 and 2007. In 2006 and 2007, our engineering review verified that savings would be at least those that Avista claimed, based on engineering calculations using the baseline and retrofit qualifications listed by Avista, with some assumptions about usage and water consumption. We accepted sampled records with those savings as verified. However, we recommended that in the future, Avista should reverse the claimed savings for these two measures, as switching from a less efficient to a more efficient 50-gallon water heater should produce more savings than switching from a less efficient to a more efficient 40-gallon water heater. In 2008, Avista changed the claimed savings to 8 therms for the 40-gallon water heater and 11 therms for the 50-gallon heater, which our engineering review accepted.
- **High-efficiency natural gas water heater (tankless):** Avista claimed 11 therms for this measure in the 2006 and 2007 programs. In 2006, our audit verified 28 therms for this measure and recommended that 28 therms be claimed. In 2007, based on new information[16], our audit verified at least 52 therms for this measure and recommended that at least 52 therms be claimed.[17] In 2008, Avista increased the minimum EF for this

16 *Residential Deemed Savings, Efficiency, and Installation Standards for Arkansas Statewide QUICKSTART Programs*, Frontier Associates LLC, April 2, 2007.

17 The exact level of savings is based on the size of replaced storage tank. If a 50-gallon tank is replaced, up to 66 therms could be claimed. We cite 52 therms as a conservative minimum.

measure from .65 to .82 and changed the claimed savings to 60 therms. Our engineering review verified these claimed savings.

Table 4.2: Summary of Engineering Evaluation for Residential Program

MEASURE	UNIT	2006 AUDIT		2007 AUDIT		2008 AUDIT	
		SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	AUDIT RECOMMENDED SAVINGS	SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	AUDIT RECOMMENDED SAVINGS	SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	AUDIT RECOMMENDED SAVINGS
High-Efficiency Natural Gas Furnace	per measure	71.6	71.6	71.6	71.6	123	123
High-Efficiency Natural Gas Boiler	per measure	71.6	71.6	71.6	71.6	123	--[1]
High-Efficiency Natural Gas Water Heater (40-Gallon)	per measure	11	8	11	8	8	--[1]
High-Efficiency Natural Gas Water Heater (50-Gallon)	per measure	8	11	8	11	11	11
High-Efficiency Natural Gas Water Heater (Tankless)	per measure	11	28	11	≥52	60	60
Ceiling/Attic Insulation	per sq ft	0.042	0.042	0.042	0.042	0.09	0.09
Floor Insulation	per sq ft	0.209	0.209	0.209	0.209	0.31	0.31
Wall Insulation	per sq ft	0.209	0.209	0.209	0.209	0.31	0.31
Duct Insulation	per linear ft	2.8	2.8	2.8	--	2.8	--[2]
New Windows	per sq ft	0.42	0.42	0.42	0.42	0.42	0.42
Replacement Windows	per sq ft	0.83	0.83	0.83	0.83	0.83	0.83
Programmable Thermostat W/AC	per measure	31	31	31	31	31	--[1]
ENERGY STAR® Homes	per measure	197	--[3]	197	197	197	--[1]

MEASURE	UNIT	2006 AUDIT		2007 AUDIT		2008 AUDIT	
		SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	AUDIT RECOMMENDED SAVINGS	SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	AUDIT RECOMMENDED SAVINGS	SAVINGS AVISTA REPORTED AS PROGRAM STANDARDS	AUDIT RECOMMENDED SAVINGS
ENERGY STAR® Dishwasher	per measure	--	--	--	--	5[4]	5
ENERGY STAR® Clothes Washer	per measure	--	--	--	--	9[4]	9

1 This measure was not identified in the 2008 sample, so it was not re-evaluated.

2 Duct insulation has been discontinued in Avista's residential program, so no savings are recommended for program year 2008.

3 This measure was not identified in the 2006 sample, so it was not evaluated until 2007.

4 New measure in 2008.

- **Insulation (ceiling/attic and floor/wall):** In 2006 and 2007, Avista claimed .042 therms per square foot of qualifying ceiling/attic insulation installed and .209 therms per square foot of qualifying floor/wall insulation installed. In 2008, Avista increased these to .09 and .31 therms, respectively. The increase was based on a review of records from prior program years that showed that average existing insulation levels were lower than had been assumed and that, on average, more than the minimum R-10 was being added. Our engineering review verified these values.
- **Duct insulation:** In 2006 and 2007, Avista claimed 2.8 therms per linear foot of this measure, which our engineering review verified. Duct insulation has been discontinued in Avista's residential program, so no savings are recommended for program year 2008.
- **New and replacement windows:** Our engineering review verified Avista's claimed savings of 0.42 and .83 therms per square foot for energy-efficient new and replacement windows, respectively, which has remained the same from 2006 through 2008. In 2008, Avista discontinued the rebate for new windows, although some rebates were given before it was discontinued.
- **Programmable thermostat:** Our engineering review verified Avista's claimed savings of 31 therms per unit for this measure, which has remained the same from 2006 through 2008.
- **ENERGY STAR® homes.** No engineering review was performed for ENERGY STAR® Homes as part of the 2006 audit as there were no cases of this measure in the sample. The engineering review performed for the 2007 audit indicates that the heating-degree-days-adjusted value could be as high as 283 therms for this measure; however, we recommended that Avista continue using its value of 197. This was not re-evaluated in 2008.
- **ENERGY STAR® dishwasher and ENERGY STAR® clothes washer:** These were new measures in 2008. Our engineering review verified Avista's claimed savings of five and nine therms per measure, respectively, and recommended these savings.

Analysis of Avista's Savings Estimates

For each case, we subtracted our calculation of saved therms from Avista's estimates to yield a *difference score* for that case. Therefore, a positive number indicated that Avista's estimate exceeded our calculation and a negative number indicated that Avista's estimate was less than our calculation. The purpose of computing a difference score was to remove any variance associated with differences among measure types from the comparison of our estimates with Avista's estimates.

Table 4.3 summarizes the results for the difference scores for both 2008 and the combined 2006-2008 data. For each, the table shows the mean Avista-reported savings, the mean savings as computed by the audit, the mean difference between Avista's reported savings and our computed savings, the mean difference expressed as a percentage of Avista's estimate[18], the 90% confidence interval around the mean difference, and the minimum and maximum difference scores found within that stratum.

Table 4.3: Comparison of Avista's Reported Residential Therm Savings and the Audit's Values

YEAR	AVISTA MEAN	AUDIT MEAN	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL (CI)	RANGE
			VALUE	PERCENT		
2008	83.3	87.0	-0.2	-0.2	-1.5 – 1.2	-55 – 189
2006 to 2008	75.3	74.3	3.2	4.3	0.7 – 5.8	-63 – 280

Note: As described in Chapter 3, *Audit Methods*, the mean difference is based on difference scores computed on a case-by-case basis and then weighted to account for differences in sampling ratios between sample strata and from year to year. This mean of the individual difference scores is not necessarily equal to the difference between the Avista and audit means.

As described above, we assigned weights that reflect the sampling ratio of each stratum before computing the means, confidence interval, and difference percent for each program year. The minimum and maximum values for the combined sample are simply the minimum and maximum values found across all strata.

The weighted combined results of the 2008 audit showed a mean underestimation of -0.2 ±1.3 therms, representing a weighted mean underage of 0.2%. The combined 2006-2008 data showed a mean overestimation of 3.2 ±2.6 therms, a mean excess of 4.3%. Based on the 90% CI for the combined data, we can have 90% confidence that, across all measures for the combined 2006, 2007 and 2008 program years, Avista overestimated savings by a mean of no more than 5.8 therms and by as little as 0.7 therms per measure.

Across the three program years, the precision of the mean difference estimate was ±2.6 therms, which is about 3.5% of Avista's mean estimated savings. Thus, the requirement of 10% precision (at 90% confidence) was well surpassed for the residential program.

In the combined 2006-2008 data, new and replacement windows showed the smallest mean difference between Avista's claimed savings and the audit's results and insulation showed the largest mean raw difference; other measures showed larger percent differences.

Summary data are shown for each stratum and each program year in Table B.2 in Appendix B.

18 In the 2006 audits, we reported the difference expressed as a percentage of our estimate, rather than as a percentage of Avista's estimate. However, this prevents the computation of a percentage in instances in which we assigned a value of 0 saved therms (e.g., in the case of measures that should not have qualified for a rebate), since it is not possible to divide by 0. Therefore, the difference is expressed as a percentage of Avista's estimate, which was nonzero in all cases.

LIMITED-INCOME PROGRAM

Documentation Review

Table 4.4 shows summary final disposition data for the limited-income sample. For the 2008 audit and the combined 2006-2008 sample, this table shows: the number and percentage of cases (with 90% CIs) with each of the four dispositions available for the limited-income group.

Table 4.4: Final Disposition of Sampled Limited-Income Cases

YEAR	DISPOSITION	2008 DATA		
		NUMBER OF CASES[1]	PERCENT	90% CONFIDENCE INTERVAL (CI)
2008	**1 = Documentation supports input data**	68	100.0	100.0 – 100.0
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	3 = Documentation contradicts input data	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	68		
2006-2008 (Weighted)	**1 = Documentation supports input data**	191	99.6%	99.5 – 99.6
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	3 = Documentation contradicts input data	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	2	0.4	0.4 – 0.5
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	193		

We were able to obtain sufficient documentation to perform analyses for all 68 cases sampled in 2008. Across the combined 2006-2008 data, we were able to perform analyses for 99.6% (weighted) of the cases, with a 90% CI of 99.5% to 99.6%.

Note that a disposition of '1' does not mean that documentation was perfect. In the 2006 through 2008 audits, we encountered cases in which it was necessary to assume baseline and retrofit assumptions and for which we discovered that some test measurements had not been recorded correctly by the CAP agencies that performed them.

Summary data on final dispositions are shown for each stratum and each program year in Table B.3 in Appendix B. A description of each sampled limited-income case with disposition 2, 4, or 5 is shown in Table C.2 in Appendix C.

Analysis of Avista's Savings Estimates

The engineering evaluation for all measures of the limited-income program included a project-by-project analysis based on the inputs provided by the CAPs. For each case for which we were able to calculate energy savings, we computed a *difference score* and computed the percent by which Avista's claimed savings exceeded or fell below our calculation.

Table 4.5 summarizes the results for the difference scores for each stratum of the limited-income sample. As for the residential sample, it shows the mean difference score with its 90% confidence interval, the mean difference percentage, and the range of difference scores found within each stratum as well as for the entire 2007 sample and the combined 2006-2007 sample.

Table 4.5: Comparison of Avista's Reported Limited-Income Therm Savings and the Audit's Values

YEAR	AVISTA MEAN	AUDIT MEAN	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL (CI)*	RANGE
			VALUE	PERCENT		
2008	98.8	129.5	30.7	23.7	9.8 – 51.7	-79 – 343
2006 to 2008	112.0	135.0	23.6	17.5	10.7 – 36.8	-175 – 343

Note: As described in Chapter 3, *Audit Methods*, the mean difference is based on difference scores computed on a case-by-case basis and then weighted to account for differences in sampling ratios between sample strata and from year to year. This mean of the individual difference scores is not necessarily equal to the difference between the Avista and audit means.

* The sample sizes generally were at least 5% of the population; therefore, the 90% CI incorporates finite population correction factor.

We found a large number of discrepancies between Avista's claimed savings and our estimates when comparing them on a case-by-case basis. In fact, the number of cases with large discrepancies was greater for 2008 than in previous years.

This is reflected in the fact that the weighted mean difference between Avista's reported savings and the audit's estimate was greater for the 2008 sample (30.7 ±21.0 therms, a mean overestimate of 23.7%) than in the combined 2006-2008 sample (23.6 ±13.2 therms, a mean overestimate of about 17.5%).

Across the three program years, the precision was ±13.2 therms, which is 10.4% of Avista's mean estimated savings. Thus, the precision for the limited-income program was only very slightly less than the targeted value of 10% precision (at 90% confidence).

We are unable to account for the large discrepancies in the 2008 data or for the greater number of large discrepancies found in 2008 than previously. However, note that the 90% CI for 2008 is not much larger than that for the combined sample. Thus, we cannot reject with much certainty the idea that the population from which the 2008 sample was drawn was similar to those for the previous program years. This implies that, had we evaluated all limited-income records, or even a larger sample of them, the mean discrepancy might have been similar for all program years.

Summary data are shown for each stratum and each program year in Table B.4 in Appendix B.

NONRESIDENTIAL PROGAM

Documentation Review

Table 4.6 shows summary final disposition data for the three nonresidential groups. Recall that, for the nonresidential program, we performed a census evaluation of the *Largest Projects* and a stratified random sample of the remaining projects. The two sampled strata were: *Prescriptive Measures* and *Other Measures*. This table shows, for each group, the number and percentage of cases (with 90% confidence intervals) with each of two dispositions, and weighted data for the combined sample (excluding the largest projects), calculated with the same method as for the residential program (see above).

Table 4.6: Disposition of Nonresidential Cases

YEAR	DISPOSITION	2008 DATA		
		NUMBER OF CASES[1]	PERCENT	90% CONFIDENCE INTERVAL (CI)
LARGEST PROJECTS (STRATUM 1)				
2008	**1 = Documentation reasonable**	6	54.5%	N/A
	2 = Documentation problematic	5	45.5%	N/A
	TOTAL	11	100.0%	N/A
2006-2008	**1 = Documentation reasonable**	16	69.6%	N/A
	2 = Documentation problematic	7	30.4%	N/A
	TOTAL	23		N/A
SAMPLED STRATA				
2008	**1 = Documentation reasonable**	18	54.5%	49.8 – 59.2
	2 = Documentation problematic	14	45.5%	40.8 – 50.2
	TOTAL	32	100.0%	
2006-2008 (Weighted)	**1 = Documentation reasonable**	71	72.8%	71.8 – 73.7
	2 = Documentation problematic	38	27.2%	26.3 – 28.2
	TOTAL	109		

continued

The table shows that for 6 of the 11 largest projects we were able to obtain detailed documentation sufficient to calculate an independent estimate of savings against which we were confident in evaluating Avista's claimed savings. This is a somewhat lower percentage of large projects compared to the previous audits, in which we were able to obtain detailed documentation for six of the seven largest projects in 2006 and four of the five largest in 2007. In total, over the three program years, we have been able to calculate independent estimates that we considered reliable for 16 of the 23 largest projects.

In the cases that we coded as "documentation problematic" (Applications 25005, 25006, 25032, 25056, and 26379), we were unable to obtain or verify many details of the model used to generate Avista's estimate; in addition, other inputs that were provided appeared to be possibly inaccurate and were inconsistent with the documentation. For example, baseline boiler efficiencies and HVAC system types in the eQUEST models did not correspond to the documentation provided, or there were inconsistencies with the ESCO reports regarding the HVAC systems. In the case of Applications 25056 and 26379, the selection of the baseline HVAC system for comparison strongly affects the savings (See Appendix D for additional details).

For the sampled strata, we obtained sufficient documentation to calculate a reliable estimate for 18 of 32 cases. Across the three audited program years, we have judged the documentation in 38 of the 109 cases (27%) in these strata to be problematic. The 90% CI suggests that between 26% and 28% of the cases in the database likely have problematic documentation.

In the sampled cases, we encountered documentation issues with several HVAC projects that were similar to the ones we encountered in the largest projects. We also found insufficient/problematic documentation for the six rooftop service projects (*AirCare Plus*, or ACP) that we reviewed in this stratum. The primary measures of the ACP program under review were the programmable thermostat modification and replacement measures, as these were the only measures that resulted in gas (therms) savings. The calculated energy savings for these measures were difficult to reproduce based on the data that we were provided. We also found documentation problems with two prescriptive demand controlled ventilation (DCV) projects and one appliances project.

Engineering Review

As described above, the engineering evaluation for all measures of the nonresidential program included a project-by-project analysis based on the assumptions and calculations provided in Avista's application and documentation. When sufficient documentation was provided, we recalculated energy savings using standard engineering methods or modeling simulations. When insufficient documentation was provided, the methodology used by Avista and the reported energy savings were evaluated for appropriateness.

We simulated each of the ACP projects using the latest commercial version of eQUEST (version 3.61e). Although overall there are more than six types of facilities, Nexant constructed only three baseline models (in line with the three facility types represented in the sample population). This entailed separate models for 1) small retail, 2) large retail, and 3) classroom wing. The main parameters documented for each model include envelope construction, square footage, schedules (lighting, equipment, and occupancy), internal loads (occupancy density, sensible and latent heat gains, lighting power density, and equipment power density), infiltration, and thermal set points.

Note that each ACP project has at least one and oftentimes several rooftop units (RTUs) which underwent modifications. Based on the documented inputs for each RTU (which included set points and schedules for pre-maintenance as well as post-maintenance) in the applications, parametric runs were performed for the models. Because the baseline models often have much more conditioned area than the actual projects, the results must be scaled down to the estimated project area (based upon therm savings on a per-square-foot basis).

The results of the simulations indicate a realization rate of about 80% or better for four of the six projects; the other two projects showed considerably less savings than that estimated by Avista. Again, however, it should be noted that several crucial parameters are unknown even to the on-site technicians, such as the heating capacity of the RTU, thermal efficiency, airflow rate for the RTU (cfm), fan operating characteristics, actual conditioned area, and zones characteristics (e.g., internal gains).

Although we were able to calculate estimates for these cases, we do not necessarily recommend that they be used instead of Avista's figures since they are not directly comparable to Avista's claimed savings. We recommend that additional review be conducted of the *AirCare Plus* program.

The engineering evaluation for various prescriptive measures included a check of Avista's reported savings value for accuracy and appropriateness. For example, we evaluated the assumptions used for gas fryers and gas combination ovens, and found that the savings values were appropriate. In the case of prescriptive steam traps (Application 28143), we judged that the assumed operating hours seemed high for a dry cleaning establishment. They were reduced from 8,760 to 2,808, which reduced the therm savings proportionately.

Regarding prescriptive DCV, we note that there was wide variation in estimated energy savings, based upon the analysis tool used (e.g. eQUEST, Honeywell, and Airtest). It may be more accurate to base the savings upon occupancy schedules, served (conditioned) area, and cfms of the applicable air handling units, than on gross square footage or facility type. We believe that Avista adopted a reasonably conservative approach to this measure, but recommend that it be investigated further for accuracy.

Analysis of Avista's Savings Estimates

For each case for which we were able to calculate energy savings, we computed a *difference score*. We discuss the differences scores for the largest projects separately from the sampled nonresidential groups.

Recall that there were several cases from the sampled strata for which we stated that our calculated savings were not directly comparable to Avista's because we did not have access to all relevant inputs; for those cases, we indicated that we do not necessarily recommend that our estimates be used instead of Avista's figures. We encountered such questionable cases in all three years of the audit.

For the reports of the 2006 and 2007 audits, we nevertheless used the audit estimates for those cases in our calculations of the summary data. That is the most conservative approach, but it may overstate the degree of error in Avista's estimates.

For this final audit, we calculated summary data with three different methods that differ only in how we dealt with those questionable cases. The first method accepts the audit's estimates for those cases; this is the method we used in the 2006 and 2007 audits. The second method accepts Avista's claimed savings for the questionable cases. The third method substitutes a random value lying between our estimate and Avista's. The assumption behind this method is that there is some error in Avista's estimate, but that it is not as great on a case-by-case basis as our estimate would indicate.

The Largest Projects (Stratum 1, Census)

Results of our engineering review for the largest nonresidential projects are presented in Table 4.7, along with the results for the largest projects from the 2006 and 2007 program years. This table shows the actual audit estimates of savings for each case and the summary data based on those values (method 1). Following the table, we present the summary results that we obtained when we used the second and third methods described above.

Table 4.7: Comparison of Avista's Reported Nonresidential Therm Savings for the Largest Projects with the Audit's Computations

APPNUM	DESCRIPTION	AVISTA	AUDIT	DIFFERENCE
25006	HVAC Combined	40,753	47,400	-6,647
26379	HVAC Combined	25,771	24,033	1,738
25005	HVAC Combined	23,894	8,550	15,344
25056	HVAC Combined	18,315	12,659	5,656
22206	HVAC Combined	14,305	14,305	0
25032	HVAC Combined	14,303	26,003	-11,700
22842	HVAC Combined	65,953	68,039	-2,086
25245	HVAC Combined	19,647	17,238	2,409
27948	HVAC Combined	18,679	18,682	-3
26700	HVAC Combined	14,703	14,171	532
26751	HVAC Heating	31,300	24,900	6,400

2008 Mean	1,058
2007 Mean	-5,879
2006 Mean	20,822
2006-2008 Mean (Unweighted)	4,872

On average, across the 11 largest 2008 projects, our estimate was 1,058 therms below Avista's, representing a mean overestimate by Avista of about 4%. Across the three program years, the mean difference between Avista's claimed therms and our estimate for the largest projects is 4,872 therms, representing a mean overestimation by Avista of about 16% over the three-year period. Note, however, that most of that difference comes from 2006, and in particular, from a single project in 2006.

When we accepted Avista's estimates for those cases for which we did not consider our estimates reliable, the 2008 mean difference fell to 598 therms, representing about a 2% overestimate by Avista; the three-year figures were 2,731 therms and 8.5%.

When we substituted a randomly generated number between our estimate and Avista's, the 2008 mean difference was 1,762 therms, a 7.2% overestimate by Avista, and the three-year mean difference was 4,638 therms, a 15.3% overestimate.

Summary descriptions of the six largest nonresidential projects are provided in Appendix D.

Sampled Strata (Stratum 2, Prescriptive, and Stratum 3, Other)

Table 4.8 summarizes the results for the two sampled strata. This table shows the 2008 and combined 2006-2008 results calculated with each of the three methods described above.

Table 4.8: Comparison of Avista's Reported Nonresidential Therm Savings with the Audit's Computations: Sampled Strata

YEAR	AVISTA MEAN	AUDIT MEAN	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL (CI)*	RANGE
			VALUE	PERCENT		
ACCEPTING ALL AUDIT ESTIMATES						
2008	1,667.6	928.8	738.8	79.9	174.9 – 1,302.7	-331 – 8,581
2006 to 2008	1,194.7	996.2	204.1	20.5	14.1 – 394.2	-10,367 – 8,581
ACCEPTING AVISTA'S ESTIMATES FOR UNCERTAIN CASES						
2008	1,667.6	1,630.6	135.8	8.3	25.0 – 246.6	-331 – 7,171
2006 to 2008	1,194.7	1,237.7	123.1	9.9	-81.3 – 327.5	-10,367 – 7,171
SUBSTITUTING RANDOM VALUE FOR UNCERTAIN CASES						
2008	1,667.6	1,303.9	363.7	27.9	101.7 – 625.7	-142 – 3,645

2006 to 2008	1,194.7	1,104.2	90.5	8.2	-50.4 – 231.4	-10,367 – 3,645

Using the first method, the weighted mean difference between Avista's estimates and our independently computed estimates, across all sampled 2008 projects, was 739 ±564 therms; Avista's estimates were, on average, about 80% higher than ours. Across all three program years, the weighted mean difference for sampled projects was 204 ±190; Avista's reported savings were, on average, about 20% higher than our estimates.

With the second method (accepting Avista's estimates for the questionable cases) reduces the mean difference for 2008 to 136 ±111 therms, about an 8% overestimate by Avista. It reduces the three-year difference to 123 ±205 therms, making Avista's overestimate about 10%.

Finally, under the third method, the mean difference for 2008 is 364 ±262 and the mean overestimate is 28%. Across all three years, the mean difference becomes 90 ±141 therms and the overestimate becomes about 8%.

The three methods resulted in somewhat different precision estimates. The three-year precision ranges from 13% (method 3) to 18% (method 2) of Avista's mean estimated savings. These fall short of the targeted value of 10% precision (at 90% confidence) despite our use of sample sizes intended to achieve that precision level. The loss of precision is the result of greater-than-anticipated levels of variability in the difference between Avista's claimed therms and the audit's calculated values.

5 CONCLUSIONS AND RECOMMENDATIONS

Avista's calendar year 2006, 2007, and 2008 natural gas residential, limited-income, and nonresidential programs are broad in nature, providing multiple opportunities to its customer base. In most cases, we found the projects to have well-documented records with sufficient supporting documentation.

Our audits of the 2006 through 2008 program years confirmed the per-unit therm savings that Avista reported for the majority of the prescriptive measures in the residential program. The one exception is that our engineering review for the 2006 audit suggested a value of 28 therms for high-efficiency tankless water heaters, rather than 11 therms, which Avista reported. We noted that Avista has proposed to increase the deemed value to 60 therms for the 2008 program, based on an increase in the minimum efficiency requirement. Our engineering review supports the use of this value, depending on the mix of 40- and 50-gallon tanks that are replaced. (No tankless water heaters were found in the database of 2007 projects.)

In our audit of the 2006 program, we confirmed Avista's use of 176 therms per unit for pre-rinse sprayers in the nonresidential program. Based on its own Measurement and Verification (M&V) study conducted in 2007, Avista drastically reduced its claimed savings for this measure to 44 therms per unit. As stated in the 2007 report, we believe this to be conservative, but accepted Avista's value.

The discrepancies between Avista's savings estimates and our computations varied widely in size. We were not able to account for much of the variance in the limited-income and nonresidential samples, as we did not receive information on the computation methods used for some of the measures that were involved.

The results revealed varying degrees of documentation issues among the programs and program strata. Part of the reason for the documentation problems and for our inability to review the computation methods for some measures is that Avista had to depend on several CAPs for this information. Below, we repeat our recommendations regarding CAPs; however, Avista is ultimately dependent on the CAPs' cooperation.

Following is a brief summary of the main problems we faced in verifying Avista's savings estimates. Below, we offer some recommendations for how Avista can improve documentation and its ability to carry out accurate engineering calculations in 2008.

SUMMARY OF VERIFICATION ISSUES

For the audit of the 2008 program, we found unresolved documentation problems in 5 of 111 cases in the residential sample. This represents a weighted mean of about 4% of all cases, a substantial decrease from the 2006 and 2007 audits.

Of the five cases with documentation problems in the 2008 residential sample, there were three cases in which the invoice provided information (e.g., window size or amount of insulation installed) that contradicted the rebate form and one each of insufficient documentation and an incorrectly coded measure. Over all three years, we identified 11 cases of insufficient documentation, 12 of contradictory documentation, 4 miscodes, and 7 measures that should not have qualified for a rebate.

Insufficient documentation for a residential project meant that we could not adequately check Avista's estimated therm savings for that project. In such cases, we excluded that project from our case-by-case analysis of savings estimates. The alternative—assigning a value of 0—would not have substantially altered the results: the mean number of claimed therms for such projects divided over the total number of residential projects was 0.3 therms.

Our review of the residential data used both Avista-supplied input data and Avista-supplied per-unit therm values or formulas. Therefore, differences found between Avista's calculations and ours for that program reflect one of three possible sources: a) data entry errors; b) errors in calculation; or c) the use by Avista of input data, per-unit therm values, or formulas other than those they provided to us. In most cases, the difference between Avista's estimate and ours appeared to come from Avista's having accepted input data on the rebate form (e.g., square feet of windows or of insulation) that was not supported on the accompanying documentation.

Some discrepancy in savings claimed for windows may possibly be the result of variability in how window dimensions were calculated. We found sometimes that only a single set of dimensions (height and weight) was provided, which could have been either rough opening or frame size. If the customer used rough opening to calculate window dimensions, the resulting total size and, hence, claimed savings, would be overestimated somewhat. Although the difference would be small, it would contribute somewhat to error. Although we consider that this would contribute little to the overall level of discrepancy between Avista's claimed savings and our estimates, Avista may wish to consider, in addition to the other recommendations we list below, establishing more clear guidelines for calculating window dimensions.

In the limited-income sample, none of the 68 cases had irresolvable documentation problems, nor did any from the 2007 program; there were only two cases with unresolvable documentation issues from 2006. For both of those cases, the measure was incorrectly coded. We did not exclude any limited-income measures from the savings analysis on the basis of insufficient documentation.

As in the previous audit, the above figures do not include a larger number of cases in the residential and limited-income samples for which we requested and received additional documentation from Avista to compute therm savings estimates. For example, the initial case-by-case documentation that we received from Avista for several of the limited-income cases (and which Avista had received from the CAPs) was insufficient to provide independent estimates of savings. We requested additional documentation from Avista and received it in all cases.

By contrast to the residential and limited-income programs, nearly one-half of the custom nonresidential projects had notable documentation problems; this was lower than in the 2007 audit but somewhat higher than what we found in the 2006 audit. We found fewer documentation problems with nonresidential prescriptive measures, and none from 2006 or 2007.

Almost all of the documentation problems in the nonresidential program were an issue of lack of detailed or explicit input, most of which were *AirCare Plus* rooftop service projects. The documentation problems we found in nonresidential projects did not prevent our calculating estimated savings; however, in several cases we noted that our results could not be used to evaluate Avista's estimates.

We found large variations in the degree to which our calculations agreed with Avista's. The mean percent difference between our estimate and Avista's was greater for some sample strata than for others. In the 2008 audit, it varied from 0% in residential Stratum 3, comprised of prescriptive measures (high-efficiency furnaces) to 80.3% in nonresidential Stratum 2. The 90% CI around the estimated mean difference for the 2008 residential sample encompasses zero difference; however, the CI for all other 2008 programs and for the combined 2006-2008 data for all three programs excludes zero difference.

We believe that implementation of the following recommendations will decrease both the amount of documentation error and the overall discrepancy between Avista's claimed savings and the audit's estimates.

RECOMMENDATIONS FOR IMPROVING ENGINEERING AND REPORTING ACCURACY

Residential Program

In the reports of the 2006 and 2007 audits, we suggested several actions for the residential program to increase accuracy of engineering calculations and reporting. Avista accepted all our recommended changes in claimed savings for particular measures.

In addition, a decrease in documentation errors and an improvement in therm calculations for the residential program suggest that Avista has adopted some of our other recommendations for improving documentation and internal review. Moreover, whether prompted by our recommendations or not, Avista has made some modification to its method of recording and tracking application data that have made verification easier and possibly more accurate. For example, Avista no longer requires that window direction be recorded on the residential program application; window direction frequently was missing from invoices and other documentation, making it difficult to verify the information recorded on the application forms.

We repeat recommendations that Avista may not yet have fully implemented, in some cases with modifications.

To improve documentation:

- ➡ **Request more detailed documentation from residential customers and their contractors submitting rebate requests.** In the previous audits, we recommended that Avista request that invoices and/or other documentation provide the following data: the number of square feet of insulation used for each type of area insulated (walls, floors, ceiling/attic); the model number and AFUE% of high-efficiency furnaces and boilers; and the model number and EF of high-efficiency water heaters. We continue to recommend this action. Most applications submitted already included the requested information, and it is possible that many or most of those who omitted it did so because they were not aware of its importance. Requiring it would allow stricter review of rebate applications as they come in, resulting in reduced error in reported savings.
- ➡ **Provide outreach to vendors to educate them about what kind of information is needed on the invoices.** Although we did not systematic interview vendors, we found when we contacted them to resolve documentation issues that the majority were familiar with Avista and supported its energy efficiency programs. We believe, therefore, that vendors will respond positively to outreach efforts to achieve more consistent documentation.

To improve internal review procedures:

- ➡ **Continue to improve review of rebate applications to ensure that the information on the invoices and/or other documentation is completely consistent with that listed on the rebate forms.** If the information on the rebate form is not thoroughly documented, contact the customer, contractor, and/or manufacturer to obtain the additional needed information and document that information on a separate form for inclusion in the files and later review. Not only would this help to ensure better accuracy of input data, but it also would help ensure that rebates are not given for measures that do not meet Avista's program standards.
- ➡ **Identify furnace, boiler, and water heater models that do and do not meet minimum efficiency requirements.** Provide a list of models that do or do not qualify, which vendors and customers can examine or use such a list to check against incoming rebate applications. Possibly pre-code the customer service database to flag records with non-qualifying models.

➡ **Institute an internal system for checking data entry accuracy to ensure that incorrect measure types are not recorded in rebate records.** For example, print lists of newly entered records and check them against the hard-copy rebate forms.

➡ **Institute a system for reviewing the entire database on a regular basis to identify and report therm values that are inconsistent with the measure.** Relatively few measures were incorrectly coded. Nevertheless, those few prescriptive measures that are incorrectly coded could easily be identified and resolved. A thorough review would include, at a minimum, the following actions:

- Identify measures with zero or negative savings;
- For each non-calculated prescriptive measure type (i.e., equipment that has a prescribed savings value per item), identify cases with values that are inconsistent with the documented prescribed amount;
- For each calculated measure type (e.g., windows, insulation), identify statistical outliers.

➡ **Continue to review rules and procedures for assigning or calculating therms in the database to ensure that they are consistent with engineering-established rules and procedures.**

Limited-Income Program

We repeat the following recommendations to increase the accuracy of engineering calculations and reporting for the limited-income measures:

➡ **Review the calculation methodologies used by all CAPs to ensure that there is consistency across the various agencies and that energy savings are being calculated correctly**.

➡ **Request that all necessary baseline information be recorded and maintained by the agencies.** This will permit greater accuracy for future evaluations or checks that Avista may choose to do throughout the year. We found multiple cases for which important baseline information – such as insulation square feet, house volume, R-values, and U-factors – was not recorded in the customer files and had to be requested separately.

Nonresidential Program

Regarding the nonresidential program, we repeat the following recommendations to increase the accuracy of engineering calculations and reporting:

➡ **Increase documentation of baseline and retrofit equipment, including model numbers, efficiencies, and shell information.** This will allow for more accurate verification of reported energy savings values.

- ➡ **Complete a separate evaluation of PECI's *AirCare Plus* program to determine the accuracy of reported energy savings.**
- ➡ **Further investigate the prescriptive values assigned for demand controlled ventilation.**

APPENDICES

APPENDIX A: CASE-BY-CASE RESULTS

APPENDIX B: SUMMARY DATA BY YEAR AND STRATUM

APPENDIX C: RESIDENTIAL AND LIMITED-INCOME DOCUMENTATION PROBLEMS

APPENDIX D: LARGEST NONRESIDENTIAL PROJECTS

A CASE-BY-CASE RESULTS

RESIDENTIAL PROGRAM

Table A.1: Case-by-Case Results for Residential Program, 2006-2008

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
STRATUM 1 (WINDOWS)						
2008	130105627	G NEW WINDOWS	3	233	216	17
2008	330110683	G NEW WINDOWS	1	58	58	0
2008	749236	G REPLC WINDOWS	1	5	5	0
2008	900346	G REPLC WINDOWS	1	107	110	-3
2008	911234	G REPLC WINDOWS	1	113	115	-2
2008	1405090	G REPLC WINDOWS	1	146	146	0
2008	1816320	G REPLC WINDOWS	1	73	75	-2
2008	1819913	G REPLC WINDOWS	1	12	50	-38
2008	2013594	G REPLC WINDOWS	1	28	0	28
2008	2314513	G REPLC WINDOWS	1	224	230	-6
2008	2427017	G REPLC WINDOWS	1	103	105	-2
2008	2514412	G REPLC WINDOWS	1	45	46	-1
2008	2541696	G REPLC WINDOWS	1	33	36	-3
2008	50035090	G REPLC WINDOWS	1	19	20	-1
2008	50078584	G REPLC WINDOWS	1	64	64	0
2008	90052513	G REPLC WINDOWS	1	32	33	-1
2008	130028887	G REPLC WINDOWS	1	6	6	0
2008	130059256	G REPLC WINDOWS	1	58	59	-1
2008	130110926	G REPLC WINDOWS	1	108	111	-3
2008	130114051	G REPLC WINDOWS	1	199	204	-5
2008	170054344	G REPLC WINDOWS	1	50	52	-2
2008	210015443	G REPLC WINDOWS	1	21	22	-1
						Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2008	210090202	G REPLC WINDOWS	1	51	106	-55
2008	210116978	G REPLC WINDOWS	1	195	200	-5
2008	290015455	G REPLC WINDOWS	1	37	56	-19
2008	290059881	G REPLC WINDOWS	1	200	205	-5
2008	370030730	G REPLC WINDOWS	1	90	92	-2
2008	370045711	G REPLC WINDOWS	1	41	42	-1
2008	450113567	G REPLC WINDOWS	1	71	73	-2
2008	490099788	G REPLC WINDOWS	3	171	103	68
2008	490114602	G REPLC WINDOWS	1	104	99	5
2008	530014517	G REPLC WINDOWS	1	8	9	-1
2008	570063063	G REPLC WINDOWS	1	142	146	-4
2008	610030788	G REPLC WINDOWS	1	47	48	-1
2008	610042803	G REPLC WINDOWS	1	676	693	-17
2008	650091986	G REPLC WINDOWS	1	46	51	-5
2008	690015813	G REPLC WINDOWS	1	355	364	-9
2008	730023438	G REPLC WINDOWS	1	16	17	-1
2008	730047728	G REPLC WINDOWS	1	41	43	-2
2008	730090423	G REPLC WINDOWS	1	187	192	-5
2008	770081573	G REPLC WINDOWS	1	23	25	-2
2007	170096666	G NEW WINDOWS	1	45	45	0
2007	250109418	G NEW WINDOWS	5	100	0	100
2007	450096382	G NEW WINDOWS	1	43	43	0
2007	570103547	G NEW WINDOWS	1	114	110	4
2007	730099205	G NEW WINDOWS	1	110	110	0
2007	730103964	G NEW WINDOWS	1	71	71	0
2007	640593	G REPLC WINDOWS	1	57	107	-50
2007	902365	G REPLC WINDOWS	3	116	70	46
2007	1010248	G REPLC WINDOWS	3	57	53	4
2007	1010427	G REPLC WINDOWS	3	45	19	26
2007	1100553	G REPLC WINDOWS	1	134	135	-1
2007	1304539	G REPLC WINDOWS	1	7	7	0

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2007	1809816	G REPLC WINDOWS	3	137	101	36
2007	2501240	G REPLC WINDOWS	1	27	27	0
2007	2521063	G REPLC WINDOWS	1	59	59	0
2007	10032460	G REPLC WINDOWS	1	25	25	0
2007	10058093	G REPLC WINDOWS	1	87	88	-1
2007	10098464	G REPLC WINDOWS	1	33	33	0
2007	10110915	G REPLC WINDOWS	1	43	44	-1
2007	50101779	G REPLC WINDOWS	1	134	135	-1
2007	90036387	G REPLC WINDOWS	1	11	12	-1
2007	130019678	G REPLC WINDOWS	1	108	114	-6
2007	170102118	G REPLC WINDOWS	1	22	23	-1
2007	210039444	G REPLC WINDOWS	3	49	44	5
2007	210095159	G REPLC WINDOWS	1	37	38	-1
2007	210105923	G REPLC WINDOWS	1	63	63	0
2007	250029773	G REPLC WINDOWS	1	9	9	0
2007	250106035	G REPLC WINDOWS	1	62	79	-17
2007	330073965	G REPLC WINDOWS	1	64	127	-63
2007	330104627	G REPLC WINDOWS	1	64	64	0
2007	370004701	G REPLC WINDOWS	1	55	55	0
2007	370024438	G REPLC WINDOWS	1	67	66	1
2007	370104699	G REPLC WINDOWS	1	45	44	1
2007	450082177	G REPLC WINDOWS	2	286	---[19]	---
2007	450103766	G REPLC WINDOWS	1	269	293	-24
2007	450104855	G REPLC WINDOWS	1	42	42	0
2007	690105505	G REPLC WINDOWS	1	100	101	-1
2007	730009786	G REPLC WINDOWS	1	34	34	0
2007	770042729	G REPLC WINDOWS	1	341	341	0
2007	770077733	G REPLC WINDOWS	1	72	73	-1

Continued

19 As noted in the text, we did not calculate estimates for cases with final disposition = 2.

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2006	1269	G NEW WINDOWS	2	17	---	---
2006	3018	G NEW WINDOWS	1	147	147	0
2006	3298	G NEW WINDOWS	2	21	---	---
2006	115	G REPLC WINDOWS	2	41	---	---
2006	418	G REPLC WINDOWS	1	52	1	51
2006	641	G REPLC WINDOWS	1	133	133	0
2006	768	G REPLC WINDOWS	1	33	33	0
2006	985	G REPLC WINDOWS	1	40	40	0
2006	1214	G REPLC WINDOWS	1	83	83	0
2006	1335	G REPLC WINDOWS	1	27	28	-1
2006	1621	G REPLC WINDOWS	1	17	18	-1
2006	1787	G REPLC WINDOWS	1	13	13	0
2006	1813	G REPLC WINDOWS	1	60	60	0
2006	1869	G REPLC WINDOWS	1	27	28	-1
2006	1940	G REPLC WINDOWS	1	42	43	-1
2006	2118	G REPLC WINDOWS	2	12	---	---
2006	2173	G REPLC WINDOWS	1	92	92	0
2006	2232	G REPLC WINDOWS	1	15	15	0
2006	2271	G REPLC WINDOWS	1	12	12	0
2006	2373	G REPLC WINDOWS	3	53	43	10
2006	2441	G REPLC WINDOWS	1	17	17	0
2006	2588	G REPLC WINDOWS	1	37	37	0
2006	2745	G REPLC WINDOWS	2	71	---	---
2006	2959	G REPLC WINDOWS	1	36	36	0
2006	2975	G REPLC WINDOWS	2	59	---	---
2006	3161	G REPLC WINDOWS	1	32	32	0
2006	3248	G REPLC WINDOWS	1	76	76	0

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
STRATUM 2 (INSULATION)						
2008	523399	G INS - CEIL/ATTIC	1	69	92	0[20]
2008	720435	G INS - CEIL/ATTIC	1	83	83	0
2008	1307535	G INS - CEIL/ATTIC	1	90	90	0
2008	1400618	G INS - CEIL/ATTIC	1	61	61	0
2008	1603972	G INS - CEIL/ATTIC	1	126	126	0
2008	1700346	G INS - CEIL/ATTIC	1	97	97	0
2008	2001884	G INS - CEIL/ATTIC	1	119	119	0
2008	2012853	G INS - CEIL/ATTIC	1	123	123	0
2008	2108083	G INS - CEIL/ATTIC	1	115	190	0
2008	2128788	G INS - CEIL/ATTIC	1	90	90	0
2008	2220479	G INS - CEIL/ATTIC	1	99	107	0
2008	50033708	G INS - CEIL/ATTIC	1	130	130	0
2008	130062327	G INS - CEIL/ATTIC	1	155	155	0
2008	170096640	G INS - CEIL/ATTIC	1	140	140	0
2008	210037823	G INS - CEIL/ATTIC	1	81	81	0
2008	250037865	G INS - CEIL/ATTIC	1	98	98	0
2008	250050319	G INS - CEIL/ATTIC	1	5	86	0
2008	250109879	G INS - CEIL/ATTIC	1	0	32	0
2008	290090682	G INS - CEIL/ATTIC	1	126	126	0
2008	330036984	G INS - CEIL/ATTIC	1	137	137	0
2008	330063510	G INS - CEIL/ATTIC	1	111	111	0
2008	490040898	G INS - CEIL/ATTIC	1	10	105	0
2008	530010428	G INS - CEIL/ATTIC	1	83	83	0
2008	530099927	G INS - CEIL/ATTIC	1	65	140	0
2008	570038040	G INS - CEIL/ATTIC	1	113	113	0
						Continued

20 It is common practice to purchase more insulation than needed, and then later return the excess insulation to the vendor. Therefore, when receipts and invoices documented more insulation than the rebate form, we assumed the difference was excess insulation that was unused and accepted the value recorded on the rebate form.

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2008	650097867	G INS - CEIL/ATTIC	1	32	69	0
2008	650103914	G INS - CEIL/ATTIC	1	73	73	0
2008	650108560	G INS - CEIL/ATTIC	1	74	74	0
2008	690093398	G INS - CEIL/ATTIC	1	144	144	0
2008	730091467	G INS - CEIL/ATTIC	1	72	72	0
2008	1810351	G INS - FLOOR	1	69	69	0
2008	2517736	G INS - FLOOR	1	62	62	0
2008	170068210	G INS - FLOOR	1	304	304	0
2008	530004884	G INS - FLOOR	1	118	118	0
2008	570104078	G INS - FLOOR	1	156	264	0
2008	690105496	G INS - FLOOR	1	214	214	0
2008	1708836	G INS - WALL	1	227	227	0
2008	1713377	G INS - WALL	1	264	579	0
2008	2305625	G INS - WALL	1	231	231	0
2008	2517736	G INS - WALL	1	164	164	0
2008	10027146	G INS - WALL	1	136	136	0
2008	90072816	G INS - WALL	1	186	186	0
2008	170106674	G INS - WALL	2	109	---	---
2008	330074670	G INS - WALL	1	62	62	0
2008	410067679	G INS - WALL	3	527	338	189
2008	650113988	G INS - WALL	1	43	43	0
2008	730044284	G INS - WALL	1	318	318	0
2008	730107653	G INS - WALL	1	203	379	0
2008	770075490	G INS - WALL	1	167	372	0
2007	818909	G INS - CEIL/ATTIC	1	40	40	0
2007	1120809	G INS - CEIL/ATTIC	1	71	71	0
2007	1611797	G INS - CEIL/ATTIC	1	50	50	0
2007	1618060	G INS - CEIL/ATTIC	1	40	40	0
2007	1819186	G INS - CEIL/ATTIC	1	48	48	0
2007	2012487	G INS - CEIL/ATTIC	5	76	0	76
2007	2401897	G INS - CEIL/ATTIC	1	49	49	0

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2007	50098623	G INS - CEIL/ATTIC	1	36	36	0
2007	90063925	G INS - CEIL/ATTIC	1	28	28	0
2007	90082345	G INS - CEIL/ATTIC	1	50	50	0
2007	170102792	G INS - CEIL/ATTIC	1	48	48	0
2007	290098926	G INS - CEIL/ATTIC	1	46	46	0
2007	290100491	G INS - CEIL/ATTIC	1	45	45	0
2007	330039815	G INS - CEIL/ATTIC	1	63	63	0
2007	330103865	G INS - CEIL/ATTIC	1	32	32	0
2007	410093226	G INS - CEIL/ATTIC	2	66	---	---
2007	450051398	G INS - CEIL/ATTIC	1	122	122	0
2007	450073257	G INS - CEIL/ATTIC	1	38	38	0
2007	450101648	G INS - CEIL/ATTIC	1	98	98	0
2007	490099973	G INS - CEIL/ATTIC	1	50	50	0
2007	570068423	G INS - CEIL/ATTIC	1	71	71	0
2007	570070462	G INS - CEIL/ATTIC	1	47	47	0
2007	690043710	G INS - CEIL/ATTIC	2	32	---	---
2007	690083912	G INS - CEIL/ATTIC	1	84	84	0
2007	690088948	G INS - CEIL/ATTIC	1	67	67	0
2007	730087620	G INS - CEIL/ATTIC	1	45	45	0
2007	770098626	G INS - CEIL/ATTIC	3	28	26	2
2007	1304539	G INS - FLOOR	1	75	75	0
2007	210094205	G INS - FLOOR	1	255	255	0
2007	250109186	G INS - FLOOR	1	223	223	0
2007	690012320	G INS - FLOOR	1	151	151	0
2007	826687	G INS - WALL	1	25	25	0
2007	90053146	G INS - WALL	3	282	71	211
2007	90096656	G INS - WALL	1	346	346	0
2007	210086578	G INS - WALL	1	191	191	0
2007	290104103	G INS - WALL	1	374	374	0
2007	450093242	G INS - WALL	1	217	217	0
2007	570046914	G INS - WALL	1	203	82	121

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2007	570102581	G INS - WALL	1	492	492	0
2007	690096414	G INS - WALL	1	84	84	0
2006	93	G FIREPLACE DAMPER	4	616	336	280
2006	570	G INS - CEIL/ATTIC	1	42	42	0
2006	722	G INS - CEIL/ATTIC	1	4	4	0
2006	1444	G INS - CEIL/ATTIC	1	50	50	0
2006	1674	G INS - CEIL/ATTIC	1	32	32	0
2006	1874	G INS - CEIL/ATTIC	1	102	102	0
2006	2076	G INS - CEIL/ATTIC	1	50	50	0
2006	2277	G INS - CEIL/ATTIC	1	54	54	0
2006	2793	G INS - CEIL/ATTIC	1	59	59	0
2006	2795	G INS - CEIL/ATTIC	1	83	83	0
2006	3048	G INS - CEIL/ATTIC	1	33	33	0
2006	1357	G INS - FLOOR	1	332	332	0
2006	3002	G INS - FLOOR	2	233	---	---
2006	1680	G INS - WALL	1	334	334	0
STRATUM 3 (FURNACES/BOILERS)						
2008	2425504	G HE FURNACE	1	123	123	0
2008	50110983	G HE FURNACE	1	123	123	0
2008	90113852	G HE FURNACE	1	123	123	0
2008	570084344	G HE FURNACE	1	123	123	0
2008	610104014	G HE FURNACE	1	123	123	0
2007	130070564	G HE BOILER	5	72	0	72
2007	170026002	G HE BOILER	1	72	72	0
2007	570092576	G HE BOILER	1	72	72	0
2007	827101	G HE FURNACE	1	72	72	0
2007	250050451	G HE FURNACE	1	72	72	0
2007	450097090	G HE FURNACE	1	72	72	0
2007	610033739	G HE FURNACE	1	72	72	0
2006	326	G HE FURNACE	1	72	72	0
2006	404	G HE FURNACE	1	72	72	0

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2006	470	G HE FURNACE	1	72	72	0
2006	475	G HE FURNACE	1	72	72	0
2006	548	G HE FURNACE	1	72	72	0
2006	589	G HE FURNACE	1	72	72	0
2006	688	G HE FURNACE	1	72	72	0
2006	869	G HE FURNACE	1	72	72	0
2006	877	G HE FURNACE	1	72	72	0
2006	879	G HE FURNACE	1	72	72	0
2006	959	G HE FURNACE	1	72	72	0
2006	1024	G HE FURNACE	1	72	72	0
2006	1113	G HE FURNACE	1	72	72	0
2006	1251	G HE FURNACE	1	72	72	0
2006	1310	G HE FURNACE	1	72	72	0
2006	1590	G HE FURNACE	1	72	72	0
2006	1709	G HE FURNACE	1	72	72	0
2006	1744	G HE FURNACE	1	72	72	0
2006	2313	G HE FURNACE	1	72	72	0
2006	2375	G HE FURNACE	1	72	72	0
2006	2816	G HE FURNACE	1	72	72	0
2006	2884	G HE FURNACE	1	72	72	0
2006	3091	G HE FURNACE	1	72	72	0
2006	3204	G HE FURNACE	1	72	72	0
STRATUM 4 (OTHER)						
2008	250109943	E ESTAR HOME ELEC/GAS	1	197	197	0
2008	1003123	G ES CLOTHES WASHER	1	9	9	0
2008	2538861	G ES CLOTHES WASHER	1	9	9	0
2008	2566027	G ES CLOTHES WASHER	1	9	9	0
2008	210052002	G ES CLOTHES WASHER	1	9	9	0
2008	450112230	G ES CLOTHES WASHER	1	9	9	0
2008	730036067	G ES CLOTHES WASHER	1	9	9	0
2008	1310695	G ES DISHWASHER	1	5	5	0
						Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2008	2119383	G ES DISHWASHER	1	5	5	0
2008	10042919	G ES DISHWASHER	1	5	5	0
2008	290070765	G ES DISHWASHER	1	5	5	0
2008	370110028	G ES DISHWASHER	1	5	5	0
2008	570052854	G ES DISHWASHER	1	5	5	0
2008	730117983	G ES DISHWASHER	4	5	9	-4
2008	1302215	G HE WH 50G	1	11	11	0
2008	10113078	G HE WH 50G	1	11	11	0
2007	90110207	E STAR HOMES	1	197	197	0
2007	1002154	G HE WH 40G	1	11	11	0
2007	1611094	G HE WH 40G	1	11	11	0
2007	210104187	G HE WH 40G	1	11	11	0
2007	1112720	G HE WH 50G	5	8	0	8
2007	2400928	G HE WH 50G	1	8	8	0
2007	130047730	G HE WH 50G	5	8	0	8
2007	210103749	G HE WH 50G	5	8	0	8
2007	250108153	G HE WH 50G	1	8	8	0
2007	450006577	G HE WH 50G	1	8	8	0
2006	1497	E STAR HOMES	4	197	0	197
2006	110	G HE WH 40G	4	11	8	3
2006	861	G HE WH 40G	5	11	0	11
2006	2288	G HE WH 40G	1	11	11	0
2006	121	G HE WH 50G	1	8	8	0
2006	1083	G HE WH 50G	1	8	8	0
2006	1811	G HE WH 50G	1	8	8	0

[1] It is common practice to purchase more insulation than needed, and then later return the excess insulation to the vendor. Therefore, when receipts and invoices documented more insulation than the rebate form, we assumed the difference was excess insulation that was unused and accepted the value recorded on the rebate form.

LIMITED INCOME PROGRAM

Table A.2: Case-by-Case Results for Limited-Income Program, 2006-2008

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
STRATUM 1 (INSULATION)						
2008	737907	G INS - CEIL/ATTIC	1	52	54	-2
2008	1806968	G INS - CEIL/ATTIC	1	438	95	343
2008	290074666	G INS - CEIL/ATTIC	1	184	25	159
2008	290104977	G INS - CEIL/ATTIC	1	54	102	-48
2008	530103226	G INS - CEIL/ATTIC	1	294	193	101
2008	770005654	G INS - DUCT	1	50	23	27
2008	1608742	G INS - FLOOR	1	168	121	47
2008	2000620	G INS - FLOOR	1	64	55	9
2008	170073090	G INS - FLOOR	1	129	51	78
2008	410102770	G INS - FLOOR	1	327	194	133
2008	490094768	G INS - FLOOR	1	61	140	-79
2008	619613	G INS - WALL	1	139	152	-13
2008	1309461	G INS - WALL	1	81	89	-8
2008	2000620	G INS - WALL	1	155	169	-14
2008	410031001	G INS - WALL	1	198	217	-19
2008	570065039	G INS - WALL	1	209	229	-20
2008	650096884	G INS - WALL	1	129	170	-41
2007	826887	G INS - CEIL/ATTIC	1	75	119	-44
2007	2545868	G INS - CEIL/ATTIC	1	244	39	205
2007	370047443	G INS - CEIL/ATTIC	1	466	236	230
2007	370065566	G INS - CEIL/ATTIC	1	197	236	-39
2007	490080502	G INS - CEIL/ATTIC	1	390	197	193
2007	690093567	G INS - CEIL/ATTIC	1	168	20	148
2007	730060565	G INS - CEIL/ATTIC	1	372	75	297
2007	770080472	G INS - CEIL/ATTIC	1	0	62	-62
2007	290078749	G INS - DUCT	1	2	168	-166

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2007	1224570	G INS - FLOOR	1	73	212	-139
2007	10078121	G INS - FLOOR	1	83	74	9
2007	10095781	G INS - FLOOR	1	7	20	-13
2007	450079399	G INS - WALL	1	164	179	-15
2007	690078482	G INS - WALL	1	191	209	-18
2007	690095215	G INS - WALL	1	135	148	-13
2006	8	G INS - CEIL/ATTIC	1	41	33	8
2006	17	G INS - CEIL/ATTIC	1	187	188	-1
2006	101	G INS - CEIL/ATTIC	1	308	68	240
2006	168	G INS - CEIL/ATTIC	1	137	30	107
2006	171	G INS - CEIL/ATTIC	1	271	240	31
2006	274	G INS - CEIL/ATTIC	1	354	435	-81
2006	301	G INS - CEIL/ATTIC	1	395	484	-89
2006	349	G INS - CEIL/ATTIC	1	302	141	161
2006	350	G INS - CEIL/ATTIC	1	319	58	261
2006	392	G INS - CEIL/ATTIC	1	299	79	220
2006	418	G INS - CEIL/ATTIC	1	375	108	267
2006	72	G INS - FLOOR	1	54	99	-45
2006	80	G INS - FLOOR	1	203	287	-84
2006	83	G INS - FLOOR	1	215	183	32
2006	175	G INS - FLOOR	1	80	91	-11
2006	315	G INS - FLOOR	1	86	82	4
2006	319	G INS - FLOOR	1	74	101	-27
2006	372	G INS - FLOOR	1	92	134	-42
2006	32	G INS - WALL	1	146	213	-67
2006	117	G INS - WALL	1	19	22	-3
2006	172	G INS - WALL	1	164	239	-75
2006	305	G INS - WALL	1	218	287	-69
2006	415	G INS - WALL	1	146	213	-67
STRATUM 2 (AIR INFILTRATION)						
2008	705022	G AIR INFILTRATION	1	188	100	88
						Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2008	1807678	G AIR INFILTRATION	1	163	87	76
2008	1815747	G AIR INFILTRATION	1	18	10	8
2008	2207931	G AIR INFILTRATION	1	65	35	30
2008	10099184	G AIR INFILTRATION	1	82	43	39
2008	250100535	G AIR INFILTRATION	1	8	10	-2
2008	370064522	G AIR INFILTRATION	1	76	41	35
2008	370093616	G AIR INFILTRATION	1	31	35	-4
2008	450009013	G AIR INFILTRATION	1	53	28	25
2008	530036695	G AIR INFILTRATION	1	197	105	92
2008	530052564	G AIR INFILTRATION	1	14	17	-3
2008	570078060	G AIR INFILTRATION	1	104	68	36
2008	570087112	G AIR INFILTRATION	1	109	58	51
2008	610103136	G AIR INFILTRATION	1	13	7	6
2008	650087567	G AIR INFILTRATION	1	200	107	93
2008	650095327	G AIR INFILTRATION	1	24	28	-4
2008	770110190	G AIR INFILTRATION	1	46	61	-15
2007	827855	G AIR INFILTRATION	1	33	53	-20
2007	1716754	G AIR INFILTRATION	1	49	75	-26
2007	50040746	G AIR INFILTRATION	1	90	67	23
2007	210103112	G AIR INFILTRATION	1	113	196	-83
2007	290067981	G AIR INFILTRATION	1	90	67	23
2007	290078749	G AIR INFILTRATION	1	7	11	-4
2007	330063253	G AIR INFILTRATION	1	107	80	27
2007	330096551	G AIR INFILTRATION	1	175	131	44
2007	370088734	G AIR INFILTRATION	1	80	121	-41
2007	490069605	G AIR INFILTRATION	1	20	27	-7
2007	490075311	G AIR INFILTRATION	1	195	147	48
2007	570085190	G AIR INFILTRATION	1	72	53	19
2007	650021131	G AIR INFILTRATION	1	56	42	14
2007	650091938	G AIR INFILTRATION	1	162	121	41
2007	770097042	G AIR INFILTRATION	1	92	58	34

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2006	47	G AIR INFILTRATION	1	198	148	50
2006	54	G AIR INFILTRATION	1	122	132	-10
2006	113	G AIR INFILTRATION	1	168	125	43
2006	119	G AIR INFILTRATION	1	34	25	9
2006	136	G AIR INFILTRATION	1	57	42	15
2006	137	G AIR INFILTRATION	1	45	45	0
2006	159	G AIR INFILTRATION	1	37	34	3
2006	172	G AIR INFILTRATION	1	47	35	12
2006	173	G AIR INFILTRATION	1	72	54	18
2006	189	G AIR INFILTRATION	1	32	23	9
2006	190	G AIR INFILTRATION	1	86	65	21
2006	200	G AIR INFILTRATION	1	23	23	0
2006	250	G AIR INFILTRATION	1	158	118	40
2006	265	G AIR INFILTRATION	1	276	206	70
2006	271	G AIR INFILTRATION	1	332	327	5
2006	277	G AIR INFILTRATION	1	66	64	2
2006	314	G AIR INFILTRATION	1	41	45	-4
2006	351	G AIR INFILTRATION	1	63	47	16
2006	356	G AIR INFILTRATION	1	14	13	1
2006	369	G AIR INFILTRATION	1	115	86	29
2006	392	G AIR INFILTRATION	1	52	39	13
2006	427	G AIR INFILTRATION	1	14	13	1
STRATUM 3 (ENERGY STAR® WINDOWS AND DOORS)						
2008	1715727	G ENERGY STAR DOORS	1	14	14	0
2008	50103544	G ENERGY STAR DOORS	1	164	185	-21
2008	170107102	G ENERGY STAR DOORS	1	124	131	-7
2008	290085948	G ENERGY STAR DOORS	1	65	64	1
2008	330108201	G ENERGY STAR DOORS	1	94	99	-5
2008	410103913	G ENERGY STAR DOORS	1	124	129	-5
2008	570016928	G ENERGY STAR DOORS	1	329	78	251
2008	770041467	G ENERGY STAR DOORS	1	182	201	-19

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2008	2217957	G ENERGY STAR WINDOWS	1	233	258	-25
2008	130012830	G ENERGY STAR WINDOWS	1	29	31	-2
2008	250105753	G ENERGY STAR WINDOWS	1	441	463	-22
2008	410089369	G ENERGY STAR WINDOWS	1	39	39	0
2008	570016928	G ENERGY STAR WINDOWS	1	5	25	-20
2007	827855	G ENERGY STAR DOORS	1	66	53	13
2007	1332240	G ENERGY STAR DOORS	1	24	92	-68
2007	10101669	G ENERGY STAR DOORS	1	22	89	-67
2007	90055315	G ENERGY STAR DOORS	1	66	89	-23
2007	690095537	G ENERGY STAR DOORS	1	55	80	-25
2007	740957	G ENERGY STAR WINDOWS	1	119	55	64
2007	1224570	G ENERGY STAR WINDOWS	1	287	212	75
2007	290064106	G ENERGY STAR WINDOWS	1	13	13	0
2007	410064696	G ENERGY STAR WINDOWS	1	44	39	5
2007	410084077	G ENERGY STAR WINDOWS	1	279	401	-122
2007	490099116	G ENERGY STAR WINDOWS	1	375	550	-175
2007	650036327	G ENERGY STAR WINDOWS	1	45	65	-20
2006	234	G ENERGY STAR WINDOWS	1	163	55	108
2006	289	G ENERGY STAR WINDOWS	1	111	65	46
2006	401	G ENERGY STAR WINDOWS	1	50	86	-36
STRATUM 4 (ALL OTHER MEASURES)						
2008	1715727	G HE FURNACE	1	73	64	9
2008	1917318	G HE FURNACE	1	230	250	-20
2008	10109658	G HE FURNACE	1	123	123	0
2008	90054359	G HE FURNACE	1	123	123	0
2008	410096429	G HE FURNACE	1	123	123	0
2008	570004563	G HE FURNACE	1	140	123	17
2008	570114369	G HE FURNACE	1	123	123	0
2008	650082824	G HE FURNACE	1	150	123	27
2008	690052738	G HE FURNACE	1	123	123	0
2008	770095216	G HE FURNACE	1	123	123	0

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2008	570114369	G HE WH 40G	1	8	8	0
2008	770005654	G HE WH 40G	1	8	8	0
2008	770112073	G HE WH 40G	1	8	8	0
2008	10099750	G HE WH 50G	1	11	11	0
2008	130084650	G HE WH 50G	1	11	11	0
2008	170081931	G HHS	1	12	12	0
2008	2127804	HEALTH & HUMAN SAFETY	1	5	5	0
2008	50096218	HEALTH & HUMAN SAFETY	1	4	4	0
2008	530109803	HEALTH & HUMAN SAFETY	1	1	2	-1
2008	570078060	HEALTH & HUMAN SAFETY	1	61	60	1
2008	610019574	HEALTH & HUMAN SAFETY	1	9	5	4
2007	826887	G HE FURNACE	1	184	119	65
2007	1128844	G HE FURNACE	1	348	105	243
2007	2119686	G HE FURNACE	1	72	105	-33
2007	50032298	G HE FURNACE	1	75	107	-32
2007	170088691	G HE FURNACE	1	50	119	-69
2007	330101145	G HE FURNACE	1	72	101	-29
2007	450100133	G HE FURNACE	1	72	105	-33
2007	450108853	G HE FURNACE	1	75	141	-66
2007	650075521	G HE FURNACE	1	298	105	193
2007	690074383	G HE FURNACE	1	72	141	-69
2007	1508613	G HE WH 40G	1	11	8	3
2007	90090201	G HE WH 40G	1	25	8	17
2007	290086632	G HE WH 40G	1	11	8	3
2007	1109368	G HE WH 50G	1	8	11	-3
2007	1609944	G HE WH 50G	1	8	11	-3
2007	1706937	G HE WH 50G	1	8	11	-3
2007	10092900	G HE WH 50G	1	8	11	-3
2007	330018934	G HE WH 50G	1	25	11	14
2007	370047443	G HE WH 50G	1	8	11	-3
2006	50	G HE FURNACE	1	72	72	0

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2006	243	G HE FURNACE	1	70	72	-2
2006	272	G HE FURNACE	4	72		
2006	344	G HE FURNACE	1	150	72	78
2006	421	G HE FURNACE	1	150	72	78
2006	229	G HE WH 40G	1	11	11	0
2006	237	G HE WH 40G	1	25	11	14
2006	369	G HE WH 40G	1	11	11	0
2006	1	G HE WH 50G	1	8	8	0
2006	15	G HE WH 50G	1	8	8	0
2006	76	G HE WH 50G	1	25	8	17
2006	135	G HE WH 50G	1	8	8	0
2006	214	G HE WH 50G	1	25	8	17
2006	236	G HE WH 50G	4	25	11	14
2006	279	G HE WH 50G	1	25	8	17
2006	424	G HE WH 50G	1	8	8	0

NONRESIDENTIAL PROGRAM

Table A.3: Case-by-Case Results for Nonresidential Program, 2006-2008

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
STRATUM 1 (LARGEST PROJECTS – CENSUS)						
2008	25006	HVAC Combined	1	40,753	47,400	-6,647
2008	26379	HVAC Combined	1	25,771	24,033	1,738
2008	25005	HVAC Combined	1	23,894	8,550	15,344
2008	25056	HVAC Combined	1	18,315	12,659	5,656
2008	22206	HVAC Combined	1	14,305	14,305	0
2008	25032	HVAC Combined	2	14,303	26,003	-11,700
2008	22842	HVAC Combined	1	65,953	68,039	-2,086
2008	25245	HVAC Combined	1	19,647	17,238	2,409
2008	27948	HVAC Combined	1	18,679	18,682	-3
2008	26700	HVAC Combined	1	14,703	14,171	532
2008	26751	HVAC Heating	1	31,300	24,900	6,400
2007	22479	LEED Certification	2	49,553	10,243	39,310
2007	21320	HVAC	1	39,297	43,728	-4,431
2007	24738	HVAC	1	36,059	50,775	-14,716
2007	24825	HVAC	1	31,723	80,915	-49,192
2007	23059	Shell	1	25,884	26,251	-367
2006	19719	HVAC	1	54,332	15,477	38,855
2006	20608	HVAC	2	19,096	---	---
2006	20933	HVAC	1	20,228	21,056	-828
2006	21202	Resource Management	1	71,731	71,731	0
2006	21310	HVAC	1	29,651	21,134	8,517
2006	21314	HVAC	1	27,193	21,754	5,439
STRATUM 2 (PRESCRIPTIVE MEASURES)						
2008	26825	Prescriptive Food Service	1	13	40.4	-27.4
2008	25198	Prescript. Demand Cont. Vent.	1	1855	894	961
2008	27343	Prescriptive Food Service	1	1463	1230.4	232.6
						Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2008	28143	Prescript. Steam Trap Repl.	1	827	265	562
2008	26989	Prescriptive Food Service	1	906	888	18
2008	27106	Prescript. Demand Cont. Vent.	1	7171	3467	3704
2007	25295	Pre-Rinse Sprayer	1	44	44	0
2007	24929	Pre-Rinse Sprayer	1	44	44	0
2007	25166	Pre-Rinse Sprayer	1	44	44	0
2007	24882	Pre-Rinse Sprayer	1	44	44	0
2007	24072	Pre-Rinse Sprayer	1	44	44	0
2006	23016	Pre-Rinse Sprayer	1	176	176	0
2006	23218	Pre-Rinse Sprayer	1	176	176	0
2006	23222	Pre-Rinse Sprayer	1	176	176	0
2006	23265	Pre-Rinse Sprayer	1	352	352	0
2006	23288	Pre-Rinse Sprayer	1	176	176	0
2006	23323	Pre-Rinse Sprayer	1	352	352	0
2006	23345	Pre-Rinse Sprayer	1	176	176	0
2006	23356	Pre-Rinse Sprayer	1	176	176	0
2006	23400	Pre-Rinse Sprayer	1	704	704	0
2006	23436	Pre-Rinse Sprayer	1	176	176	0
2006	23444	Pre-Rinse Sprayer	1	704	704	0
2006	23450	Pre-Rinse Sprayer	1	528	528	0
2006	23453	Pre-Rinse Sprayer	1	176	176	0
2006	23464	Pre-Rinse Sprayer	1	176	176	0
2006	23488	Pre-Rinse Sprayer	1	176	176	0
2006	23732	Pre-Rinse Sprayer	1	528	528	0
2006	23801	Pre-Rinse Sprayer	1	176	176	0
2006	23806	Pre-Rinse Sprayer	1	880	880	0
2006	23818	Pre-Rinse Sprayer	1	176	176	0
2006	23828	Pre-Rinse Sprayer	1	176	176	0
2006	23865	Pre-Rinse Sprayer	1	704	704	0
2006	23868	Pre-Rinse Sprayer	1	528	528	0
2006	23887	Pre-Rinse Sprayer	1	352	352	0

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
STRATUM 3 (ALL OTHER MEASURES)						
2008	27262	Appliances	1	700	1031	-331
2008	25927	Appliances	1	1578	1716	-138
2008	25031	HVAC Combined	2	5696	100	5596
2008	25958	HVAC Combined	1	8125	5779.9	2345.1
2008	26366	HVAC Combined	1	259	263	-4
2008	25952	HVAC Combined	1	587	586	1
2008	25881	HVAC Combined	1	611	666	-55
2008	27919	HVAC Combined	1	955	306	649
2008	27229	HVAC Heating	1	397	370.5	26.5
2008	28066	Rooftop Service	2	358	46	312
2008	28065	Rooftop Service	2	12011	3430	8581
2008	27593	Rooftop Service	2	326	275	51
2008	27501	Shell	1	31	24	7
2008	26621	Shell	1	1302	1074	228
2008	25899	Shell	1	80	85	-5
2008	26617	Shell	1	648	534	114
2008	28571	HVAC Heating	1	362	399.8	-37.8
2008	18249	HVAC Combined	1	1051	146.5	904.5
2008	28130	HVAC Heating	1	210	188.5	21.5
2008	27910	HVAC Combined	1	164	205.8	-41.8
2008	28868	Rooftop Service	2	2214	2098	116
2008	28878	Rooftop Service	2	1928	1535	393
2008	28290	Rooftop Service	2	584	459	125
2008	27506	Shell	1	392	394	-2
2008	27533	Shell	1	1614	1614	0
2008	28611	UCON MF Shell	1	648	535.68	112.32
2007	23959	Appliances	2	124	205	-81
2007	22920	HVAC	2	3,755	3,866	-111
2007	22003	HVAC	1	1,427	11,794	-10,367
2007	25628	HVAC	1	2,439	3,235	-796

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2007	21824	HVAC	2	966	2,742	-1,776
2007	22939	HVAC	1	273	124	149
2007	24106	HVAC	1	203	163	40
2007	22796	HVAC	1	12,524	9,883	2,641
2007	24422	HVAC	1	6,337	6,337	0
2007	24150	HVAC	1	11,494	11,494	0
2007	26030	Rooftop Service	2	1,814	544	1,270
2007	26144	Rooftop Service	2	390	242	148
2007	26283	Rooftop Service	2	103	103	0
2007	25477	Rooftop Service	2	573	231	342
2007	25496	Rooftop Service	2	87	149	-62
2007	26255	Rooftop Service	2	1,220	7	1,213
2007	25254	Rooftop Service	2	777	14	763
2007	25250	Rooftop Service	2	37	74	-37
2007	26011	Rooftop Service	2	93	157	-64
2007	25480	Rooftop Service	2	556	58	498
2007	26226	Rooftop Service	2	751	838	-87
2007	26238	Rooftop Service	2	389	444	-55
2007	26237	Rooftop Service	2	1,895	433	1,462
2007	25269	Rooftop Service	2	6,403	1,174	5,229
2007	24867	Shell	1	905	735	170
2007	22457	Shell	1	235	239	-4
2006	22514	Appliances	1	769	669	100
2006	19629	HVAC	1	319	297	22
2006	20873	HVAC	1	8,159	8,986	-827
2006	21282	HVAC	1	6,798	6,298	500
2006	22019	HVAC	1	3,651	4,170	-519
2006	22417	HVAC	1	1,588	1,574	14
2006	22425	HVAC	1	162	226	-64
2006	23092	Rooftop Service	2	518	1,081	-563
2006	23120	Rooftop Service	2	1,359	327	1,032

Continued

YEAR	ID #	MEASURE	FINAL DISPOSITION CODE#	ƒL<zd ~		AVISTA MINUS AUDIT
				AVISTA	AUDIT	
2006	23237	Rooftop Service	2	1,428	1,041	387
2006	23549	Rooftop Service	2	145	106	39
2006	23592	Rooftop Service	2	736	1,666	-930
2006	23594	Rooftop Service	2	29	510	-481
2006	7082	Shell	1	4,600	4,600	0
2006	21238	Shell	1	1,028	917	111
2006	21674	Shell	1	93	97	-4
2006	22257	Shell	2	797	---	---
2006	22308	Shell	1	216	247	-31
2006	22492	Shell	1	1,280	1,189	91
2006	22595	Shell	1	220	249	-29
2006	22597	Shell	1	134	125	9
2006	22601	Shell	1	166	154	12
2006	22604	Shell	1	258	351	-93

B SUMMARY DATA BY YEAR AND STRATUM

RESIDENTIAL PROGRAM

Table B.6: Final Disposition of Sampled Residential Cases

YEAR	DISPOSITION	2008 DATA		
		NUMBER OF CASES[1]	PERCENT	90% CONFIDENCE INTERVAL (CI)
2008	**1 = Documentation supports input data**	106	96.1	95.8 – 96.4
	2 = Insufficient documentation	1	0.2	0.2 – 0.3
	3 = Documentation contradicts input data	3	1.5	1.3 – 1.7
	4 = Measure was incorrectly coded	1	2.1	1.9 – 2.3
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	111	100.0	
2007	**1 = Documentation supports input data**	81	83.5	82.7 – 84.2
	2 = Insufficient documentation	3	1.9	1.7 – 2.2
	3 = Documentation contradicts input data	7	7.2	6.7 – 7.7
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	6	7.4	6.9 – 8.0
	TOTAL	97	100.0	
2006	**1 = Documentation supports input data**	60	82.0	80.9 – 83.0
	2 = Insufficient documentation	7	12.1	11.2 – 13.0
	3 = Documentation contradicts input data	2	2.9	2.4 – 3.3
	4 = Measure was incorrectly coded	3	2.4	2.0 – 2.8
	5 = Measure does not qualify for rebate	1	0.7	0.4 – 0.9
	TOTAL	73		
2006-2008 Stratum 1	**1 = Documentation supports input data**	92	84.8	84.6 – 85.1
	2 = Insufficient documentation	7	7.5	7.3 – 7.7
	3 = Documentation contradicts input data	8	6.9	6.7 – 7.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	1	0.8	0.7 – 0.8
	TOTAL	108		

Continued

YEAR	DISPOSITION	2008 DATA		
		NUMBER OF CASES[1]	PERCENT	90% CONFIDENCE INTERVAL (CI)
2006-2008 Stratum 2	1 = Documentation supports input data	94	88.1	87.9 – 88.4
	2 = Insufficient documentation	4	4.5	4.4 – 4.6
	3 = Documentation contradicts input data	4	4.5	4.4 – 4.6
	4 = Measure was incorrectly coded	1	1.9	1.8 – 2.0
	5 = Measure does not qualify for rebate	1	0.9	0.9 – 1.0
	TOTAL	104		
2006-2008 Stratum 3	1 = Documentation supports input data	35	91.6	91.4 – 91.7
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	3 = Documentation contradicts input data	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	1	8.4	8.3 – 8.6
	TOTAL	36		
2006-2008 Stratum 4	1 = Documentation supports input data	26	72.9	72.6 – 73.2
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	3 = Documentation contradicts input data	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	3	3.4	3.3 – 3.5
	5 = Measure does not qualify for rebate	4	23.7	23.5 – 24.0
	TOTAL	33		
2006-2008 Total (Weighted)	1 = Documentation supports input data	247	88.2	87.9 - 88.4
	2 = Insufficient documentation	11	3.0	2.9 - 3.1
	3 = Documentation contradicts input data	12	3.4	3.3 - 3.5
	4 = Measure was incorrectly coded	4	1.8	1.8 - 1.9
	5 = Measure does not qualify for rebate	7	3.6	3.5 - 3.7
	TOTAL	280[2]	100.0	

1 For readability, raw (unweighted) counts are shown in the table. However, percentages were based on counts that were weighted to account for differences in the sampling ratios across strata and across program years.

2 The number of cases of each disposition sum to 280, not 281, because one case represented both disposition '3' and disposition '4'. If that case had been counted twice, the total would be 281.

Table B.2: Stratum-by-Stratum and Year-by-Year Comparisons of Avista's Reported Residential Therm Savings and the Audit's Values

YEAR/STRATUM	AVISTA MEAN	AUDIT MEAN	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE
			VALUE	PERCENT		
2008 PROGRAM YEAR						
Stratum 1	103.4	105.5	-2.2	-2.1	-6.4 – 2.1	-55 – 68
Stratum 2	128.2	150.3	3.9	3.1	-2.5 – 10.3	0 – 189
Stratum 3	123.0	123.0	0.0	0.0	0 – 0	0 – 0
Stratum 4	19.3	19.3	0.0	0.0	-0.5 – 0.5	-4 – 2
Total	**83.3**	**86.9**	**-0.1**	**-0.1**	**-1.4 – 1.3**	**-55 – 189**
2007 PROGRAM YEAR						
Stratum 1	81.1	74.5	1.4	1.7	-4.8 – 7.5	-63 – 100
Stratum 2	109.7	102.1	10.8	9.8	0.3 – 21.3	0 – 211
Stratum 3	72.0	61.7	10.3	14.3	-6.6 – 27.2	0 – 72
Stratum 4	27.8	25.4	2.4	8.6	0.4 – 4.4	0 – 8
Total	**79.2**	**72.2**	**5.4**	**6.8**	**-0.8 – 11.5**	**-63 – 211**
2006 PROGRAM YEAR						
Stratum 1	46.9	47.0	2.7	5.8	-0.8 – 6.3	-1 – 51
Stratum 2	144.6	116.2	21.5	14.9	-12.5 – 55.6	0 – 280
Stratum 3	72.0	72.0	0.0	0.0	0 – 0	0 – 0
Stratum 4	36.3	6.1	30.1	83.1	-15.5 – 75.8	0 – 197
Total	**68.3**	**62.4**	**6.0**	**8.8**	**0.3 – 11.8**	**-1 – 280**
COMBINED 2006-2008 PROGRAM YEARS						
Stratum 1	81.0	81.4	0.2	0.3	-2.5 – 3	-63 – 100
Stratum 2	123.2	127.3	10.9	8.9	0.9 – 20.9	0 – 280
Stratum 3	79.1	77.1	6.7	8.5	-4.3 – 17.7	0 – 72
Stratum 4	25.5	18.3	3.1	12.1	0.2 – 6	-4 – 197
Total	75.3	**74.3**	**3.2**	**4.3**	**0.7 – 5.8**	**-63 – 280**

LIMITED-INCOME PROGRAM

Table B.3: Final Disposition of Sampled Limited-Income Cases

YEAR	DISPOSITION	2008 DATA		
		NUMBER OF CASES[1]	PERCENT	90% CONFIDENCE INTERVAL (CI)
2008	**1 = Documentation supports input data**	68	100.0	100.0 – 100.0
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	68		
2007	**1 = Documentation supports input data**	61	100.0	100.0 – 100.0
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	61		
2006	**1 = Documentation supports input data**	62	98.0	97.6 – 98.4
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	2	2.0	1.6 – 2.4
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	64		
2006-2008 Stratum 1	**1 = Documentation supports input data**	55	100.0	100.0 – 100.0
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	55		
2006-2008 Stratum 2	**1 = Documentation supports input data**	54	100.0	100.0 – 100.0
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	54		
				Continued

YEAR	DISPOSITION	2008 DATA		
		NUMBER OF CASES[1]	PERCENT	90% CONFIDENCE INTERVAL (CI)
2006-2008 Stratum 3	**1 = Documentation supports input data**	28	100.0	100.0 – 100.0
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	0	0.0	0.0 – 0.0
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	28		
2006-2008 Stratum 4	**1 = Documentation supports input data**	54	93.7	93.5 – 93.9
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	2	6.3	6.1 – 6.5
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	56		
2006-2008 Total (Weighted)	**1 = Documentation supports input data**	191	99.6	99.5 – 99.6
	2 = Insufficient documentation	0	0.0	0.0 – 0.0
	4 = Measure was incorrectly coded	2	0.4	0.4 – 0.5
	5 = Measure does not qualify for rebate	0	0.0	0.0 – 0.0
	TOTAL	193		

[1] For readability, raw (unweighted) counts are shown in the table. However, percentages were based on counts that were weighted to account for differences in the sampling ratios across strata and across program years.

Table B.4: Stratum-by-Stratum and Year-by-Year Comparisons of Avista's Reported Limited-Income Therm Savings and the Audit's Values

YEAR/STRATUM	AVISTA MEAN	AUDIT MEAN	MEAN DIFFERENCE		90% CONFIDENCE INTERVAL	RANGE
			VALUE	PERCENT		
2008 Program Year						
Stratum 1	160.7	122.3	38.4	31.4	-0.8 – 77.6	-79 – 343
Stratum 2	81.8	49.4	32.4	65.6	18.8 – 46	-15 – 93
Stratum 3	141.8	132.1	9.7	7.3	-19.6 – 39	-25 – 251
Stratum 4	70.0	68.2	1.8	2.6	-0.2 – 3.7	-20 – 27
Total	**129.5**	**98.8**	**30.7**	**31.1**	**9.8 – 51.7**	**-79 – 343**
2007 Program Year						
Stratum 1	171.1	133.0	38.1	28.6	-19.7 – 95.9	-166 – 296.8
Stratum 2	89.4	83.2	6.2	7.4	-8.5 – 20.9	-83.4 – 48.5
Stratum 3	116.3	144.8	-28.5	-19.7	-58.7 – 1.7	-175 – 75.1
Stratum 4	75.3	65.2	10.1	15.5	-14.4 – 34.6	-68.8 – 243.1
Total	**133.4**	**113.8**	**19.6**	**17.3**	**-10.2 – 49.5**	**-175 – 296.8**
2006 Program Year						
Stratum 1	195.0	165.9	29.1	17.6	-9.9 – 68.2	-89.4 – 266.7
Stratum 2	93.3	77.7	15.6	20.1	9.1 – 22	-10 – 69.9
Stratum 3	108.0	68.5	39.5	57.8	-26.5 – 105.5	-35.7 – 108.4
Stratum 4	43.3	25.9	15.5	60.1	5.6 – 25.5	-2 – 78
Total	**136.2**	**113.9**	**23.7**	**20.8**	**4.4 – 43.1**	**-89.4 – 266.7**
Combined 2006-2008 Program Years						
Stratum 1	177.9	143.4	35.4	24.7	10.1 – 60.7	-166 – 343
Stratum 2	88.6	70.3	19.2	27.4	12.1 – 26.3	-83.4 – 93
Stratum 3	127.2	130.7	2.2	1.7	-19.4 – 23.8	-175 – 251
Stratum 4	64.1	55.6	10.0	17.9	3.4 – 16.6	-68.8 – 243.1
Total	**135.0**	**112.0**	**23.6**	**21.1**	**10.5 – 36.8**	**-175 – 343**

C RESIDENTIAL AND LIMITED-INCOME DOCUMENTATION PROBLEMS

Table C.1: Residential Sample Cases with Documentation Problems, 2006-2008

YEAR	CASE ID	MEASURE TYPE	EXCEPTION
DISPOSITION = 2, "INSUFFICIENT DETAIL"			
2006	115	Replacement Windows	The invoice does not provide any detail on window dimensions or size.
2006	2118	Replacement Windows	The invoice does not provide any detail on window dimensions or size.
2006	2745	Replacement Windows	The invoice does not provide any detail on window dimensions or size.
2006	2975	Replacement Windows	The invoice does not provide any detail on window dimensions or size.
2006	1269	New Windows	No invoice was provided. No other documentation provides detail on window dimensions or size.
2006	3002	Insulation – Wall/Floor	The invoice does not provide any detail on amount of insulation installed.
2006	3298	New Windows	No invoice was provided. No other documentation provides detail on window dimensions or size.
2007	450082177	New Windows	No invoice was provided. Unable to obtain invoice from vendor.
2007	410093226	Insulation - Ceiling/Attic	Invoice does not specify number of square feet covered. Vendor did not return repeat calls.
2007	690043710	Insulation - Ceiling/Attic	Invoice does not specify number of square feet covered. Vendor was not able to provide the data.
2008	170106674	Insulation – Wall/Floor	The invoice did not provide sufficient detail. When contacted, the vendor stated that they installed no insulation at this site.
DISPOSITION = 3, "INVOICE CONTRADICTS REBATE FORM"			
2006	2373	Replacement Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 19%.
2006	93	Insulation – Duct	The rebate form counts water pipe insulation, in addition to duct insulation, documented on the invoice. As a result, savings in the Avista data file exceeded that calculated from documented insulation linear footage by 46%.
			continued

YEAR	CASE ID	MEASURE TYPE	EXCEPTION
2007	902365	New Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 40%.
2007	1010248	New Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 9%.
DISPOSITION = 3, "INVOICE CONTRADICTS REBATE FORM" (CONTINUED)			
2007	210039444	New Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 10%.
2007	1809816	New Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 26%.
2007	1010427	New Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 58%.
2007	770098626	Insulation - Ceiling/Attic	Therm savings in Avista data file exceed that calculated from documented insulation square footage by 7%.
2007	90053146	Insulation - Wall/Floor	Therm savings in Avista data file exceed that calculated from documented insulation square footage by 75%.
2008	130105627	New Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 7%.
2008	490099788	Replacement Windows	Therm savings in Avista data file exceed that calculated from documented window square footage by 40%.
2008	410067679	Insulation – Wall/Floor	Therm savings in Avista data file exceed that calculated from documented insulation square footage by 36%.
DISPOSITION = 4, "INCORRECTLY CLASSIFIED"[2]			
2006	93	Fireplace Damper	The measure was duct insulation, not a fireplace damper.
2006	110	High-Efficiency 40-Gallon Water Heater	Model number on rebate form is for 50-G, not 40-G.
2006	1497	ENERGY STAR® Home	The measure was electric, not gas.
2008	730117983	ENERGY STAR® Dishwasher	The measure was an ENERGY STAR® clothes washer, not dishwasher.
DISPOSITION = 5, "DOES NOT QUALIFY"			
2006	861	High-Efficiency 40-Gallon Water Heater	EF < .60, does not meet standard for rebate.

YEAR	CASE ID	MEASURE TYPE	EXCEPTION
			continued
2007	250109418	Replacement Windows	The invoice indicated U-factors all exceed .35.
2007	2012487	Insulation - Ceiling/Attic	The measure was insulation under siding; does not qualify.
2007	130070564	High-Efficiency Boiler	AFUE < 85%, does not meet standard for rebate
2007	210103749	High-Efficiency 50-Gallon Water Heater	EF < .60, does not meet standard for rebate.
2007	1112720	High-Efficiency 50-Gallon Water Heater	EF < .60, does not meet standard for rebate.
2007	130047730	High-Efficiency 50-Gallon Water Heater	Electric to gas conversion

1 In the 2006 report, three additional cases were reported as having documentation that contradicted the rebate form. These were ID 1214, 1787, and 2173. All were cases of replacement windows. A review of all records indicating documentation errors, carried out for this final report, found that all three should have been classified as confirmed because the square footage of windows on the invoice, although differing somewhat from that shown on the rebate form, was within 5%.

2 In the 2006 report, two additional cases were reported as having been incorrectly classified. These were ID 121 and ID 1083. In both cases, the rebate form indicated the measure was "High-Efficiency Water Heater 50-gallon" but the invoice stated that they were tankless water heaters. Subsequent discussion with Avista clarified that Avista used the same measure code for both measures, since they both had the same level of prescribed savings. Our engineering review accepted Avista's prescribed savings for both the measures (but recommended a higher level of savings for the tankless water heaters), so there is no reason to consider these as misclassified.

Table C.2: Limited-Income Sample Cases with Documentation Problems, 2006-2008

YEAR	CASE ID	MEASURE TYPE	EXCEPTION
2006	319	Health & Human Safety	The Avista database recorded 3 therms for *Health & Human Safety* measures for this case. We received only invoice form screen captures with output data, and no input data. The form indicates that *Health & Safety* was "N/A", with 0 therms, but a cost of $154.67.
2006	399	Health & Human Safety	The Avista database recorded 2 therms for *Health & Human Safety* measures for this case. The invoice form documents *Health & Safety* expenses, but does not document the measures installed and indicates 0 therm savings.
2006	236	High-Efficiency 50-Gallon Water Heater	The invoice documents a 40-gallon water heater, not a 50-gallon heater.
2006	272	High-Efficiency Furnace	The invoice documents electric to gas conversion, not a high-efficiency gas furnace.
2007	50040746	Air Infiltration	Pre- and post-CFM measurements from the fandoor test do not match the CFM listed on the input forms
2007	570085190	Air Infiltration	Pre- and post-CFM measurements from the fandoor test do not match the CFM listed on the input forms
2007	1128844	High-Efficiency Furnace	Baseline and retrofit efficiencies had to be assumed, and were assumed using AVISTA assumptions for baseline equipment and residential program requirements for retrofit equipment
2007	650075521	High-Efficiency Furnace	Baseline and retrofit efficiencies had to be assumed, and were assumed using AVISTA assumptions for baseline equipment and residential program requirements for retrofit equipment
2007	90090201	High-Efficiency 40-Gallon Water Heater	Available documentation did not provide sufficient input to support the claimed savings, which exceeded the prescriptive amount
2007	330018934	High-Efficiency 50-Gallon Water Heater	Available documentation did not provide sufficient input to support the claimed savings, which exceeded the prescriptive amount

D LARGEST NONRESIDENTIAL PROJECTS

2008 PROGRAM (SIX OF ELEVEN LARGEST PROGRAMS)

As explained in detail in the report body, we initially drew projects to verify from the first three quarters of 2008 so that we could begin the verification audit before the end of the year to meet the strict deadline for completion. When we drew the sample from the first three quarters, we also selected the six largest projects for verification.

Later, when other large projects were provided from the fourth quarter, we identified five projects for which the claimed savings were greater than at least one of the six drawn from the first three quarters. Combined, there were 11 large project candidates. We performed verification analyses on all 11 projects, and we include the results of all 11 analyses in the report body. Below, we describe the 6 largest of those 11 projects.

22842 – Hecla Mining

This project involved several measures such as insulation of steam lines, installation of new hot water boilers, replacement of steam heat exchangers, removal of steam lines, hot water outdoor reset, and insulation of new hot water lines. The savings for the first measure (1F) were recalculated as 8,510 therms, an increase of 2,086 therms. Due to a change in the pipe R-value, the baseline heat loss for the 130-foot steam pipe was recalculated as 608 Btu/hr, higher than the Avista value of 469 Btu/hr. The modified (post verification) savings from the 2nd measure (1G) were accepted as 59,529.

25006 – Kellogg High School

This application involved several upgrades to the HVAC system at the high school, including new high-efficiency boilers, a new chiller, outdoor reset for the hot water and the chilled water. In several areas of the school, fan-coil units and unit ventilators using HW and CHW were installed to replace RTUs using gas furnaces and D/X cooling. In other areas, existing RTUs were replaced with newer, high-efficiency RTUs.

Replicating the savings for this project was difficult, as it involved a very large facility (90,500 sf) with many HVAC systems of varying type and size. For example, the audit report from the ESCO indicated that the school had 10 RTUs, but did not identify the zones served by the RTUs.

Nonetheless, an eQUEST model calibrated to the previous (2003 – 2004 year) energy consumption of was provided and used as a baseline. A new proposed model was supplied and compared to the retrofits as documented by the ESCO and Avista. The results show savings of 47,400 therms, a slight increase of the reported value by Avista.

It is worth mentioning that the ESCO project involved several EEMs, of which this application was only one. For large projects like this, it should be recognized that the estimated savings are greatly affected by the order in which the measures are evaluated, due to interactive effects. It is generally recommended that measures be evaluated in the following order—loads (as affected by the envelope), systems, and then plant. This is in accordance with the strategy suggested in the *California Energy Commission's Guide to Preparing Feasibility Studies for Energy Efficiency Projects*. Because the ESCO evaluated the measures in a different order, the savings can vary drastically from one measure to the next.

26751 – Washington Mutual Tower

This project involved the replacement of the existing gas-fired hot water boilers with high-efficiency boilers. The building is a 3-story 75,000 sf office building in Spokane. It was not entirely clear from the documentation what the baseline boiler efficiency should be; Nexant did not change the boiler efficiency in the baseline model. Nexant determined that the savings were 24,900 therms, about 20% less than what was reported by Avista.

26379 – Sandpoint Financial and Technical Center

This project consisted of evaluating different HVAC types compared to the baseline "code-level" system for a new 3-story, 87,000 sf office. The proposed system is a ground-source heat pump. Nexant determined that the savings were 24,033 therms, slightly less than that reported by Avista.

The eQUEST models were generally sound--the largest source of discrepancy comes from the determination of the proper baseline HVAC system. The baseline system selected by Avista was a large multi-zone AHU, which is inherently less efficient than separate packaged single zone RTUs. Selection of packaged single zone equipment shows less consumption in the baseline.

Nexant recommends that in the future, either WESC Appendix RS-29 or ASHRAE 90.1-2004 Appendix G be used to determine the baseline system. Per RS-29, the baseline system would be central VAV with reheat, fan-powered terminals and HW boiler; per Appendix G, the baseline system would be packaged VAV with reheat and HW boiler. Selection of either of these systems as the baseline would yield less therm savings for the proposed system. It is also suggested that the actual internal loads (e.g. lighting, equipment) of the facility be used, as these strongly affect energy consumption; these could not be verified from the documentation.

25005 – Kellogg High School

This project is directly related to Application #25006 described above. The measure investigated is Demand Controlled Ventilation (DCM), which adjusts the outside air (OA) to match the occupancy of the conditioned space. The occupancy of the space is monitored by CO_2 sensors, which are placed in the return air ducts. It should be noted that the savings originally reported by Avista (23,894 therms) were mis-transcribed and did not correspond to the value reported by the ESCO in its report (10,392). Nexant determined that the savings for this measure were 8,550 therms, about 18% less than what was reported by the ESCO.

The eQUEST models seemed basically sound; however it is suggested that the OA cfm requirement per person in the models be reduced to the values published in ASHRAE 62.1—for example, 10 cfm/person (classrooms), 7.5 cfm/person (gymnasium, cafeteria).

25056 – Post Falls City Hall

This application involved a new 3-story, 42,000 sf office building, to be occupied by the City of Post Falls, Idaho. Several different HVAC system types were considered for the facility, as improvements over the baseline system.

As in the case of application #26379 above, the largest source of discrepancy comes from the determination of the proper baseline HVAC system. The baseline system selected by Avista was a large multi-zone AHU, which is inherently less efficient than separate packaged single zone RTUs. Selection of packaged single zone equipment shows less consumption in the baseline.

Nexant recommends that in the future, either WESC Appendix RS-29 or ASHRAE 90.1-2004 Appendix G be used to determine the baseline system. Per RS-29, the baseline system would be packaged rooftop VAV with reheat, fan-powered terminals and HW boiler; per Appendix G, the baseline system would be packaged single zone with D/X cooling and natural gas furnace. Selection of either of these systems as the baseline would yield less therm savings for the proposed system. It is also suggested that the actual internal loads (e.g. lighting, equipment) of the facility be used, as these strongly affect energy consumption; these could not be verified from the documentation.

2007 PROGRAM (FIVE LARGEST PROGRAMS)

24825 – Spokane Valley Mall

This is an extremely large facility, comprising approximately 738,000 square feet. The eQUEST analysis seems generally sound, but it appears that many default settings were used within eQUEST, which could be problematic for a facility of this size.

The default skylight settings caused a warning in eQUEST, as the number of skylights exceeds the maximum allowed. The internal loads seem extremely low. There was no external documentation of many critical components, such as the actual HVAC systems, zoning and internal loads. It is acceptable to go with eQUEST defaults on many construction parameters, but strongly suggest that actual operating schedule and temperature setpoints for the facility be used, as these strongly affect energy consumption.

The baseline eQUEST model (as supplied) over-predicts the actual energy consumption. Consequently, scaling factors (less than 0.2) must be applied to the output to get results close to the actual consumption. Nexant made minor revisions to the model, and reanalyzed this project using a more recent version of eQUEST. Nexant calculated the savings to be significantly larger than that reported by Avista. Because of the large deviation in estimated savings, and because there were a large number of unknown parameters, Nexant recommends that the Avista value be used.

24738 – Saranac Building

This is a new construction project which was seeking LEED certification. The project was analyzed using eQUEST by an ESCO. There are several energy savings features in the proposed design which result in savings over the baseline model. The main source of gas savings was the use of a ground source heat pump system instead of the baseline HVAC system.

The existing eQUEST analysis seems generally sound, but baseline model indicates electric heating, which doesn't seem to correspond with other documentation. The largest source of error comes from the determination of the baseline HVAC system. Per ASHRAE 90.1-2004, the baseline system should be PVAV with hot water gas fired boiler (not electric reheat or furnace as analyzed by the ESCO). Also, the building shell had a few problems (e.g. exterior walls are missing on a portion of roof) and efficiency ratings of heat pumps seem overly optimistic. It is also suggested that actual operating schedule and temperature setpoints for the facility be used, as these strongly affect energy consumption; these could not be verified from the documentation.

Nexant made modifications to the models and recalculated the savings to be 50,775 therms (compared to 36,059 as reported by Avista).

23059 – (Name Withheld, No Release Signed)

The analysis was originally performed using a customized spreadsheet developed by Avista for shell measures. The project consisted of upgraded wall and ceiling insulation for a manufacturing facility.

Nexant re-analyzed the project using its own customized spreadsheet, which entailed an hourly bin analysis using the UA method. Nexant calculated gas therm savings very close to Avista's reported gas savings (about 1% higher than Avista's value).

21320 – Odessa Memorial Hospital

This project was originally evaluated by an ESCO using eQUEST version 3.54. In ECM 1, several changes to the envelope were made, consisting of wall and window upgrades. In ECM 2, several mechanical upgrades were evaluated, including a high efficiency condensing gas boiler, new air handlers, a new DDC control system, and a high efficiency hot water heater.

Nexant reviewed the eQUEST input files and found the models to be solid and consistent with the documentation. However, because Nexant used a more current version of eQUEST (version 3.61e) than originally used, the results are slightly different. It should be noted that the savings are based on the difference between the design and the current Washington *code* requirements, not the *actual* use. Nexant estimates the savings to be 43,728 therms over the modified baseline, compared to 39,297 therms, as reported by Avista.

22479 – Spokane Convention Center

This is a new construction project which was seeking LEED certification. The project was analyzed using Carrier's HAP model by an ESCO. There are several gas and electric energy savings features in the proposed design, which result in kWh and therms savings over the baseline model.

Several HAP model output reports were provided, showing energy consumption before and after various measures. In addition, many of the input parameters were summarized in the LEED documentation. Curiously, the baseline model was based upon ASHRAE 90.1-1999 prescriptive requirements, while it seems as if the 2004 version would have been more applicable.

The key measures evaluated are demand controlled ventilation, domestic hot water reduction (low flow faucets), higher efficiency hot water heaters, a higher efficiency boiler, along with other measures.

For the review, Nexant created an eQUEST model and calibrated the annual gas usage to match the base case gas usage provided by Avista's HAP model. However, because we did not have many of the details of the model (such as the geometry, layout, occupancy, and zoning), our calibration procedure is partially incomplete. Using our eQUEST model, we ran an 8760 hourly analysis to compute the annual gas savings. The results indicated that the savings would be substantially less than that predicted by the HAP tool. This seems to be partly due to the heating hours and occupancy periods used in HAP, which appear too high and not consistent with the documentation. Nexant estimates that the savings would be 10,243 therms, as opposed to 49,553 therms reported by Avista.

2006 PROGRAM (SEVEN LARGEST PROGRAMS)

19719 – Spokane Public Facilities

This is a new construction project. The customer is claiming therms savings for a proposed central heating system in lieu of packaged rooftop units. A Carrier HAP model output summary and the equipment schedule showing the boiler rated heating capacity and efficiency were provided. We also were provided with information pertaining to the DHW heating upgrade, which accounts for 2,033 therms of the 54,332 therms reported.

For the review, we created an *EZ Sim* model and calibrated the annual gas usage to match the base case gas usage provided by Avista's HAP model. However, because we did not have many of the details of the HAP model, our calibration procedure is partially incomplete. Using the estimated boiler heating capacity from our *EZ Sim* model, we ran an hourly temperature bin analysis to compute the annual gas savings.

The energy savings calculated from our analysis are significantly less than Avista's reported value (13,444 therms vs. a reported value of 52,299 therms). We were able to verify the reported energy savings from the DHW heating upgrade and confirmed Avista's reported savings of 2,033 therms. Therefore, our overall calculated savings came to 15,477, approximately 28% of Avista's reported savings.

20608 – Kootenai Medical Center

During our review, we found no documentation or M&V (measurement and verification) conducted to show that the air flow rate is at 12,485 CFM, as reported. Also, there was no documentation to show that at 65% effectiveness, the heat exchanger is able to achieve a 45^{o} F temperature rise, without knowing what the hot and cold fluid streams temperatures are going in and out of the heat exchanger. We deemed an 80% AFUE or thermal efficiency for the gas heater to be a reasonable assumption.

Because of the lack of documentation to validate the stated assumptions for this project, we were unable to verify the project savings.

20933 – Huntwood Industries

During our review, we found no documentation on the size of the heating equipment and no indication that the DDC on/off occupied/unoccupied time schedule has been programmed into the EMCS. We were not able to verify whether the *EZ Sim* model had accurately estimated the required heating load of the building. However, while using the *EZ Sim* estimated heating equipment size, we recalculated the energy savings from the given occupied/unoccupied set points. The results of our analysis were approximately 4% higher than the *EZ Sim* results.

21202 – Spokane Public Schools

This is a special partnership program between Avista and the Spokane Public School District (SPSD), called the *Resource Management Partnership Program* (RMPP), which aims to "promote resource savings and demonstrate the cost effectiveness of improved operations and maintenance within existing facilities... to reduce user-oriented inefficiencies in fuel source consumption..."

We received historical utility data and irrigation reports for all the facilities in the Spokane Public School District. We checked the analysis and found no errors, and therefore we have approved the reported energy savings as submitted.

21310 – East Valley School District

During our review, we found no documentation to support the assumed base case boiler efficiency of 60%. A 60% boiler efficiency was deemed too low and, in the absence of proper documentation, we increased the baseline efficiency. There was also no identifiable reason as to why the W/SF for the DHW heater decreased after reducing the storage tank volume, therefore we revised the proposed 0.25 W/SF back to the base case value of 0.29 W/SF. We used the original *EZ Sim* model with slight modifications to the input parameters, as described above, to obtain our savings value of 21,134 therms, which was about 29% less than Avista's reported savings of 29,651.

21314 – Triple Play Park (HVAC)

For this measure, we calculated savings using a catalogue-sizing approach – that is, using the manufacturer's method for unit sizing. We checked this approach against ASHRAE and found it to be reasonably conservative. However, the calculation further divided the recovered energy by heater efficiency of 80%. This is an unnecessary step because this heat did not originate from the pool heater, but rather is the latent heat of vaporization from the dehumidifier. We accepted the assumption of 80% recoverable heat, and our calculated results were about 20% lower than Avista's reported value.

21542 – Spokane Athletic Club

Avista used *EZ Sim* to model the gas savings from the installation of the new high efficiency burners for two existing boilers. The burners on the existing boilers were being replaced because they were found to be malfunctioning. The facility contacted Avista when they noticed a large increase in utility usage and stated that the boilers were barely able to maintain the space heating and water heating load for the facility. The original energy savings for this project were reported at 17,260 therms, based on the *EZ Sim* model. Avista revised this energy savings amount after reviewing and comparing the customer's gas usage for the period 10/2005 through 6/2006 against gas usage from one year before (10/2004 through 6/2005). Based on the utility bill data (adjusted for heating degree-days), the energy savings were increased to 110,558 therms.

We have determined that the baseline energy usage must not be based solely on the 10/2004-6/2005 gas billing data, because we believe that during this period the boilers were malfunctioning and operating at an unusually high gas usage rate. Therefore, we evaluated the energy savings based on 2002 and 2003 utility history and calculated energy savings to be approximately 66% lower than Avista's reported savings estimate of 110,558 therms.

3. Please provide documentation showing Avista's measures to limit the cost incurred by the DSM tariff rider for the annual DSM verification audits to $35,000 each.

For the audits of 2006 and 2007 DSM activity, a total of $120,397.63 was paid to RIA. Only $70,000 should have been tariff rider dollars. The Company should have charged $50,397.63 of that total below the line.

For the 2008 audit, the Company will be paying RIA an estimate of $60,000. Approximately 75% of their work was completed during 2008. Applying $45,000 (75% of $60k) of this estimate during 2008 with the first $35,000 to be paid with rider funds, the remaining $10,000 should be accrued below the line for 2008. Assuming a final payment is made to RIA in 2009, the difference between the total amount paid to RIA for the 2008 audit and $45,000 would be recorded below the line in 2009.

Therefore, the total amount that was recorded/expensed in Dec. '08 was $60,397.63, which was charged to the same account used for Titus (FERC Account # 426500) with a $50,397.63 offset to the tariff rider.

Exhibit H-5 Schedule Migration Tracking Methodology

Description of Schedule Shifting Estimation Process & Results

Monthly deferrals under Avista's decoupling pilot began in January 2007. The "base year" for all of the monthly deferrals during 2007 was 2004. For the new customer adjustment, each month beginning Jan. '07, the monthly usage for all new customers added since the corresponding month of the base year (Jan. '04) is subtracted from the total usage as part of the deferral calculation. The base year for all of the monthly deferrals during 2008 is 2006 (new general rates effective 1/1/08 with a 2006 test year). For the new customer adjustment for 2008 deferrals, the monthly usage for all new customers added since the corresponding month of 2006 is subtracted from the total usage.

Each month, the company runs a program that calculates the annual bill for Schedule 101 and 111 customers based on their most recent twelve months usage. If the customer's annual bill would have been 5% or $300 less on the other schedule, they are switched to the other schedule. In estimating the effect of customer schedule switching on the decoupling deferrals during the 2007-2008 period, we have to eliminate new customers from those that switched schedules during the relevant time period.

For the 2004 base year (used for 2007 deferrals), we ran a query to identify the customers that switched schedules from 1/05 – 12/07 (excluding new open accounts during that time). The accounts that switched schedules during that period are shown on the "For 2007 Deferrals" tab on the attached Decoupling Schedule Migration spreadsheet. The accounts are divided into four subsets: 1) switched from 111 to 101 during '05 and '06, 2) switched from 101 to 111 during '05 and '06, 3) switched from 111 to 101 during '07, and 4) switched from 101 to 111 during '07.

Schedule switches that affect the 2007 deferrals are those that occurred during '05-'07. For the schedule switches that occurred during '05 and '06, the spreadsheet shows the 2004 base year usage for nearly all of those customers. For customers that switched from 111 to 101, we averaged the 2004 usage for all of the customer usage shown, (5,856) and multiplied it by the total number of customers that switched (66), resulting in 386,474 therms for that subset. The same methodology was used for customers that switched from 101 to 111, resulting in (418,629) therms for that subset.

For customers that switched during '07, only a portion of their 2004 usage would affect the 2007 decoupling deferrals. For each of these customers, we looked at the date they were switched ("change after" column). The number of days remaining in '07 following the day they were switched was divided by 365 to result in the percentage shown in the "% of 2007" column. This percentage was then multiplied by their 2004 usage to result in an estimate of their usage that was in the base year that is not in the 2007 deferral year. This % of 2007 amount was then totaled for all customers that switched from 111 to 101, which resulted in 57,482 therms, and for switches from 101 to 111, which resulted in (72,959) therms. The net result for all four subsets is (47,632) therms.

Exhibit H-5 Schedule Migration Tracking Methodology

For the 2006 base year (used for 2008 deferrals), we identified customers that switched schedules from 1/07 – 10/08 and excluded those that were a new open account during that time. A similar analysis was done to the switches applicable to the 2007 deferrals/2004 base year, with all (2006) usage included for customers that switched during 2007 and a percentage of ’06 usage included for customers that switched during 2008. The net result for all four subsets for the 2008 deferrals is (289,753) therms.

Combining the results of both the 2007 and 2008 deferral periods results in an estimated net shift of 337,385 therms from 101 to 111, i.e., additional deferrals resulting from 47,632 therms times the 2006 margin and 289,753 therms times the 2007 margin.

Note that this methodology was modified in 2009 to capture the actual usage impact after switching rate schedules in lieu of using a proportion based on days in each rate schedule. Therefore, all usages in this exhibit have been updated and are shown on the following pages. (Titus, 3/9/09)

Exhibit H-5 Schedule Migration Tracking Methodology

For 2007 Deferrals

CUST_ACCT_KY	CUST_OPEN_DTE	SRV_CDE	_SCHEDULE	CHANGE_DTE	month	Test Year Usage	Open After	12/31/2004	old sched	new sched	% of 2007	change after	12/31/2004	Therms From Migration
2539117	03-Mar-94	G	111	22-Jan-05	1	2,211			111	101	100%	1/22/2005		2,211
410068643	01-Nov-02	G	111	22-Jan-05	1	2,333			111	101	100%	1/22/2005		2,333
450054460	26-Jun-01	G	111	23-Feb-05	2	-			111	101	100%	2/23/2005		-
410054528	01-Jul-01	G	111	05-Mar-05	3	2,814			111	101	100%	3/5/2005		2,814
923976	01-Jun-76	G	111	17-Mar-05	3	2,772			111	101	100%	3/17/2005		2,772
50083340	04-Oct-04	G	111	05-May-05		8,867			111	101	100%	5/5/2005		
90007905	01-Feb-95	G	111	02-Jun-05	6	8,272			111	101	100%	6/2/2005		8,272
2308102	01-Jun-70	G	111	24-Jun-05	6	6,847			111	101	100%	6/24/2005		6,847
509233	01-Jan-79	G	111	24-Jun-05	6	6,301			111	101	100%	6/24/2005		6,301
627865	01-Jan-79	G	111	24-Jun-05	6	6,557			111	101	100%	6/24/2005		6,557
2307239	01-Jan-79	G	111	24-Jun-05	6	3,563			111	101	100%	6/24/2005		3,563
1702643	19-Sep-80	G	111	24-Jun-05	6	3,339			111	101	100%	6/24/2005		3,339
1312290	23-Oct-86	G	111	24-Jun-05	6	4,159			111	101	100%	6/24/2005		4,159
2307119	22-Aug-89	G	111	24-Jun-05	6	7,910			111	101	100%	6/24/2005		7,910
1000601	29-Jun-92	G	111	24-Jun-05	6	2,418			111	101	100%	6/24/2005		2,418
2115851	15-Mar-93	G	111	24-Jun-05	6	2,564			111	101	100%	6/24/2005		2,564
621103	15-May-93	G	111	24-Jun-05	6	6,690			111	101	100%	6/24/2005		6,690
50005715	30-Nov-94	G	111	24-Jun-05	6	7,068			111	101	100%	6/24/2005		7,068
530008147	28-Feb-95	G	111	24-Jun-05	6	4,884			111	101	100%	6/24/2005		4,884
250015401	03-May-96	G	111	24-Jun-05	6	6,233			111	101	100%	6/24/2005		6,233
330025229	25-Sep-97	G	111	24-Jun-05	6	6,935			111	101	100%	6/24/2005		6,935
130046390	13-Jul-00	G	111	24-Jun-05	6	5,473			111	101	100%	6/24/2005		5,473
170048161	19-Jul-00	G	111	24-Jun-05	6	7,034			111	101	100%	6/24/2005		7,034
250063240	02-Jul-02	G	111	24-Jun-05	6	5,524			111	101	100%	6/24/2005		5,524
650068500	22-Feb-03	G	111	24-Jun-05	6	9,092			111	101	100%	6/24/2005		9,092
770077928	06-Aug-03	G	111	24-Jun-05	6	5,138			111	101	100%	6/24/2005		5,138
250073695	11-Sep-03	G	111	24-Jun-05	6	6,903			111	101	100%	6/24/2005		6,903
370077133	29-Jan-04	G	111	24-Jun-05	6	4,979			111	101	100%	6/24/2005		4,979
130081586	23-Aug-04	G	111	24-Jun-05		703			111	101	100%	6/24/2005		
450085593	18-Dec-04	G	111	24-Jun-05		6,174			111	101	100%	6/24/2005		
923244	06-Apr-93	G	111	22-Jul-05	7	3,602			111	101	100%	7/22/2005		3,602
1000598	09-Jan-78	G	111	21-Aug-05	8	5,576			111	101	100%	8/21/2005		5,576
739734	01-Mar-78	G	111	21-Aug-05	8	2,753			111	101	100%	8/21/2005		2,753
2007195	22-Dec-78	G	111	21-Aug-05	8	4,209			111	101	100%	8/21/2005		4,209
505161	31-Jul-80	G	111	21-Aug-05	8	6,154			111	101	100%	8/21/2005		6,154
250049007	01-Oct-00	G	111	21-Aug-05	8	2,481			111	101	100%	8/21/2005		2,481
290067547	03-Jan-03	G	111	21-Aug-05	8	4,746			111	101	100%	8/21/2005		4,746
570075683	20-Nov-03	G	111	21-Aug-05	8	4,673			111	101	100%	8/21/2005		4,673
770080057	29-May-04	G	111	21-Aug-05	8	2,298			111	101	100%	8/21/2005		2,298
290076857	24-Jan-04	G	111	23-Aug-05	8	4,353			111	101	100%	8/23/2005		4,353
Conversions to 101 less new customers signified by														
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
2	1	2	0	0	22	1	9	0	0	0	0			
37														**178,858**
2550884	03-May-94	G	111	20-Jan-06	1	3,837			111	101	100%	1/20/2006		3,837
1902839	06-Nov-70	G	111	13-Jun-06	6	5,874			111	101	100%	6/13/2006		5,874
1505592	11-Feb-74	G	111	13-Jun-06	6	5,959			111	101	100%	6/13/2006		5,959
514903	01-Jan-79	G	111	13-Jun-06	6	5,855			111	101	100%	6/13/2006		5,855
816893	01-Jan-79	G	111	13-Jun-06	6	17,687			111	101	100%	6/13/2006		17,687
2122467	01-Jan-79	G	111	13-Jun-06	6	14,977			111	101	100%	6/13/2006		14,977
1217394	31-Jan-89	G	111	13-Jun-06	6	9,084			111	101	100%	6/13/2006		9,084
1803949	28-Nov-89	G	111	13-Jun-06	6	3,803			111	101	100%	6/13/2006		3,803
690025784	01-May-97	G	111	13-Jun-06	6	24,672			111	101	100%	6/13/2006		24,672
450028357	18-Mar-98	G	111	13-Jun-06	6	9,396			111	101	100%	6/13/2006		9,396
770030309	04-Jun-98	G	111	13-Jun-06	6	6,098			111	101	100%	6/13/2006		6,098
530070201	01-May-03	G	111	13-Jun-06	6	7,421			111	101	100%	6/13/2006		7,421
370079500	02-Jun-04	G	111	13-Jun-06	6	1,764			111	101	100%	6/13/2006		1,764
730057977	01-Nov-01	G	111	19-Jun-06	6	24,331			111	101	100%	6/19/2006		24,331
1313002	25-Sep-91	G	111	18-Jul-06	7	5,588			111	101	100%	7/18/2006		5,588
2114959	14-Oct-88	G	111	20-Sep-06	9	7,303			111	101	100%	9/20/2006		7,303
90004405	15-Sep-94	G	111	18-Oct-06	10	2,723			111	101	100%	10/18/2006		2,723
2201640	01-Aug-79	G	111	26-Oct-06	10	12,383			111	101	100%	10/26/2006		12,383
610024908	09-Sep-97	G	111	12-Dec-06	12	5,613			111	101	100%	12/12/2006		5,613
Conversions to 101 less new customers signified by														
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
2	0	0	0	0	13	1	0	1	2	0	1			
20						**6,150**							**122,990**	**174,368**

Exhibit H-5 Schedule Migration Tracking Methodology

For 2007 Deferrals

CUST_ACCT_KY	CUST_OPEN_DTE	SRV_CDE	_SCHEDULE	CHANGE_DTE	month	Test Year Usage	Open After	12/31/2004	old sched	new sched	% of 2007	change after	12/31/2004	Therms From Migration
530080987	12-Jul-04	G	101	01-Jan-05	1	321			101	111	100%	1/1/2005		(321)
570071502	08-Apr-03	G	101	20-Jan-05	1	3,380			101	111	100%	1/20/2005		(3,380)
905044	01-Dec-72	G	101	22-Jan-05	1	9,263			101	111	100%	1/22/2005		(9,263)
2540259	06-Mar-94	G	101	22-Jan-05	1	15,010			101	111	100%	1/22/2005		(15,010)
530007878	24-Jan-95	G	101	22-Jan-05	1	8,835			101	111	100%	1/22/2005		(8,835)
650029895	09-Jun-98	G	101	22-Jan-05	1	12,146			101	111	100%	1/22/2005		(12,146)
90059355	17-Jan-02	G	101	22-Jan-05	1	8,919			101	111	100%	1/22/2005		(8,919)
50059378	18-Jan-02	G	101	22-Jan-05	1	9,086			101	111	100%	1/22/2005		(9,086)
50080410	03-Jun-04	G	101	22-Jan-05	1	13,259			101	111	100%	1/22/2005		(13,259)
610083744	15-Sep-04	G	101	22-Jan-05	1	3,818			101	111	100%	1/22/2005		(3,818)
330084121	02-Oct-04	G	101	22-Jan-05	1	3,858			101	111	100%	1/22/2005		(3,858)
290066724	21-Nov-02	G	101	24-Jan-05	1	6,340			101	111	100%	1/24/2005		(6,340)
330066724	21-Nov-02	G	101	24-Jan-05	1	4,861			101	111	100%	1/24/2005		(4,861)
370066724	21-Nov-02	G	101	24-Jan-05	1	3,063			101	111	100%	1/24/2005		(3,063)
410066724	21-Nov-02	G	101	24-Jan-05	1	5,942			101	111	100%	1/24/2005		(5,942)
490084501	16-Nov-04	G	101	25-Jan-05	1	2,109			101	111	100%	1/25/2005		(2,109)
370076788	27-Jan-04	G	101	30-Jan-05	1	1,245			101	111	100%	1/30/2005		(1,245)
490084428	12-Nov-04	G	101	09-Feb-05	2	1,637			101	111	100%	2/9/2005		(1,637)
10085198	16-Dec-04	G	101	17-Feb-05	2	5,742			101	111	100%	2/17/2005		(5,742)
2302087	27-Jun-86	G	101	05-Mar-05	3	6,932			101	111	100%	3/5/2005		(6,932)
2554336	23-Dec-93	G	101	05-Mar-05	3	10,075			101	111	100%	3/5/2005		(10,075)
530081572	01-Aug-04	G	101	05-Mar-05	3	3,900			101	111	100%	3/5/2005		(3,900)
50083035	10-Sep-04	G	101	05-Mar-05	3	3,422			101	111	100%	3/5/2005		(3,422)
490084617	17-Nov-04	G	101	05-Mar-05	3	2,965			101	111	100%	3/5/2005		(2,965)
650085695	18-Dec-04	G	101	18-Mar-05	3	2,383			101	111	100%	3/18/2005		(2,383)
290081505	26-Jul-04	G	101	05-May-05	5	2,159			101	111	100%	5/5/2005		(2,159)
10068020	01-Feb-03	G	101	27-May-05	5	4,940			101	111	100%	5/27/2005		(4,940)
690082271	01-Aug-04	G	101	14-Jun-05	6	2,420			101	111	100%	6/14/2005		(2,420)
1111888	12-Aug-77	G	101	24-Jun-05	6	8,093			101	111	100%	6/24/2005		(8,093)
250021407	25-Mar-97	G	101	21-Aug-05	8	7,492			101	111	100%	8/21/2005		(7,492)
570077747	03-Mar-04	G	101	21-Aug-05	8	790			101	111	100%	8/21/2005		(790)
290083655	18-Oct-04	G	101	21-Aug-05	8	1,756			101	111	100%	8/21/2005		(1,756)
10083951	01-Nov-04	G	101	21-Aug-05	8	5,623			101	111	100%	8/21/2005		(5,623)
622129	01-Jan-79	G	101	10-Oct-05	10	2,504			101	111	100%	10/10/2005		(2,504)
450084969	24-Nov-04	G	101	10-Oct-05	10	2,595			101	111	100%	10/10/2005		(2,595)
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
17	2	6	0	2	2	0	4	0	2	0	0	35		
35														**(186,883)**
2307513	01-Mar-72	G	101	20-Jan-06	1	11,897			101	111	100%	1/20/2006		(11,897)
1301457	01-Jan-79	G	101	20-Jan-06	1	11,186			101	111	100%	1/20/2006		(11,186)
2306181	01-Jan-79	G	101	20-Jan-06	1	5,997			101	111	100%	1/20/2006		(5,997)
2308609	19-Apr-86	G	101	20-Jan-06	1	9,511			101	111	100%	1/20/2006		(9,511)
606003	15-Sep-89	G	101	20-Jan-06	1	10,152			101	111	100%	1/20/2006		(10,152)
570005783	12-Nov-94	G	101	20-Jan-06	1	5,262			101	111	100%	1/20/2006		(5,262)
450034263	05-Jan-99	G	101	20-Jan-06	1	4,159			101	111	100%	1/20/2006		(4,159)
130035056	02-Feb-99	G	101	20-Jan-06	1	8,891			101	111	100%	1/20/2006		(8,891)
210038849	24-Aug-99	G	101	20-Jan-06	1	8,244			101	111	100%	1/20/2006		(8,244)
730042985	22-Feb-00	G	101	20-Jan-06	1	7,891			101	111	100%	1/20/2006		(7,891)
770051984	12-Mar-01	G	101	20-Jan-06	1	9,080			101	111	100%	1/20/2006		(9,080)
130053623	21-May-01	G	101	20-Jan-06	1	8,565			101	111	100%	1/20/2006		(8,565)
650073095	20-Aug-03	G	101	20-Jan-06	1	8,157			101	111	100%	1/20/2006		(8,157)
450075420	17-Nov-03	G	101	20-Jan-06	1	809			101	111	100%	1/20/2006		(809)
690081005	15-Jul-04	G	101	20-Jan-06	1	1,507			101	111	100%	1/20/2006		(1,507)
330081860	01-Aug-04	G	101	20-Jan-06	1	551			101	111	100%	1/20/2006		(551)
1721721	01-Jan-79	G	101	02-Feb-06	2	7,535			101	111	100%	2/2/2006		(7,535)
410029136	29-May-98	G	101	02-Feb-06	2	3,995			101	111	100%	2/2/2006		(3,995)
650055706	10-Aug-01	G	101	30-Mar-06	3	8,137			101	111	100%	3/30/2006		(8,137)
2404644	01-Jan-79	G	101	13-Jun-06	6	5,706			101	111	100%	6/13/2006		(5,706)
130011170	23-Aug-95	G	101	13-Jun-06	6	11,089			101	111	100%	6/13/2006		(11,089)
330011483	01-Sep-95	G	101	13-Jun-06	6	2,275			101	111	100%	6/13/2006		(2,275)
90065725	20-Sep-02	G	101	13-Jun-06	6	9,203			101	111	100%	6/13/2006		(9,203)
770077744	01-Mar-04	G	101	13-Jun-06	6	3,606			101	111	100%	6/13/2006		(3,606)
290079783	02-Jun-04	G	101	13-Jun-06	6	2,205			101	111	100%	6/13/2006		(2,205)
530083879	21-Oct-04	G	101	13-Jun-06	6	2,744			101	111	100%	6/13/2006		(2,744)
2309439	01-Jun-90	G	101	17-Oct-06	10	7,207			101	111	100%	10/17/2006		(7,207)
2307685	01-Jan-79	G	101	08-Dec-06	12	7,629			101	111	100%	12/8/2006		(7,629)
2114765	09-Mar-88	G	101	08-Dec-06	12	9,721			101	111	100%	12/8/2006		(9,721)
2009267	20-Dec-88	G	101	08-Dec-06	12	5,560			101	111	100%	12/8/2006		(5,560)
2309365	26-Jun-90	G	101	08-Dec-06	12	745			101	111	100%	12/8/2006		(745)
130046394	22-Jun-00	G	101	08-Dec-06	12	3,143			101	111	100%	12/8/2006		(3,143)
530048093	08-Sep-00	G	101	08-Dec-06	12	6,697			101	111	100%	12/8/2006		(6,697)
50079797	02-Jun-04	G	101	08-Dec-06	12	2,824			101	111	100%	12/8/2006		(2,824)
690080916	12-Jul-04	G	101	08-Dec-06	12	4,734			101	111	100%	12/8/2006		(4,734)
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
16	2	1	0	0	7	0	0	0	1	0	8	35		
35						**5,683**							**(198,907)**	**(216,614)**

Exhibit H-5 Schedule Migration Tracking Methodology

For 2007 Deferrals

CUST_ACCT_KY	CUST_OPEN_DTE	SRV_CDE	_SCHEDULE	CHANGE_DTE	month	Test Year Usage	Open After	12/31/2004	old sched	new sched	% of 2007	change after	12/31/2004	Therms From Migration
											12/31/2007			
829525	17-Jan-94	G	111	23-Mar-07	3	3,448			111	101	78%	3/23/2007		2,673
330059354	09-Jan-02	G	111	23-Mar-07	3	4,854			111	101	78%	3/23/2007		3,764
210084902	15-Dec-04	G	111	23-Mar-07		8,627			111	101	78%	3/23/2007		
503912	01-Jul-81	G	111	04-May-07	5	6,104			111	101	66%	5/4/2007		4,030
530032129	01-Nov-98	G	111	04-May-07	5	6,875			111	101	66%	5/4/2007		4,539
519241	01-May-72	G	111	17-May-07	5	5,846			111	101	62%	5/17/2007		3,652
516262	14-Nov-75	G	111	17-May-07	5	2,570			111	101	62%	5/17/2007		1,605
1923727	15-Jul-92	G	111	17-May-07	5	2,695			111	101	62%	5/17/2007		1,683
690079849	22-May-04	G	111	17-May-07	5	1,714			111	101	62%	5/17/2007		1,071
1316828	24-Mar-76	G	111	15-Jun-07	6	13,526			111	101	55%	6/15/2007		7,374
170034975	05-Feb-99	G	111	15-Jun-07	6	5,014			111	101	55%	6/15/2007		2,734
1216966	01-Dec-72	G	111	24-Aug-07	8	6,650			111	101	35%	8/24/2007		2,350
1410713	01-Jan-79	G	111	24-Aug-07	8	8,509			111	101	35%	8/24/2007		3,007
1307091	11-Mar-91	G	111	24-Aug-07	8	5,445			111	101	35%	8/24/2007		1,924
210032487	01-Oct-98	G	111	24-Aug-07	8	2,726			111	101	35%	8/24/2007		963
50050859	05-Jan-01	G	111	24-Aug-07	8	11,450			111	101	35%	8/24/2007		4,047
530051372	18-Jan-01	G	111	24-Aug-07	8	2,504			111	101	35%	8/24/2007		885
2518171	14-Sep-92	G	111	19-Sep-07	9	4,055			111	101	28%	9/19/2007		1,144
650040465	07-Oct-99	G	111	19-Sep-07	9	4,983			111	101	28%	9/19/2007		1,406
370014292	13-Feb-96	G	111	15-Nov-07	11	7,168			111	101	13%	11/15/2007		903
330054468	26-Jun-01	G	111	15-Nov-07	11	2,655			111	101	13%	11/15/2007		335
170035680	01-Mar-99	G	111	21-Nov-07	11	6,404			111	101	11%	11/21/2007		702
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
0	00-Jan-00	2	0	6	2	0	6	2	0	3	0	21		
21						**5,628**					**47%**		**55,240**	**50,793**
2310130	27-May-77	G	101	04-Jan-07	1	1,489			101	111	99%	1/4/2007		(1,473)
2306134	24-Nov-81	G	101	26-Jan-07	1	9,524			101	111	93%	1/26/2007		(8,846)
290033434	11-Dec-98	G	101	26-Jan-07	1	6,399			101	111	93%	1/26/2007		(5,943)
170059498	25-Jan-02	G	101	05-Feb-07	2	6,149			101	111	90%	2/5/2007		(5,543)
250044521	01-May-00	G	101	13-Feb-07	2	5,113			101	111	88%	2/13/2007		(4,497)
2305554	10-Oct-79	G	101	23-Mar-07	3	8,269			101	111	78%	3/23/2007		(6,411)
1310085	25-Apr-89	G	101	23-Mar-07	3	3,648			101	111	78%	3/23/2007		(2,828)
808713	17-Mar-93	G	101	23-Mar-07	3	382			101	111	78%	3/23/2007		(296)
330060411	28-Feb-02	G	101	23-Mar-07	3	6,713			101	111	78%	3/23/2007		(5,205)
250065099	28-Aug-02	G	101	23-Mar-07	3	9,849			101	111	78%	3/23/2007		(7,636)
770075658	01-Dec-03	G	101	23-Mar-07	3	9,280			101	111	78%	3/23/2007		(7,195)
730085263	01-Dec-04	G	101	23-Mar-07	3	3,741			101	111	78%	3/23/2007		(2,901)
90050449	15-Dec-00	G	101	15-May-07	5	7,051			101	111	63%	5/15/2007		(4,443)
2019403	03-Dec-87	G	101	15-Jun-07	6	1,306			101	111	55%	6/15/2007		(712)
1907863	08-Mar-91	G	101	24-Aug-07	8	5,799			101	111	35%	8/24/2007		(2,050)
2308717	01-Apr-91	G	101	24-Aug-07	8	8,788			101	111	35%	8/24/2007		(3,106)
130019677	03-Dec-96	G	101	24-Aug-07	8	3,566			101	111	35%	8/24/2007		(1,260)
370036885	08-Jun-99	G	101	19-Sep-07	9	6,063			101	111	28%	9/19/2007		(1,711)
250042874	15-Jan-00	G	101	19-Sep-07	9	2,416			101	111	28%	9/19/2007		(682)
1209492	24-Feb-87	G	101	15-Nov-07	11	1,168			101	111	13%	11/15/2007		(147)
1217370	09-Jul-92	G	101	15-Nov-07	11	6,007			101	111	13%	11/15/2007		(757)
410082686	09-Sep-04	G	101	07-Dec-07	12	184			101	111	7%	12/7/2007		(12)
530013056	07-Dec-95	G	101	18-Dec-07	12	6,103			101	111	4%	12/18/2007		(217)
650035532	05-Apr-99	G	101	26-Dec-07	12	3,045			101	111	1%	12/26/2007		(42)
610059502	28-Jan-02	G	101	26-Dec-07	12	10,689			101	111	1%	12/26/2007		(146)
2402169	01-Jan-79	G	101	31-Dec-07	12	7,189			101	111	0%	12/31/2007		-
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
3	2	7	0	1	1	0	3	2	0	2	5	26		
26						**5,382**					**51%**		**(71,233)**	**(74,059)**
Net Migration	**(20)**			**Customers**										**(65,512)**

The four accounts above with this highlight were eliminated from the migration count because they should have been considered new customers and adding their usage to Schedule 101 would result in double-counting their usage. New customers are identified as customers that were not a customer in either rate shedule during the base year. Those switching from 101 to 111 are not included.

Exhibit H-5 Schedule Migration Tracking Methodology

For 2008 Deferrals

CUST_ACCT_KY	CUST_OPEN_DTE	SRV_CDE	CHEDU	CHANGE_DTE	month	Test Year Usage	Open Afte	12/31/2006	old sched	new sched	% of 2008	change after	12/31/2006	Therms From Migration
690102939	11-Dec-06	G	111	23-Jan-07		-			111	101	100%	1/23/2007		-
490093430	14-Oct-05	G	111	23-Mar-07	3	8,360			111	101	100%	3/23/2007		8,360
90102528	20-Oct-06	G	111	23-Mar-07		267			111	101	100%	3/23/2007		
829525	17-Jan-94	G	111	23-Mar-07	3	3,082			111	101	100%	3/23/2007		3,082
330059354	09-Jan-02	G	111	23-Mar-07	3	4,071			111	101	100%	3/23/2007		4,071
210084902	15-Dec-04	G	111	23-Mar-07	3	4,063			111	101	100%	3/23/2007		4,063
570085776	01-Jan-05	G	111	04-May-07	5	3,094			111	101	100%	5/4/2007		3,094
503912	01-Jul-81	G	111	04-May-07	5	5,120			111	101	100%	5/4/2007		5,120
530032129	01-Nov-98	G	111	04-May-07	5	4,990			111	101	100%	5/4/2007		4,990
530089390	13-Jun-05	G	111	17-May-07	5	4,144			111	101	100%	5/17/2007		4,144
730092185	13-Sep-05	G	111	17-May-07	5	3,447			111	101	100%	5/17/2007		3,447
570096041	31-Mar-06	G	111	17-May-07	5	18,143			111	101	100%	5/17/2007		18,143
519241	01-May-72	G	111	17-May-07	5	5,036			111	101	100%	5/17/2007		5,036
516262	14-Nov-75	G	111	17-May-07	5	5,412			111	101	100%	5/17/2007		5,412
1923727	15-Jul-92	G	111	17-May-07	5	2,624			111	101	100%	5/17/2007		2,624
690079849	22-May-04	G	111	17-May-07	5	2,544			111	101	100%	5/17/2007		2,544
650092877	24-Oct-05	G	111	15-Jun-07	6	795			111	101	100%	6/15/2007		795
450097096	21-Apr-06	G	111	15-Jun-07	6	1,600			111	101	100%	6/15/2007		1,600
1316828	24-Mar-76	G	111	15-Jun-07	6	3,857			111	101	100%	6/15/2007		3,857
170034975	05-Feb-99	G	111	15-Jun-07	6	4,014			111	101	100%	6/15/2007		4,014
730101934	02-Oct-06	G	111	24-Aug-07		8,411			111	101	100%	8/24/2007		
1216966	01-Dec-72	G	111	24-Aug-07	8	7,738			111	101	100%	8/24/2007		7,738
1410713	01-Jan-79	G	111	24-Aug-07	8	7,178			111	101	100%	8/24/2007		7,178
1307091	11-Mar-91	G	111	24-Aug-07	8	3,928			111	101	100%	8/24/2007		3,928
210032487	01-Oct-98	G	111	24-Aug-07	8	2,460			111	101	100%	8/24/2007		2,460
530051372	18-Jan-01	G	111	24-Aug-07	8	2,281			111	101	100%	8/24/2007		2,281
2518171	14-Sep-92	G	111	19-Sep-07	9	3,610			111	101	100%	9/19/2007		3,610
650040465	07-Oct-99	G	111	19-Sep-07	9	4,879			111	101	100%	9/19/2007		4,879
570099327	20-Jul-06	G	111	15-Nov-07	11	30			111	101	100%	11/15/2007		30
370014292	13-Feb-96	G	111	15-Nov-07	11	6,522			111	101	100%	11/15/2007		6,522
330054468	26-Jun-01	G	111	15-Nov-07	11	2,626			111	101	100%	11/15/2007		2,626
170035680	01-Mar-99	G	111	21-Nov-07	11	6,206			111	101	100%	11/21/2007		6,206
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
0	0	4	0	10	4	0	5	2	0	4	0			
29						**4,392**							**127,357**	**131,854**

Exhibit H-5 Schedule Migration Tracking Methodology

For 2008 Deferrals

CUST_ACCT_KY	CUST_OPEN_DTE	SRV_CDE	SCHEDU	CHANGE_DTE	month	Test Year Usage	Open Afte	12/31/2006	old sched	new sched	% of 2008	change after	12/31/2006	Therms From Migration
2310130	27-May-77	G	101	04-Jan-07	1	10,052			101	111	100%	1/4/2007		(10,052)
90087223	23-Mar-05	G	101	26-Jan-07	1	13,945			101	111	100%	1/26/2007		(13,945)
770096175	15-Mar-06	G	101	26-Jan-07	1	5,340			101	111	100%	1/26/2007		(5,340)
50099741	29-Jul-06	G	101	26-Jan-07	1	6,042			101	111	100%	1/26/2007		(6,042)
10101240	28-Aug-06	G	101	26-Jan-07	1	2,064			101	111	100%	1/26/2007		(2,064)
330101213	26-Sep-06	G	101	26-Jan-07	1	7,263			101	111	100%	1/26/2007		(7,263)
410101758	11-Oct-06	G	101	26-Jan-07	1	4,689			101	111	100%	1/26/2007		(4,689)
2306134	24-Nov-81	G	101	26-Jan-07	1	10,463			101	111	100%	1/26/2007		(10,463)
290033434	11-Dec-98	G	101	26-Jan-07	1	9,077			101	111	100%	1/26/2007		(9,077)
610095717	21-Feb-06	G	101	05-Feb-07	2	13,189			101	111	100%	2/5/2007		(13,189)
170059498	25-Jan-02	G	101	05-Feb-07	2	8,369			101	111	100%	2/5/2007		(8,369)
250044521	01-May-00	G	101	13-Feb-07	2	5,327			101	111	100%	2/13/2007		(5,327)
170094341	14-Dec-05	G	101	23-Mar-07	3	7,107			101	111	100%	3/23/2007		(7,107)
290094737	01-Jan-06	G	101	23-Mar-07	3	7,105			101	111	100%	3/23/2007		(7,105)
330096035	25-Jan-06	G	101	23-Mar-07	3	3,659			101	111	100%	3/23/2007		(3,659)
410100378	19-Jul-06	G	101	23-Mar-07	3	4,397			101	111	100%	3/23/2007		(4,397)
330101312	16-Oct-06	G	101	23-Mar-07	3	6,299			101	111	100%	3/23/2007		(6,299)
250102495	20-Nov-06	G	101	23-Mar-07	3	7,113			101	111	100%	3/23/2007		(7,113)
2305554	10-Oct-79	G	101	23-Mar-07	3	9,978			101	111	100%	3/23/2007		(9,978)
1310085	25-Apr-89	G	101	23-Mar-07	3	8,352			101	111	100%	3/23/2007		(8,352)
808713	17-Mar-93	G	101	23-Mar-07	3	8,100			101	111	100%	3/23/2007		(8,100)
490007275	31-Dec-94	G	101	23-Mar-07	3	6,139			101	111	100%	3/23/2007		(6,139)
330060411	28-Feb-02	G	101	23-Mar-07	3	10,523			101	111	100%	3/23/2007		(10,523)
250065099	28-Aug-02	G	101	23-Mar-07	3	9,269			101	111	100%	3/23/2007		(9,269)
770075658	01-Dec-03	G	101	23-Mar-07	3	10,556			101	111	100%	3/23/2007		(10,556)
730085263	01-Dec-04	G	101	23-Mar-07	3	8,811			101	111	100%	3/23/2007		(8,811)
730102501	10-Nov-06	G	101	28-Mar-07	3	113			101	111	100%	3/28/2007		(113)
730101173	22-Sep-06	G	101	06-Apr-07	4	5,664			101	111	100%	4/6/2007		(5,664)
370102861	09-Nov-06	G	101	06-Apr-07	4	371			101	111	100%	4/6/2007		(371)
130093183	01-Nov-05	G	101	15-May-07	5	5,168			101	111	100%	5/15/2007		(5,168)
90050449	15-Dec-00	G	101	15-May-07	5	8,439			101	111	100%	5/15/2007		(8,439)
290096684	01-Apr-06	G	101	29-May-07	5	6,125			101	111	100%	5/29/2007		(6,125)
2019403	03-Dec-87	G	101	15-Jun-07	6	5,371			101	111	100%	6/15/2007		(5,371)
650088343	05-May-05	G	101	10-Aug-07	8	728			101	111	100%	8/10/2007		(728)
1907863	08-Mar-91	G	101	24-Aug-07	8	7,211			101	111	100%	8/24/2007		(7,211)
2308717	01-Apr-91	G	101	24-Aug-07	8	9,228			101	111	100%	8/24/2007		(9,228)
130019677	03-Dec-96	G	101	24-Aug-07	8	6,967			101	111	100%	8/24/2007		(6,967)
210097894	19-May-06	G	101	19-Sep-07	9	3,163			101	111	100%	9/19/2007		(3,163)
370036885	08-Jun-99	G	101	19-Sep-07	9	5,791			101	111	100%	9/19/2007		(5,791)
250042874	15-Jan-00	G	101	19-Sep-07	9	4,410			101	111	100%	9/19/2007		(4,410)
410088503	27-Apr-05	G	101	25-Oct-07	10	3,454			101	111	100%	10/25/2007		(3,454)
650093930	28-Oct-05	G	101	25-Oct-07	10	3,607			101	111	100%	10/25/2007		(3,607)
610095471	09-Feb-06	G	101	15-Nov-07	11	2,495			101	111	100%	11/15/2007		(2,495)
1209492	24-Feb-87	G	101	15-Nov-07	11	8,631			101	111	100%	11/15/2007		(8,631)
1217370	09-Jul-92	G	101	15-Nov-07	11	7,605			101	111	100%	11/15/2007		(7,605)
410082686	09-Sep-04	G	101	07-Dec-07	12	7,071			101	111	100%	12/7/2007		(7,071)
370103725	14-Dec-06	G	101	17-Dec-07	12	312			101	111	100%	12/17/2007		(312)
530013056	07-Dec-95	G	101	18-Dec-07	12	7,977			101	111	100%	12/18/2007		(7,977)
450102493	17-Nov-06	G	101	21-Dec-07	12	307			101	111	100%	12/21/2007		(307)
650035532	05-Apr-99	G	101	26-Dec-07	12	8,495			101	111	100%	12/26/2007		(8,495)
610059502	28-Jan-02	G	101	26-Dec-07	12	10,750			101	111	100%	12/26/2007		(10,750)
210082901	14-Sep-04	G	101	27-Dec-07	12	5,687			101	111	100%	12/27/2007		(5,687)
2402169	01-Jan-79	G	101	31-Dec-07	12	5,120			101	111	100%	12/31/2007		(5,120)
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
9	03-Jan-00	15	2	3	1	0	4	3	2	3	8			
53						**6,481**							**(343,488)**	**(343,488)**

Exhibit H-5 Schedule Migration Tracking Methodology

For 2008 Deferrals

CUST_ACCT_KY	CUST_OPEN_DTE	SRV_CDE	CHEDU	CHANGE_DTE	month	Test Year Usage	Open Afte	12/31/2006	old sched	new sched	% of 2008 12/31/2008	change after	12/31/2006	Therms From Migration
770093400	28-Oct-05	G	111	22-Feb-08	2	2,632			111	101	86%	2/22/2008		2,257
290016471	25-Jun-96	G	111	22-Feb-08	2	8,182			111	101	86%	2/22/2008		7,016
10056037	01-Aug-01	G	111	27-Mar-08	3	6,599			111	101	76%	3/27/2008		5,044
90082876	16-Sep-04	G	111	27-Mar-08	3	2,553			111	101	76%	3/27/2008		1,951
50101318	30-Sep-06	G	111	29-Apr-08	4	2,054			111	101	67%	4/29/2008		1,384
510496	01-Jan-79	G	111	29-Apr-08	4	9,507			111	101	67%	4/29/2008		6,407
10101240	28-Aug-06	G	111	30-Apr-08	4	642			111	101	67%	4/30/2008		431
1902841	29-Apr-86	G	111	30-Apr-08	4	9,096			111	101	67%	4/30/2008		6,106
450076043	10-Dec-03	G	111	30-Apr-08	4	6,020			111	101	67%	4/30/2008		4,041
210086818	07-Jan-05	G	111	05-May-08	5	4,352			111	101	66%	5/5/2008		2,862
450102740	03-Nov-06	G	111	30-May-08	5	288			111	101	59%	5/30/2008		170
637024	01-Jan-79	G	111	30-May-08	5	4,960			111	101	59%	5/30/2008		2,922
570095540	13-Jan-06	G	111	03-Jun-08	6	5,645			111	101	58%	6/3/2008		3,263
1830334	01-Aug-71	G	111	03-Jun-08	6	3,164			111	101	58%	6/3/2008		1,829
908132	29-Oct-82	G	111	03-Jun-08	6	3,457			111	101	58%	6/3/2008		1,998
1406247	17-Nov-84	G	111	03-Jun-08	6	4,719			111	101	58%	6/3/2008		2,728
505173	02-Feb-70	G	111	15-Jun-08	6	31,279			111	101	55%	6/15/2008		17,053
2120548	20-May-74	G	111	15-Jul-08	7	6,654			111	101	46%	7/15/2008		3,081
1406245	11-Jan-84	G	111	17-Sep-08	9	6,374			111	101	29%	9/17/2008		1,834
1307392	15-Dec-82			24-Nov-08	11	3,010			111	101	10%	11/24/2008		305
2309523	02-Dec-85			20-Nov-08	11	54,829			111	101	11%	11/20/2008		6,159
1316843	01-Dec-08			01-Dec-08		9,361	new cust		111	101	8%	12/1/2008		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
0	2	2	5	3	5	1	0	1	0	2	0			
21						**8,426**					**56%**		**99,295**	**78,842**

Exhibit H-5 Schedule Migration Tracking Methodology

For 2008 Deferrals

CUST_ACCT_KY	CUST_OPEN_DTE	SRV_CDE	CHEDU	CHANGE_DTE	month	Test Year Usage	Open Afte	12/31/2006	old sched	new sched	% of 2008	change after	12/31/2006	Therms From Migration
2504179	01-Oct-68	G	101	22-Feb-08	2	8,192			101	111	86%	2/22/2008		(7,025)
1401604	01-Jan-79	G	101	22-Feb-08	2	9,619			101	111	86%	2/22/2008		(8,249)
1811741	15-Jul-89	G	101	22-Feb-08	2	7,209			101	111	86%	2/22/2008		(6,182)
739014	14-Dec-89	G	101	22-Feb-08	2	5,567			101	111	86%	2/22/2008		(4,774)
410056554	12-Sep-01	G	101	22-Feb-08	2	10,915			101	111	86%	2/22/2008		(9,360)
650065220	09-Sep-02	G	101	22-Feb-08	2	8,893			101	111	86%	2/22/2008		(7,626)
690076638	24-Dec-03	G	101	22-Feb-08	2	8,231			101	111	86%	2/22/2008		(7,058)
410086088	01-Feb-05	G	101	27-Mar-08	3	6,465			101	111	76%	3/27/2008		(4,942)
770094590	30-Dec-05	G	101	27-Mar-08	3	8,599			101	111	76%	3/27/2008		(6,573)
90094933	01-Jan-06	G	101	27-Mar-08	3	6,160			101	111	76%	3/27/2008		(4,709)
290099982	14-Jul-06	G	101	27-Mar-08	3	1,828			101	111	76%	3/27/2008		(1,397)
905079	16-Feb-90	G	101	27-Mar-08	3	9,220			101	111	76%	3/27/2008		(7,048)
650099969	21-Jul-06	G	101	08-Apr-08	4	121			101	111	73%	4/8/2008		(89)
210086531	18-Feb-05	G	101	29-Apr-08	4	7,553			101	111	67%	4/29/2008		(5,091)
210057614	13-Oct-01	G	101	29-Apr-08	4	6,368			101	111	67%	4/29/2008		(4,292)
908198	30-Jan-92	G	101	30-May-08	5	6,487			101	111	59%	5/30/2008		(3,821)
450077013	05-Feb-04	G	101	30-May-08	5	7,926			101	111	59%	5/30/2008		(4,669)
290085924	20-Jan-05	G	101	03-Jun-08	6	8,805			101	111	58%	6/3/2008		(5,090)
1209688	01-Jan-79	G	101	03-Jul-08	7	6,859			101	111	50%	7/3/2008		(3,401)
370090948	05-Aug-05	G	101	15-Jul-08	7	6,495			101	111	46%	7/15/2008		(3,007)
821760	30-Nov-90	G	101	15-Jul-08	7	3,457			101	111	46%	7/15/2008		(1,601)
50014047	10-Jan-96	G	101	15-Aug-08	8	4,224			101	111	38%	8/15/2008		(1,597)
10095648	18-Feb-06	G	101	17-Sep-08	9	4,624			101	111	29%	9/17/2008		(1,330)
1115785	03-Nov-69	G	101	17-Sep-08	9	7,531			101	111	29%	9/17/2008		(2,166)
810841	12-Dec-77	G	101	17-Sep-08	9	9,174			101	111	29%	9/17/2008		(2,639)
829264	10-Jun-80	G	101	17-Sep-08	9	6,135			101	111	29%	9/17/2008		(1,765)
250025496	07-Oct-97	G	101	17-Sep-08	9	7,980			101	111	29%	9/17/2008		(2,296)
490032647	19-Oct-98	G	101	17-Sep-08	9	4,852			101	111	29%	9/17/2008		(1,396)
50037921	08-Jul-99	G	101	17-Sep-08	9	5,054			101	111	29%	9/17/2008		(1,454)
50072045	02-Jul-03	G	101	17-Sep-08	9	6,764			101	111	29%	9/17/2008		(1,946)
2407043	01-Jan-79	G	101	02-Oct-08	10	10,066			101	111	25%	10/2/2008		(2,482)
770076553	15-Jan-04	G	101	02-Oct-08	10	8,594			101	111	25%	10/2/2008		(2,119)
1707571	18-Oct-93	G	101	22-Oct-08	10	10,187			101	111	19%	10/22/2008		(1,954)
490065845	15-Oct-02	G	101	27-Oct-08	10	8,828			101	111	18%	10/27/2008		(1,572)
250102283	07-Nov-06	G	101	31-Oct-08	10	1,506			101	111	17%	10/31/2008		(252)
2113870	10-Sep-81	G	101	31-Oct-08	10	8,599			101	111	17%	10/31/2008		(1,437)
490021882	08-Mar-97	G	101	31-Oct-08	10	7,471			101	111	17%	10/31/2008		(1,249)
250058163	11-Nov-01	G	101	31-Oct-08	10	602			101	111	17%	10/31/2008		(101)
1816481	10-Jul-90			20-Nov-08	11	7,872			101	111	11%	11/20/2008		(884)
50005715	30-Nov-94			24-Nov-08	11	9,703			101	111	10%	11/24/2008		(984)
730085314	20-Dec-04			24-Nov-08	11	7,573			101	111	10%	11/24/2008		(768)
530049369	01-Nov-00			08-Dec-08	12	6,796			101	111	6%	12/8/2008		(428)
650065516	14-Nov-02			08-Dec-08	12	7,155			101	111	6%	12/8/2008		(451)
690026980	03-Jan-98			08-Dec-08	12	6,777			101	111	6%	12/8/2008		(427)
502880	29-Jul-76			08-Dec-08	12	7,977			101	111	6%	12/8/2008		(503)
518622	11-Oct-89			08-Dec-08	12	9,205			101	111	6%	12/8/2008		(580)
708406	15-Jun-93			08-Dec-08	12	8,397			101	111	6%	12/8/2008		(529)
330099211	16-Dec-08			08-Dec-08	12	2,796	new cust		101	111	6%	12/8/2008		(176)
1216987	11-Dec-80			08-Dec-08	12	3,612			101	111	6%	12/8/2008		(228)
1217334	18-Jan-91			08-Dec-08	12	7,479			101	111	6%	12/8/2008		(471)
1321739	11-Jun-97			08-Dec-08	12	7,145			101	111	6%	12/8/2008		(450)
1606612	18-Dec-98			08-Dec-08	12	4,908			101	111	6%	12/8/2008		(309)
2019411	14-Dec-88			08-Dec-08	12	3,523			101	111	6%	12/8/2008		(222)
2509610	27-Jan-76			08-Dec-08	12	7,467			101	111	6%	12/8/2008		(471)
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
0	7	5	3	2	1	3	1	8	8	3	13			
54						**6,769**					**38%**		**(138,280)**	**(141,636)**
Net Migration	**(57)**			**Customers**										**(274,428)**

The four accounts above with this highlight were eliminated from the migration count because they should have been considered new customers and adding their usage to Schedule 101 would result in double-counting their usage. New customers are identified as customers that were not a customer in either rate shedule during the base year. Those switching from 101 to 111 are not included.

Exhibit I-1 Unaccounted Customers

From Avista's response to Data Request 7, Question 4.
Number of Customer Analysis

Test Year Number of Customers by Class	**2007** **Dec-03**	**Jan-04**	**Feb-04**	**Mar-04**	**Apr-04**	**May-04**	**Jun-04**	**Jul-04**	**Aug-04**	**Sep-04**	**Oct-04**	**Nov-04**	**Dec-04**
Total 101	128,636	128,840	129,031	129,013	128,996	129,023	129,061	129,192	129,490	129,888	130,451	131,281	131,646

12 Months Ended December 2007 Number of Customers

	Period	Meters 200701	200702	200703	200704	200705	200706	200707	200708	200709	200710	200711	200712	12 Month Averag	Total Meters Billed
101 FIRM AND GENERAL SERVICE		138,804	139,210	139,055	139,113	139,012	138,838	138,877	139,096	139,568	140,039	140,930	141,242	139,482	1,673,784

Change in Number of Customers	**Jan-07**	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**	Average
Schedule 101	9,964	10,179	10,042	10,117	9,989	9,777	9,685	9,606	9,680	9,588	9,649	9,596	9,823
New Customer Report	10,898	10,871	10,114	10,418	9,679	10,073	9,708	9,388	8,874	8,678	9,448	10,818	9,914
Net Migration Customer Count for 2007 Deferral	(32)	(5)	(10)	-	3	27	2	8	1	(1)	1	(12)	
Compare New Customer Report to Change in Number of Customers after adjusting for customer migration.													
Sch 101	902	687	62	301	(307)	323	25	(210)	(805)	(911)	(200)	1,210	90 0.9%

Although in some months the opposite effect occurs, on average over the course of 2007 when "New Customers" are deducted from the current revenue run number of meters billed, it results in 210 less customers than were reported on the revenue runs in 2004. Revenue runs include various corrections, cancel and rebill and other anomalies that average out over time.
The December results of the "New Customer" report were double checked at that time because of the variance from the revenue run expectation. All was in order with the parameters of the queries.

Additional Analysis — Reflects Avista's Correction
Based on 828 therms usage for average Schedule 101 customer.

101 Usage Profile	18.23%	17.26%	12.46%	9.22%	5.66%	3.38%	2.25%	1.82%	2.08%	3.82%	8.12%	15.70%	
Average Sch 101 Customer Monthly Usage	151	143	103	76	47	28	19	15	17	32	67	130	
Usage Difference for Change in # of Customers (therms)	136,131	98,197	6,396	22,988	(14,391)	9,043	466	(3,165)	(13,887)	(28,785)	(13,440)	157,259	356,813
Proportion of New Customer Usage	8.4%	6.3%	0.6%	3.3%	-3.5%	3.4%	0.3%	-2.2%	-8.6%	-10.4%	-2.2%	11.1%	**4.3%**
Claimed New Customer Usage	**(1,620,408)**	**(1,565,117)**	**(1,001,608)**	**(706,395)**	**(412,954)**	**(269,857)**	**(180,683)**	**(141,329)**	**(161,990)**	**(277,602)**	**(613,037)**	**(1,421,829)**	(8,372,809)
Proportion of Usage Reduction Claimed	22.1%	-64.5%	0.7%	5.1%	-3.9%	-2.4%	0.2%	-1.8%	3.1%	-2.2%	-1.0%	28.6%	**7.1%**
Therm Difference	-614,739	152,327	-940,379	-454,083	-373,132	374,721	-194,262	-171,291	448,366	-1,334,188	-1,405,054	-549,187	(5,060,900)

Migration Therms	
2007	(73,537)
2008	(274,428)

Exhibit J-1 Weather Normalized Usage

	State	Schedule	Class	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06
Revenue Run															
WR101	WA		101 Residential	15,138,797	13,938,964	14,045,674	9,586,901	5,754,622	3,179,163	2,127,472	1,782,659	2,224,823	3,818,050	8,453,672	15,218,160
WC101	WA		101 Commercial	3,365,161	2,721,617	2,831,963	1,689,116	787,064	354,779	248,563	201,385	252,810	468,356	1,413,541	3,092,298
WI101	WA		101 Industrial	45,943	38,818	36,251	21,363	6,543	3,130	1,882	1,399	1,870	4,608	18,960	43,260
WT101	WA		101 Total	18,562,669	16,709,536	16,924,558	11,304,373	6,552,477	3,538,290	2,378,214	1,985,594	2,479,717	4,292,105	9,891,005	18,364,798
WR111	WA		111 Residential	754,344	711,700	644,464	466,407	382,600	196,314	147,535	109,830	122,067	185,664	390,086	585,059
WC111	WA		111 Commercial	6,085,527	5,487,436	5,599,451	3,906,808	2,343,123	1,226,528	1,154,496	979,211	1,256,405	1,972,215	3,622,026	6,064,109
WI111	WA		111 Industrial	277,571	285,076	254,106	229,128	137,441	101,627	106,816	94,677	147,396	129,100	188,520	331,939
WT111	WA	111/112	Total	7,173,391	6,529,398	6,548,879	4,639,578	2,884,728	1,535,240	1,415,998	1,184,571	1,526,823	2,296,771	4,230,174	7,030,356
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	675,525	755,058	706,586	603,487	481,870	411,021	344,598	357,610	375,238	434,600	545,362	663,304
WI121	WA		121 Industrial	104,106	102,641	111,988	113,605	125,718	139,517	145,232	145,630	161,232	166,862	121,907	97,875
WT121	WA	121/122	Total	779,631	857,699	818,574	717,092	607,588	550,538	489,830	503,240	536,470	601,462	667,269	761,179
WT131	WA	131/132	Interruptible	79,033	73,746	75,280	67,227	56,865	40,563	31,401	24,316	26,942	36,942	50,798	80,909
WT146	WA		146 Transportation	2,519,665	2,320,723	2,302,017	2,363,910	1,932,226	1,728,188	1,613,858	1,296,571	1,284,733	1,587,273	2,112,380	2,422,019
WT148	WA	147/148	Special Contract Transportation	4,735,180	3,981,136	3,753,076	3,777,435	3,194,661	3,079,009	2,944,624	3,113,192	3,214,148	3,307,189	3,671,407	4,002,352
			Total WA	33,849,569	30,472,238	30,422,384	22,869,615	15,228,545	10,471,828	8,873,925	8,107,484	9,068,833	12,121,742	20,623,033	32,661,613
Unbilled															
WR101	WA		101 Residential	(1,578,121)	110,620	(1,898,237)	(2,789,488)	(2,145,906)	(753,444)	(118,576)	157,006	466,499	2,903,704	3,807,747	2,088,206
WC101	WA		101 Commercial	(182,502)	(188,636)	(355,515)	(508,184)	(374,184)	(180,333)	(10,556)	14,103	129,965	520,941	891,018	441,633
WI101	WA		101 Industrial	(33,220)	(5,295)	(7,887)	(10,036)	(2,971)	(191)	(327)	432	943	8,831	12,955	7,430
WT101	WA		101 Total	(1,793,843)	(83,311)	(2,261,639)	(3,307,708)	(2,523,061)	(933,968)	(129,459)	171,541	597,407	3,433,476	4,711,720	2,537,269
WR111	WA		111 Residential	(171,677)	24,859	(45,937)	(73,249)	(59,544)	(6,211)	(6,016)	7,818	(1,153)	74,111	69,676	56,993
WC111	WA		111 Commercial	(787,920)	226,556	(668,259)	(971,528)	(748,437)	(265,161)	(45,096)	55,647	158,821	988,315	1,167,596	704,075
WI111	WA		111 Industrial	(167,075)	2,071	(34,831)	(35,831)	(40,960)	2,244	(4,858)	9,252	4,536	65,142	26,427	25,995
WT111	WA		111 Total	(1,126,672)	253,486	(749,027)	(1,080,608)	(848,941)	(269,128)	(55,970)	72,717	162,204	1,127,568	1,263,699	787,063
WR121	WA		121 Residential	411	442	(113)	(356)	(458)	431	(147)	189	(479)	365	52	109
WC121	WA		121 Commercial	(292,330)	63,619	(101,905)	(104,019)	(97,729)	24,596	399	15,963	(25,808)	126,835	66,295	58,166
WI121	WA		121 Industrial	(7,630)	(10,856)	1,880	(2,935)	(19,878)	28,867	(3,772)	9,121	(10,613)	22,835	(16,096)	9,243
WT121	WA		121 Total	(299,549)	53,205	(100,138)	(107,310)	(118,065)	53,894	(3,520)	25,273	(36,900)	150,035	50,251	67,518
WT131	WA		131 Interruptible	-	-	-	-	-	-	-	-	-	-	-	-
WT146	WA		146 Transportation	271,247	(372,912)	6,917	(336,850)	19,402	84,532	(553,537)	59,560	297,245	559,879	396,602	(236,765)
WT148	WA		148 Special Contract Transportation	114,206	(136,092)	(559,572)	(330,169)	(144,165)	401,969	(60,257)	119,283	49,760	369,698	(76,224)	263,561
			Total WA	(2,834,611)	(285,624)	(3,663,459)	(5,162,645)	(3,614,830)	(662,701)	(802,743)	448,374	1,069,716	5,640,656	6,346,048	3,418,646
		101 Total		16,768,826	16,626,225	14,662,919	7,996,665	4,029,416	2,604,322	2,248,755	2,157,135	3,077,124	7,725,581	14,602,725	20,902,067
		111 Total		6,046,719	6,782,884	5,799,852	3,558,970	2,035,787	1,266,112	1,360,028	1,257,288	1,689,027	3,424,339	5,493,873	7,817,419
		121 Total		480,082	910,904	718,436	609,782	489,523	604,432	486,310	528,513	499,570	751,497	717,520	828,697
		131 Interruptible		79,033	73,746	75,280	67,227	56,865	40,563	31,401	24,316	26,942	36,942	50,798	80,909
		146 Transportation		2,790,912	1,947,811	2,308,934	2,027,060	1,951,628	1,812,720	1,060,321	1,356,131	1,581,978	2,147,152	2,508,982	2,185,254
		148 Special Contract Transportation		4,849,386	3,845,044	3,193,504	3,447,266	3,050,496	3,480,978	2,884,367	3,232,475	3,263,908	3,676,887	3,595,183	4,265,913
		Total WA		31,014,958	30,186,614	26,758,925	17,706,970	11,613,715	9,809,127	8,071,182	8,555,858	10,138,549	17,762,398	26,969,081	36,080,259
	Weather Adjustment														
WR101	WA		101 Residential	3,310,469	(389,202)	(201,009)	369,474	414,925	503,650	-	-	-	22,656	364,415	616,074
WC101	WA		101 Commercial	721,004	(84,965)	(43,892)	62,797	70,190	85,533	-	-	-	3,827	61,586	133,833
WI101	WA		101 Industrial	10,472	(1,204)	(614)	919	996	1,253	-	-	-	54	901	1,884
WT101	WA		101 Total	4,041,946	(475,370)	(245,515)	433,190	486,111	590,436	-	-	-	26,537	426,902	751,791
WR111	WA		111 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC111	WA		111 Commercial	1,169,655	(140,027)	(72,160)	119,995	134,121	162,526	-	-	-	7,208	115,876	218,163
WI111	WA		111 Industrial	-	-	-	-	-	-	-	-	-	-	-	-
WT111	WA		111 Total	1,169,655	(140,027)	(72,160)	119,995	134,121	162,526	-	-	-	7,208	115,876	218,163
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	-	-	-	-	-	-	-	-	-	-	-	-
WI121	WA		121 Industrial												
WT121	WA		121 Total	-	-	-	-	-	-	-	-	-	-	-	-
WT131	WA		131 Interruptible												
WT146	WA		146 Transportation												
WT148	WA		148 Special Contract Transportation												
			Total WA	5,211,600	(615,398)	(317,675)	553,185	620,232	752,962	-	-	-	33,746	542,778	969,954
	Weather Normalized Sales Volumes														
WR101	WA		101 Residential	16,871,145	13,660,382	11,946,428	7,166,887	4,023,641	2,929,369	2,008,896	1,939,665	2,691,322	6,744,410	12,625,834	17,922,440
WC101	WA		101 Commercial	3,903,663	2,448,016	2,432,556	1,243,729	483,070	259,979	238,007	215,488	382,775	993,124	2,366,145	3,667,764
WI101	WA		101 Industrial	23,195	32,319	27,750	12,246	4,568	4,192	1,555	1,831	2,813	13,493	32,816	52,574
WT101	WA		101 Total	20,810,772	16,150,855	14,417,404	8,429,855	4,515,527	3,194,758	2,248,755	2,157,135	3,077,124	7,752,118	15,029,627	21,653,858
WR111	WA		111 Residential	582,667	736,559	598,527	393,158	323,056	190,103	141,519	117,648	120,914	259,775	459,762	642,052
WC111	WA		111 Commercial	6,467,262	5,573,965	4,859,032	3,055,275	1,728,807	1,123,893	1,109,400	1,034,858	1,415,226	2,967,738	4,905,498	6,986,347
WI111	WA		111 Industrial	110,496	287,147	219,275	193,297	96,481	103,871	101,958	103,929	151,932	194,242	214,947	357,934
WT111	WA		111 Total	7,216,374	6,642,857	5,727,692	3,678,965	2,169,908	1,428,638	1,360,028	1,257,288	1,689,027	3,431,547	5,609,749	8,035,582
WR121	WA		121 Residential	411	442	(113)	(356)	(458)	431	(147)	189	(479)	365	52	109
WC121	WA		121 Commercial	383,195	818,677	604,681	499,468	384,141	435,617	344,997	373,573	349,430	561,435	611,657	721,470
WI121	WA		121 Industrial	96,476	91,785	113,868	110,670	105,840	168,384	141,460	154,751	150,619	189,697	105,811	107,118
WT121	WA		121 Total	480,082	910,904	718,436	609,782	489,523	604,432	486,310	528,513	499,570	751,497	717,520	828,697
WT131	WA		131 Interruptible	79,033	73,746	75,280	67,227	56,865	40,563	31,401	24,316	26,942	36,942	50,798	80,909
WT146	WA		146 Transportation	2,790,912	1,947,811	2,308,934	2,027,060	1,951,628	1,812,720	1,060,321	1,356,131	1,581,978	2,147,152	2,508,982	2,185,254
WT148	WA		148 Special Contract Transportation	4,849,386	3,845,044	3,193,504	3,447,266	3,050,496	3,480,978	2,884,367	3,232,475	3,263,908	3,676,887	3,595,183	4,265,913
			Total WA	36,226,558	29,571,216	26,441,250	18,260,155	12,233,947	10,562,089	8,071,182	8,555,858	10,138,549	17,796,144	27,511,859	37,050,213

From Avista's Response to Data Request 10-6.

Exhibit J-1 Weather Normalized Usage

	State	Schedule	Class	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
Revenue Run															
WR101	WA		101 Residential	17,512,280	17,427,394	12,071,017	8,417,549	5,379,946	3,288,855	2,203,231	1,808,092	2,079,148	3,982,835	8,118,585	15,323,927
WC101	WA		101 Commercial	3,720,368	3,740,106	2,360,219	1,283,323	721,858	372,147	257,735	200,809	252,083	495,802	1,258,630	3,018,080
WI101	WA		101 Industrial	47,081	53,767	31,449	16,968	8,235	2,797	1,322	1,130	1,461	4,889	16,044	39,205
WT101	WA		101 Total	21,292,599	21,234,566	14,472,322	9,724,124	6,113,562	3,664,833	2,462,636	2,010,203	2,332,936	4,484,817	9,398,517	18,392,852
WR111	WA		111 Residential	815,164	738,587	659,822	465,364	361,399	216,666	126,796	107,750	114,336	184,613	361,557	622,068
WC111	WA		111 Commercial	6,772,412	6,768,011	4,995,645	3,667,541	2,489,445	1,640,849	1,159,288	964,099	1,168,908	1,972,973	3,477,724	6,046,200
WI111	WA		111 Industrial	275,434	334,729	228,595	177,615	120,617	129,049	83,401	75,603	102,895	120,240	211,833	267,098
WT111	WA	111/112	Total	7,929,745	7,910,206	5,921,062	4,326,012	2,986,351	1,997,606	1,375,634	1,148,652	1,387,387	2,283,758	4,078,897	6,988,474
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	756,366	825,466	598,570	498,073	432,902	377,981	329,925	276,899	340,479	371,913	476,314	651,598
WI121	WA		121 Industrial	64,631	70,500	69,416	69,081	76,607	89,869	91,337	93,832	101,922	78,810	109,891	80,201
WT121	WA	121/122	Total	820,997	895,966	667,986	567,154	509,509	467,850	421,262	370,731	442,401	450,723	586,205	731,799
WT131	WA	131/132	Interruptible	75,087	84,056	76,611	63,911	50,186	44,662	32,191	22,511	25,947	31,352	56,927	80,019
WT146	WA		146 Transportation	2,465,600	2,935,439	2,190,055	2,079,563	2,009,516	1,733,716	1,682,838	1,392,151	1,599,685	1,834,446	2,238,461	2,431,320
WT148	WA	147/148	Special Contract Transportation	4,205,863	4,635,258	3,612,133	3,719,339	3,429,296	2,956,627	3,000,689	3,080,932	3,787,994	3,333,615	3,988,466	4,267,030
			Total WA	36,789,891	37,695,491	26,940,169	20,480,103	15,098,420	10,865,294	8,975,250	8,025,180	9,576,350	12,418,711	20,347,473	32,891,494
Unbilled															
WR101	WA		101 Residential	523,814	(3,587,125)	(2,157,310)	(1,493,717)	(1,713,504)	(858,912)	(345,228)	349,115	441,882	2,634,999	4,145,562	1,252,506
WC101	WA		101 Commercial	127,461	(682,349)	(578,631)	(410,450)	(286,694)	(99,369)	(55,620)	47,117	65,956	521,726	1,094,218	339,713
WI101	WA		101 Industrial	819	(11,446)	(8,537)	(7,224)	(2,121)	(1,220)	(699)	444	563	7,384	15,107	4,973
WT101	WA		101 Total	652,094	(4,280,920)	(2,744,478)	(1,911,391)	(2,002,319)	(959,501)	(401,547)	396,676	508,401	3,164,109	5,254,887	1,597,192
WR111	WA		111 Residential	227,421	(166,760)	(92,210)	(10,287)	(120,868)	(34,122)	(12,384)	(9,268)	65,028	205,936	20,492	150,127
WC111	WA		111 Commercial	342,869	(972,735)	(908,656)	(618,209)	(691,004)	(60,648)	(2,823)	(1,939)	676,799	999,041	1,413,790	187,733
WI111	WA		111 Industrial	29,818	(65,703)	(10,893)	(37,875)	(18,952)	855	(3,178)	26,637	(22,186)	58,257	4,038	34,113
WT111	WA		111 Total	600,108	(1,205,198)	(1,011,759)	(666,371)	(830,824)	(93,915)	(18,385)	15,430	719,641	1,263,234	1,438,320	371,973
WR121	WA		121 Residential	(1,832)	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	78,775	(121,219)	(46,919)	(26,295)	(63,798)	(46,399)	(130)	12,054	(59,075)	167,101	88,489	57,391
WI121	WA		121 Industrial	10,091	(41,438)	(12,698)	2,859	8,603	(302)	1,362	11,748	(44,395)	30,443	18,885	1,385
WT121	WA		121 Total	87,034	(162,657)	(59,617)	(23,436)	(55,195)	(46,701)	1,232	23,802	(103,470)	197,544	107,374	58,776
WT131	WA		131 Interruptible	-	-	-	-	-	-	-	-	-	-	-	-
WT146	WA		146 Transportation	(13,197)	(21,598)	(435,597)	(205,211)	(199,032)	(81,622)	59,434	140,741	458,868	402,390	113,842	(113,990)
WT148	WA		148 Special Contract Transportation	590,642	33,657	(585,935)	(342,868)	173,323	15,384	285,009	(69,444)	240,545	262,544	102,376	225,834
			Total WA	1,916,681	(5,636,716)	(4,837,386)	(3,149,277)	(2,914,047)	(1,166,355)	(74,257)	507,205	1,823,985	5,289,821	7,016,799	2,139,785
		101 Total		21,944,693	16,953,646	11,727,844	7,812,733	4,111,243	2,705,332	2,061,089	2,406,879	2,841,337	7,648,926	14,653,404	19,990,044
		111 Total		8,529,853	6,705,008	4,909,303	3,659,641	2,155,527	1,903,691	1,357,249	1,164,082	2,107,028	3,546,992	5,517,217	7,360,447
		121 Total		908,031	733,309	608,369	543,718	454,314	421,149	422,494	394,533	338,931	648,267	693,579	790,575
		131 Interruptible		75,087	84,056	76,611	63,911	50,186	44,662	32,191	22,511	25,947	31,352	56,927	80,019
		146 Transportation		2,452,403	2,913,841	1,754,458	1,874,352	1,810,484	1,652,094	1,742,272	1,532,892	2,058,553	2,236,836	2,352,303	2,317,330
		148 Special Contract Transportation		4,796,505	4,668,915	3,026,198	3,376,471	3,602,619	2,972,011	3,285,698	3,011,488	4,028,539	3,596,159	4,090,842	4,492,864
		Total WA		38,706,572	32,058,775	22,102,783	17,330,826	12,184,373	9,698,939	8,900,993	8,532,385	11,400,335	17,708,532	27,364,272	35,031,279
	Weather Adjustment														
WR101	WA		101 Residential	(951,336)	669,845	1,364,908	(309,893)	779,780	148,842	-	-	-	11,553	34,889	549,017
WC101	WA		101 Commercial	(205,175)	145,921	294,929	(52,333)	131,928	25,274	-	-	-	1,952	5,880	119,431
WI101	WA		101 Industrial	(2,686)	2,151	4,115	(760)	1,935	378	-	-	-	28	84	1,648
WT101	WA		101 Total	(1,159,196)	817,916	1,663,952	(362,986)	913,643	174,494	-	-	-	13,534	40,853	670,096
WR111	WA		111 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC111	WA		111 Commercial	(332,010)	238,411	484,504	(100,214)	250,853	47,835	-	-	-	3,627	11,044	192,759
WI111	WA		111 Industrial	-	-	-	-	-	-	-	-	-	-	-	-
WT111	WA		111 Total	(332,010)	238,411	484,504	(100,214)	250,853	47,835	-	-	-	3,627	11,044	192,759
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	-	-	-	-	-	-	-	-	-	-	-	-
WI121	WA		121 Industrial												
WT121	WA		121 Total	-	-	-	-	-	-	-	-	-	-	-	-
WT131	WA		131 Interruptible												
WT146	WA		146 Transportation												
WT148	WA		148 Special Contract Transportation												
			Total WA	(1,491,206)	1,056,327	2,148,456	(463,201)	1,164,496	222,328	-	-	-	17,161	51,897	862,854
	Weather Normalized Sales Volumes														
WR101	WA		101 Residential	17,084,758	14,510,114	11,278,615	6,613,939	4,446,222	2,578,785	1,858,003	2,157,207	2,521,030	6,629,387	12,299,036	17,125,450
WC101	WA		101 Commercial	3,642,654	3,203,678	2,076,517	820,540	567,092	298,052	202,115	247,926	318,039	1,019,480	2,358,728	3,477,224
WI101	WA		101 Industrial	45,214	44,472	27,027	8,984	8,049	1,955	623	1,574	2,024	12,301	31,235	45,826
WT101	WA		101 Total	20,785,497	17,771,562	13,391,796	7,449,747	5,024,886	2,879,826	2,061,089	2,406,879	2,841,337	7,662,460	14,694,257	20,660,140
WR111	WA		111 Residential	1,042,585	571,827	567,612	455,077	240,531	182,544	114,412	98,482	179,364	390,549	382,049	772,195
WC111	WA		111 Commercial	6,783,271	6,033,687	4,571,493	2,949,118	2,049,294	1,628,036	1,156,465	962,160	1,845,707	2,975,641	4,902,558	6,426,692
WI111	WA		111 Industrial	305,252	269,026	217,702	139,740	101,665	129,904	80,223	102,240	80,709	178,497	215,871	301,211
WT111	WA		111 Total	8,197,843	6,943,419	5,393,807	3,559,427	2,406,380	1,951,526	1,357,249	1,164,082	2,107,028	3,550,619	5,528,261	7,553,206
WR121	WA		121 Residential	(1,832)	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	835,141	704,247	551,651	471,778	369,104	331,582	329,795	288,953	281,404	539,014	564,803	708,989
WI121	WA		121 Industrial	74,722	29,062	56,718	71,940	85,210	89,567	92,699	105,580	57,527	109,253	128,776	81,586
WT121	WA		121 Total	908,031	733,309	608,369	543,718	454,314	421,149	422,494	394,533	338,931	648,267	693,579	790,575
WT131	WA		131 Interruptible	75,087	84,056	76,611	63,911	50,186	44,662	32,191	22,511	25,947	31,352	56,927	80,019
WT146	WA		146 Transportation	2,452,403	2,913,841	1,754,458	1,874,352	1,810,484	1,652,094	1,742,272	1,532,892	2,058,553	2,236,836	2,352,303	2,317,330
WT148	WA		148 Special Contract Transportation	4,796,505	4,668,915	3,026,198	3,376,471	3,602,619	2,972,011	3,285,698	3,011,488	4,028,539	3,596,159	4,090,842	4,492,864
			Total WA	37,215,366	33,115,102	24,251,239	16,867,625	13,348,869	9,921,267	8,900,993	8,532,385	11,400,335	17,725,693	27,416,169	35,894,133

From Avista's Response to Data Request 10-6.

Exhibit J-1 Weather Normalized Usage

	State	Schedule	Class	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Revenue Run															
WR101	WA		101 Residential	17,010,047	18,552,818	12,413,960	11,538,463	7,519,334	3,769,309	2,480,176	1,998,290	2,245,817	3,488,339	7,441,122	12,819,105
WC101	WA		101 Commercial	3,684,010	3,902,556	2,405,279	2,060,003	1,178,010	457,899	281,057	223,664	240,745	440,981	1,144,732	2,483,854
WI101	WA		101 Industrial	47,663	44,777	30,025	22,623	11,946	4,170	2,009	1,090	1,149	3,247	12,606	32,817
WT101	WA		101 Total	20,755,627	22,514,347	14,859,076	13,629,159	8,714,627	4,232,714	2,763,613	2,223,233	2,487,966	3,933,329	8,603,159	15,345,278
WR111	WA		111 Residential	719,132	820,263	553,232	529,326	372,507	207,635	149,371	100,796	120,432	169,459	340,250	494,106
WC111	WA		111 Commercial	6,767,383	7,251,023	5,043,841	5,111,153	3,195,448	1,796,318	1,224,663	1,063,186	1,222,152	1,779,394	3,184,649	5,136,487
WI111	WA		111 Industrial	357,019	366,607	220,596	216,411	170,152	121,334	108,354	117,011	145,466	149,877	215,565	288,856
WT111	WA	111/112	Total	7,912,407	8,511,695	5,875,074	5,881,556	3,784,022	2,145,901	1,491,595	1,282,440	1,489,965	2,114,322	3,767,239	5,964,525
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	713,660	812,337	636,820	155,321	449,336	389,018	314,417	283,133	300,961	300,515	446,295	522,604
WI121	WA		121 Industrial	65,394	7,939	68,296	72,790	72,174	67,688	132,533	59,956	83,008	137,487	116,591	87,842
WT121	WA	121/122	Total	779,054	820,276	705,116	228,111	521,510	456,706	446,950	343,089	383,969	438,002	562,886	610,446
WT131	WA	131/132	Interruptible	73,637	93,723	74,260	67,610	56,425	39,006	31,997	22,754	26,857	31,848	47,455	61,119
WT146	WA		146 Transportation	2,625,069	2,882,932	2,329,796	2,328,185	2,194,716	1,722,294	1,840,480	1,602,949	1,889,824	1,657,180	2,307,873	1,898,178
WT148	WA	147/148	Special Contract Transportation	4,458,368	5,241,334	4,084,683	4,051,579	4,096,532	3,253,015	3,163,858	3,088,562	3,489,833	3,290,911	3,683,398	3,724,754
			Total WA	36,604,162	40,064,307	27,928,005	26,186,200	19,367,832	11,849,636	9,738,493	8,563,027	9,768,414	11,465,592	18,972,010	27,604,300
Unbilled															
WR101	WA		101 Residential	1,251,181	(3,261,868)	105,076	(2,270,711)	(3,282,252)	(618,960)	(512,025)	96,969	295,202	2,852,640	2,902,944	6,815,529
WC101	WA		101 Commercial	227,439	(756,925)	(111,505)	(526,966)	(639,685)	(161,596)	(73,046)	8,908	24,899	394,331	571,266	1,523,295
WI101	WA		101 Industrial	1,480	(11,909)	365	(8,524)	(6,975)	(1,817)	(992)	(182)	179	3,241	8,722	22,334
WT101	WA		101 Total	1,480,100	(4,030,702)	(6,064)	(2,806,201)	(3,928,912)	(782,373)	(586,063)	105,695	320,280	3,250,212	3,482,932	8,361,158
WR111	WA		111 Residential	(26,914)	(123,300)	8,090	(93,445)	(141,770)	(20,539)	(21,547)	(8,029)	20,278	130,116	119,941	-305,932
WC111	WA		111 Commercial	571,033	(1,355,351)	165,607	(711,318)	(1,503,702)	(162,730)	(221,365)	102,661	177,597	1,397,977	866,498	2,326,652
WI111	WA		111 Industrial	74,577	(79,635)	(13,563)	(34,196)	(52,365)	3,732	(1,151)	25,395	28,126	85,270	19,630	94,106
WT111	WA		111 Total	618,696	(1,558,286)	160,134	(838,959)	(1,697,837)	(179,537)	(244,063)	120,027	226,001	1,613,363	1,006,069	2,114,826
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	0	0	0
WC121	WA		121 Commercial	(20,402)	(122,150)	64,599	(333,614)	69,607	43,014	(21,557)	33,624	28,445	164,034	53,972	113,819
WI121	WA		121 Industrial	(73,354)	(39,723)	41,438	(7,852)	(12,554)	9,222	37,982	(28,090)	20,652	117,273	-64,083	-22,562
WT121	WA		121 Total	(93,756)	(161,873)	106,037	(341,466)	57,053	52,236	16,425	5,534	49,097	281,307	-10,111	91,257
WT131	WA		131 Interruptible	-	-	-	-	-	-	-	-	-	0	0	0
WT146	WA		146 Transportation	(271,493)	(73,112)	(269,851)	2,860,152	(3,029,520)	(343,459)	41,077	143,963	607,504	328,471	71,816	317,442
WT148	WA		148 Special Contract Transportation	(517,073)	184,058	(481,260)	(3,330,965)	2,846,375	(194,227)	305,480	25,733	568,539	408,493	1,050,261	374,533
			Total WA	1,216,474	(5,639,915)	(491,004)	(4,457,439)	(5,752,841)	(1,447,360)	(467,144)	400,952	1,771,421	5,881,846	5,600,967	11,259,216
		101 Total		22,235,727	18,483,645	14,853,012	10,822,958	4,785,715	3,450,341	2,177,550	2,328,928	2,808,246	7,183,541	12,086,091	23,706,436
		111 Total		8,531,103	6,953,409	6,035,208	5,042,597	2,086,185	1,966,364	1,247,532	1,402,467	1,715,966	3,727,685	4,773,308	8,079,351
		121 Total		685,298	658,403	811,153	(113,355)	578,563	508,942	463,375	348,623	433,066	719,309	552,775	701,703
		131 Interruptible		73,637	93,723	74,260	67,610	56,425	39,006	31,997	22,754	26,857	31,848	47,455	61,119
		146 Transportation		2,353,576	2,809,820	2,059,945	5,188,337	(834,804)	1,378,835	1,881,557	1,746,912	2,497,328	1,985,651	2,379,689	2,215,620
		148 Special Contract Transportation		3,941,295	5,425,392	3,603,423	720,614	6,942,907	3,058,788	3,469,338	3,114,295	4,058,372	3,699,404	4,733,659	4,099,287
		Total WA		37,820,636	34,424,392	27,437,001	21,728,761	13,614,991	10,402,276	9,271,349	8,963,979	11,539,835	17,347,438	24,572,977	38,863,516
	Weather Adjustment														
WR101	WA		101 Residential	(969,946)	(91,868)	(1,181,246)	(1,472,624)	747,492	(314,879)	-	-	-	293,227	1,320,571	(2,124,474)
WC101	WA		101 Commercial	(210,192)	(19,886)	(255,879)	(248,948)	126,363	(53,497)	-	-	-	49,433	221,382	(457,112)
WI101	WA		101 Industrial	(2,873)	(266)	(3,418)	(3,354)	1,704	(711)	-	-	-	666	2,982	(6,009)
WT101	WA		101 Total	(1,183,010)	(112,021)	(1,440,543)	(1,724,926)	875,560	(369,087)	-	-	-	343,325	1,544,934	(2,587,596)
WR111	WA		111 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC111	WA		111 Commercial	(341,353)	(32,470)	(416,632)	(474,321)	239,235	(100,265)	-	-	-	92,603	415,705	(739,930)
WI111	WA		111 Industrial	-	-	-	-	-	-	-	-	-	-	-	-
WT111	WA		111 Total	(341,353)	(32,470)	(416,632)	(474,321)	239,235	(100,265)	-	-	-	92,603	415,705	(739,930)
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	-	-	-	-	-	-	-	-	-	-	-	-
WI121	WA		121 Industrial												
WT121	WA		121 Total	-	-	-	-	-	-	-	-	-	-	-	-
WT131	WA		131 Interruptible												
WT146	WA		146 Transportation												
WT148	WA		148 Special Contract Transportation												
			Total WA	(1,524,363)	(144,491)	(1,857,174)	(2,199,248)	1,114,795	(469,352)	-	-	-	435,927	1,960,639	(3,327,526)
	Weather Normalized Sales Volumes														
WR101	WA		101 Residential	17,291,282	15,199,082	11,337,791	7,795,128	4,984,574	2,835,470	1,968,151	2,095,259	2,541,019	6,634,206	11,664,637	17,510,160
WC101	WA		101 Commercial	3,701,257	3,125,745	2,037,895	1,284,089	664,688	242,806	208,011	232,572	265,644	884,745	1,937,380	3,550,037
WI101	WA		101 Industrial	46,270	32,602	26,972	10,745	6,675	1,642	1,017	908	1,328	7,154	24,310	49,142
WT101	WA		101 Total	21,052,717	18,371,624	13,412,469	9,098,032	5,661,275	3,081,254	2,177,550	2,328,928	2,808,246	7,526,866	13,631,025	21,118,840
WR111	WA		111 Residential	692,218	696,963	561,322	435,881	230,737	187,096	127,824	92,767	140,710	299,575	460,191	188,174
WC111	WA		111 Commercial	6,997,063	5,863,202	4,792,816	3,925,514	1,930,981	1,533,323	1,003,298	1,165,847	1,399,749	3,269,974	4,466,852	6,723,209
WI111	WA		111 Industrial	431,596	286,972	207,033	182,215	117,787	125,066	107,203	142,406	173,592	235,147	235,195	382,962
WT111	WA		111 Total	8,189,750	6,920,939	5,618,576	4,568,276	2,325,420	1,866,099	1,247,532	1,402,467	1,715,966	3,820,288	5,189,013	7,339,421
WR121	WA		121 Residential	-	-	-	-	-	-	-	-	-	-	-	-
WC121	WA		121 Commercial	693,258	690,187	701,419	(178,293)	518,943	432,032	292,860	316,757	329,406	464,549	500,267	636,423
WI121	WA		121 Industrial	(7,960)	(31,784)	109,734	64,938	59,620	76,910	170,515	31,866	103,660	254,760	52,508	65,280
WT121	WA		121 Total	685,298	658,403	811,153	(113,355)	578,563	508,942	463,375	348,623	433,066	719,309	552,775	701,703
WT131	WA		131 Interruptible	73,637	93,723	74,260	67,610	56,425	39,006	31,997	22,754	26,857	31,848	47,455	61,119
WT146	WA		146 Transportation	2,353,576	2,809,820	2,059,945	5,188,337	(834,804)	1,378,835	1,881,557	1,746,912	2,497,328	1,985,651	2,379,689	2,215,620
WT148	WA		148 Special Contract Transportation	3,941,295	5,425,392	3,603,423	720,614	6,942,907	3,058,788	3,469,338	3,114,295	4,058,372	3,699,404	4,733,659	4,099,287
			Total WA	36,296,273	34,279,901	25,579,827	19,529,513	14,729,786	9,932,924	9,271,349	8,963,979	11,539,835	17,783,365	26,533,616	35,535,990

From Avista's Response to Data Request 10-6.

Exhibit J-2 Weather Normalization Margin Impact

Schedule	Month		2006		2007		2008
	Billed Usage		112,983,336		115,583,967		120,062,128
	Net Unbilled Usage		418,424		(726,797)		4,860,062
	Billed Customers		1,636,851		1,673,784		1,702,600
	Basic Charge	$	5.26	$	5.26	$	5.26
	Margin Rate/Therm		0.19822		0.19822		0.21748
101	**Recorded Margin Revenue**	**$**	**31,089,858**	**$**	**31,572,651**	**$**	**36,128,983**
	Weather Adjustment Usage		6,036,027		2,772,306		(4,653,364)
	Incremental Margin	$	1,196,461	$	549,527	$	(1,012,014)
101	**Weather Adjusted Margin Revenue**	**$**	**32,286,319**	**$**	**32,122,178**	**$**	**35,116,969**
Adjusted to Exclude Revenue Related Exp							
	Billed Usage		46,995,907		48,333,784		50,220,741
	Block 1		4,552,860		4,879,920		5,011,152
	Block 2		12,621,162		13,390,005		13,909,269
	Block 3		29,821,887		30,063,859		31,300,320
	Net Unbilled Usage		(463,609)		582,254		1,340,434
	Billed Customers		26,476		26,910		27,095
	Minimum Charge	$	45.19	$	45.19	$	49.05
	Margin Rate/Therm						
	1st Block		0.22595		0.22595		0.24524
	2nd Block		0.16172		0.16172		0.17675
	3rd Block		0.09904		0.09904		0.11314
111/112	**Recorded Margin Revenue**	**$**	**6,145,189**	**$**	**6,416,686**	**$**	**7,480,394**
	Weather Adjustment Usage		1,715,357		796,807		(1,357,429)
	Incremental Margin	$	169,889	$	78,916	$	(153,580)
111/112	**Weather Adjusted Margin Revenue**	**$**	**6,315,078**	**$**	**6,495,601**	**$**	**7,326,814**
	Note: Applied tail block rate to unbilled and weather adjustment usage						
	Billed Usage		7,890,572		6,932,583		6,296,115
	Block 1		191,000		188,459		182,991
	Block 2		191,000		186,375		180,960
	Block 3		3,298,050		3,056,283		2,879,616
	Block 4		2,657,986		2,250,918		2,054,370
	Block 5		1,552,535		1,250,548		998,179
	Net Unbilled Usage		(265,306)		24,686		51,740
	Billed Customers		382		378		381
	Minimum Charge	$	106.41	$	106.41	$	116.05
	Margin Rate/Therm						
	1st Block		0.21282		0.21282		0.23209
	2nd Block		0.16452		0.16452		0.17955
	3rd Block		0.10184		0.10184		0.11540
	4th Block		0.06211		0.06211		0.07511
	5th Block		0.05126		0.05126		0.06409
121/122	**Recorded Margin Revenue**	**$**	**639,016**	**$**	**587,310**	**$**	**630,605**
	Weather Adjustment Usage		-		-		-
	Incremental Margin	$	-	$	-	$	-
121/122	**Weather Adjusted Margin Revenue**	**$**	**639,016**	**$**	**587,310**	**$**	**630,605**
	Note: Applied tail block rate to unbilled and weather adjustment usage						

Exhibit J-2 Weather Normalization Margin Impact

Schedule	Month		2006		2007		2008
	Billed Usage		644,022		643,460		626,691
	Block 1		120,000		120,000		120,000
	Block 2		179,316		177,511		177,754
	Block 3		210,848		209,152		202,163
	Block 4		133,858		136,797		126,774
	Net Unbilled Usage		-		-		-
	Billed Customers		12		12		12
	Minimum Charge	$	-	$	-	$	-
	Margin Rate/Therm						
	1st Block		0.10871		0.10871		0.12227
	2nd Block		0.06974		0.06974		0.08273
	3rd Block		0.06017		0.06017		0.07302
	4th Block		0.05702		0.05702		0.06982
131/132	**Recorded Margin Revenue**	**$**	**45,870**	**$**	**45,810**	**$**	**52,991**
	Weather Adjustment Usage		-		-		-
	Incremental Margin	$	-	$	-	$	-
131/132	**Weather Adjusted Margin Revenue**		**45,870**		**45,810**		**52,991**
	Billed Usage		23,483,563		24,592,790		25,279,476
	Net Unbilled Usage		195,320		105,028		382,990
	Billed Customers		316		345		382
	Basic Charge	$	200.00	$	200.00	$	200.00
	Exclude Demand Cost/Therm		0.00056		0.00056		0.00056
	Exclude Amort Prior Gas Cost/Therm		0.00190		0.00157		0.00008
	Non-Margin Revenue	$	58,132	$	52,648	$	16,424
	Billed Revenue	$	1,659,686	$	1,833,959	$	1,902,507
	Unbilled Revenue	$	(21,929)	$	(68,004)	$	36,678
	Revenue Related Expense Factor		0.956533		0.956533		0.956922
146	**Recorded Margin Revenue**	**$**	**1,510,964**	**$**	**1,638,835**	**$**	**1,839,932**
	Weather Adjustment Usage		-		-		-
	Incremental Margin	$	-	$	-	$	-
146	**Weather Adjusted Margin Revenue**		**1,510,964**		**1,638,835**		**1,839,932**
All 148 Revenue is Margin Revenue							
	Schedule 147 Spec Contract	$	53,960	$	46,940	$	45,643
	Schedule 148 Spec Contract	$	1,039,822	$	1,067,985	$	1,107,075
	Unbilled Schedule 148 Revenue	$	(57,926)	$	(8,962)	$	16,520
148	**Recorded Margin Revenue**	**$**	**990,831**	**$**	**1,057,890**	**$**	**1,118,870**

Exhibit J-2 Weather Normalization Margin Impact

Schedule 111/112 Block Analysis

Test Block Max

2006	2007	2008
5295200	5382000	5382000
21180800	21528000	21528000

Schedule 121/122 Block Analysis

Test Block Max

2006	2007	2008	2006 Max Adj Calc
191000	189000	189000	0
191000	189000	189000	0
3438000	3402000	3402000	(139,950)
5730000	5670000	5670000	(3,072,014)

Exhibit J-2 Weather Normalization Margin Impact

Schedule 131/132 Block Analysis

	2006	1st Block	2nd Block	3rd Block	4th Block
Jan	79033	10000	15000	25000	29033
Feb	73746	10000	15000	25000	23746
Mar	75280	10000	15000	25000	25280
Apr	67227	10000	15000	25000	17227
May	56865	10000	15000	25000	6865
Jun	40563	10000	15000	15563	
Jul	31401	10000	15000	6401	
Aug	24316	10000	14316		
Sep	26942	10000	15000	1942	
Oct	36942	10000	15000	11942	
Nov	50798	10000	15000	25000	798
Dec	80909	10000	15000	25000	30909
	644022	120000	179316	210848	133858

	2007	1st Block	2nd Block	3rd Block	4th Block
Jan	75087	10000	15000	25000	25087
Feb	84056	10000	15000	25000	34056
Mar	76611	10000	15000	25000	26611
Apr	63911	10000	15000	25000	13911
May	50186	10000	15000	25000	186
Jun	44662	10000	15000	19662	
Jul	32191	10000	15000	7191	
Aug	22511	10000	12511		
Sep	25947	10000	15000	947	
Oct	31352	10000	15000	6352	
Nov	56927	10000	15000	25000	6927
Dec	80019	10000	15000	25000	30019
	643460	120000	177511	209152	136797

	2008	1st Block	2nd Block	3rd Block	4th Block
Jan	73637	10000	15000	25000	23637
Feb	93723	10000	15000	25000	43723
Mar	74260	10000	15000	25000	24260
Apr	67610	10000	15000	25000	17610
May	56425	10000	15000	25000	6425
Jun	39006	10000	15000	14006	
Jul	31997	10000	15000	6997	
Aug	22754	10000	12754		
Sep	26857	10000	15000	1857	
Oct	31848	10000	15000	6848	
Nov	47455	10000	15000	22455	
Dec	61119	10000	15000	25000	11119
	626691	120000	177754	202163	126774

Exhibit J-3 Change in Number of Customers

From Revenue Runs

Table J3-C Quantity of Customers					
Schedule	2004	2005	2006	2007	2008
101	129,659	132,870	136,404	139,482	141,883
111	2,272	2,202	2,206	2,243	2,258
121	38	35	32	32	32
131	1	1	1	1	1
146	24	25	26	29	32
147	3	3	3	2	2
148	6	5	5	5	6
Total	132,004	135,142	138,678	141,793	144,214

Table J3-A Change in # of Customers					
Schedule	2004	2005	2006	2007	2008
101	2.5%	2.5%	2.7%	2.3%	1.7%
111	-4.0%	-3.1%	0.2%	1.6%	0.7%
121	13.0%	-9.3%	-8.6%	-1.0%	0.8%
131	-33.3%	-25.0%	0.0%	0.0%	0.0%
146	-3.3%	3.4%	5.3%	9.2%	10.7%
147	25.0%	13.3%	0.0%	-14.7%	-13.8%
148	16.7%	-12.9%	-1.6%	0.0%	13.3%

Exhibit J-4 Gas Rate Summary

Change in delivered average monthly price per therm by rate schedule 2006 - 2008
Detailed incremental chronological listing (including Docket #) and price per therm impact of all rate adjustments
Cumulative Impact

Date of Change	Basic Chg	USAGE	Base Rates		Adjustment For Sch 150		Adjustment For Sch 155		Subtotal	Adjustment For Sch 156		Adjustment For Sch 159		Adjustment For Sch 191		Total As Billed	Filing Description	Docket #
Schedule 101																		
11/01/08	$ 5.50	All	1.12076	5th	-0.00839	7th	-0.04653	9th	1.06584	0.04967	14th	0.00593	2nd	0.02603	7th	**$1.14747**	PGA & Decoupling	UG-081672 & UG-081601
01/01/08	$ 5.50	All	1.12076	5th	-0.00839	7th	-0.00300	8th	1.10937	0.00	13th	0.00257	Original	0.02603	7th	**$1.13797**	GRC	UG-070805
11/01/07	$ 5.50	All	0.89117	4th	-0.00839	7th	-0.00300	8th	0.87978	0.20991	12th	0.00257	Original	0.02445	6th	**$1.11671**	PGA & Decoupling	UG-071864 & UG-071863
11/01/06	$ 5.50	All	0.89117	4th	0	6th	0.06455	7th	0.95572	0.20991	12th			0.02445	6th	**$1.19008**	PGA+DSM	UG-061531 & UG-061529
01/01/06	$ 5.50	All	0.89117	3rd	0	6th	0.02584	6th	0.91701	0.23163	10th			0.01062	5th	**$1.15926**	GRC	UG-050483

Date of Change	USAGE	Base Rates		Adjustment For Sch 150		Adjustment For Sch 155		Subtotal	Adjustment For Sch 156		Adjustment For Sch 191		Total As Billed	Filing Description	Docket #
Schedule 111															
11/01/08	Min Chg =	$135.07	5th		7th		9th	$135.07		14th		7th	**$135.07**	PGA	UG-081672
	+ Therms used times	$0.47163		-0.00836		-$0.04417		0.41910	$0.04964		0.02278		**$0.49152**		
	200	1.14698		-0.00836		-$0.04417		1.09445	$0.04964		0.02278		**$1.16687**		
	201-1000	1.07541		-0.00836		-$0.04417		1.02288	$0.04964		0.02278		**$1.09530**		
	1001+	1.00893		-0.00836		-$0.04417		0.95640	$0.04964		0.02278		**$1.02882**		
01/01/08	Min Chg =	$135.07	5th		7th		8th	$135.07		13th		7th	**$135.07**	GRC	UG-070805
	+ Therms used times	$0.47163		-0.00836		$0.00000		0.46327	0		0.02278		**$0.48605**		
	200	1.14698		-0.00836		$0.00000		1.13862	0		0.02278		**$1.16140**		
	201-1000	1.07541		-0.00836		$0.00000		1.06705	0		0.02278		**$1.08983**		
	1001+	1.00893		-0.00836		$0.00000		1.00057	0		0.02278		**$1.02335**		
11/01/07	Min Chg =	$131.13	4th		7th		8th	$131.13		12th		6th	**$131.13**	PGA	UG-071864
	+ Therms used times	$0.26186		-0.00836		$0.00000		0.25350	0.20977		0.02141		**$0.48468**		
	200	0.91751		-0.00836		$0.00000		0.90915	0.20977		0.02141		**$1.14033**		
	201-1000	0.85036		-0.00836		$0.00000		0.84200	0.20977		0.02141		**$1.07318**		
	1001+	0.78483		-0.00836		$0.00000		0.77647	0.20977		0.02141		**$1.00765**		
11/01/06	Min Chg =	$131.13	4th	$ -	6th		7th	$131.13		12th		6th	**$131.13**	PGA+DSM	UG-061531 & UG-061529
	+ Therms used times	$0.26186		$ -		$0.06451		0.32637	0.20977		0.02141		**$0.55755**		
	200	0.91751		$ -		$0.06451		0.98202	0.20977		0.02141		**$1.21320**		
	201-1000	0.85036		$ -		$0.06451		0.91487	0.20977		0.02141		**$1.14605**		
	1001+	0.78483		$ -		$0.06451		0.84934	0.20977		0.02141		**$1.08052**		
01/01/06	Min Chg =	$131.13	3rd	$ -	6th		6th	$131.13		10th		5th	**$131.13**	GRC	UG-050483
	+ Therms used times	$0.26186		$ -		$0.02667		0.28853	0.23148		0.00916		**$0.52917**		
	200	0.91751		$ -		$0.02667		0.94418	0.23148		0.00916		**$1.18482**		
	201-1000	0.85036		$ -		$0.02667		0.87703	0.23148		0.00916		**$1.11767**		
	1001+	0.78483		$ -		$0.02667		0.81150	0.23148		0.00916		**$1.05214**		

Date of Change	USAGE	Base Rates		Adjustment For Sch 150		Adjustment For Sch 155		Subtotal	Adjustment For Sch 156		Adjustment For Sch 191		Total As Billed	Filing Description	Docket #
Schedule 121															
01/01/08	Min Chg =	$329.43	5th		7th		9th	329.43		14th		7th	**$329.43**	PGA	UG-081672
	+ # Therms used times	$0.45812		-0.00806		-0.03005		0.42001	0.0496		0.02124		**$0.49085**		
	1st 500	1.11698		-0.00806		-0.03005		1.07887	0.0496		0.02124		**$1.14971**		
	501-1000	1.06208		-0.00806		-0.03005		1.02397	0.0496		0.02124		**$1.09481**		
	1001-10,000	0.99504		-0.00806		-0.03005		0.95693	0.0496		0.02124		**$1.02777**		
	10,001-25,000	0.95293		-0.00806		-0.03005		0.91482	0.0496		0.02124		**$0.98566**		
	over 25,000	0.94142		-0.00806		-0.03005		0.90331	0.0496		0.02124		**$0.97415**		
01/01/08	Min Chg =	$329.43	5th		7th		8th	329.43		13th		7th	**$329.43**	GRC	UG-070805
	+ # Therms used times	$0.45812		-0.00806		0.01087		0.46093	0		0.02124		**$0.48217**		
	1st 500	1.11698		-0.00806		0.01087		1.11979	0		0.02124		**$1.14103**		
	501-1000	1.06208		-0.00806		0.01087		1.06489	0		0.02124		**$1.08613**		
	1001-10,000	0.99504		-0.00806		0.01087		0.99785	0		0.02124		**$1.01909**		
	10,001-25,000	0.95293		-0.00806		0.01087		0.95574	0		0.02124		**$0.97698**		
	over 25,000	0.94142		-0.00806		0.01087		0.94423	0		0.02124		**$0.96547**		
11/01/07	Min Chg =	$319.59	4th		7th		8th	319.59		12th		6th	**$319.59**	PGA	UG-071864
	+ # Therms used times	$0.24854		-0.00806		0.01087		0.25135	0.20958		0.01998		**$0.48091**		
	1st 500	0.88772		-0.00806		0.01087		0.89053	0.20958		0.01998		**$1.12009**		
	501-1000	0.83722		-0.00806		0.01087		0.84003	0.20958		0.01998		**$1.06959**		
	1001-10,000	0.77169		-0.00806		0.01087		0.77450	0.20958		0.01998		**$1.00406**		
	10,001-25,000	0.73016		-0.00806		0.01087		0.73297	0.20958		0.01998		**$0.96253**		
	over 25,000	0.71881		-0.00806		0.01087		0.72162	0.20958		0.01998		**$0.95118**		
11/01/06	Min Chg =	$319.59	4th		6th		7th	319.59		12th		6th	**$319.59**	PGA+DSM	UG-061531 & UG-061529
	+ # Therms used times	$0.24854		0		0.06621		0.31475	0.20958		0.01998		**$0.54431**		
	1st 500	0.88772		0		0.06621		0.95393	0.20958		0.01998		**$1.18349**		
	501-1000	0.83722		0		0.06621		0.90343	0.20958		0.01998		**$1.13299**		
	1001-10,000	0.77169		0		0.06621		0.83790	0.20958		0.01998		**$1.06746**		
	10,001-25,000	0.73016		0		0.06621		0.79637	0.20958		0.01998		**$1.02593**		
	over 25,000	0.71881		0		0.06621		0.78502	0.20958		0.01998		**$1.01458**		
01/01/06	Min Chg =	$319.59	3rd		6th		6th	319.59		10th		5th	**$319.59**	GRC	UG-050483
	+ # Therms used times	$0.24854		0		0.02615		0.27469	0.23121		0.00848		**$0.51438**		
	1st 500	0.88772		0		0.02615		0.91387	0.23121		0.00848		**$1.15356**		
	501-1000	0.83722		0		0.02615		0.86337	0.23121		0.00848		**$1.10306**		
	1001-10,000	0.77169		0		0.02615		0.79784	0.23121		0.00848		**$1.03753**		
	10,001-25,000	0.73016		0		0.02615		0.75631	0.23121		0.00848		**$0.99600**		
	over 25,000	0.71881		0		0.02615		0.74496	0.23121		0.00848		**$0.98465**		

Exhibit J-4 Gas Rate Summary

Date of Change	USAGE	Base Rates		Adjustment For Sch 150		Adjustment For Sch 155		Subtotal	Adjustment For Sch 156		Adjustment For Sch 191		Total As Billed		
Schedule 131															
11/01/08	Minimum	$36,177.50	3rd		7th		9th	36177.50		14th		7th	**$ 36,178**	PGA	UG-081672
	1st 10,000	0.98327		-0.00818		-0.02923		0.94586	0.05013		0.02053		**$1.01652**		
	10,001-25,000	0.94195		-0.00818		-0.02923		0.90454	0.05013		0.02053		**$0.97520**		
	25,001-50,000	0.93181		-0.00818		-0.02923		0.89440	0.05013		0.02053		**$0.96506**		
	over 50,000	0.92846		-0.00818		-0.02923		0.89105	0.05013		0.02053		**$0.96171**		
01/01/08	Minimum	$36,177.50	3rd		7th		8th	36177.50		13th		7th	**$ 36,178**	GRC	UG-070805
	1st 10,000	0.98327		-0.00818		0.00664		0.98173	0		0.02053		**$1.00226**		
	10,001-25,000	0.94195		-0.00818		0.00664		0.94041	0		0.02053		**$0.96094**		
	25,001-50,000	0.93181		-0.00818		0.00664		0.93027	0		0.02053		**$0.95080**		
	over 50,000	0.92846		-0.00818		0.00664		0.92692	0		0.02053		**$0.94745**		
11/01/07	Minimum	$42,500.00	3rd		7th		8th	42500.00		12th		6th	**$ 42,500**	PGA	UG-071864
	1st 10,000	0.76056		-0.00818		0.00664		0.75902	0.20894		0.01931		**$0.98727**		
	10,001-25,000	0.71982		-0.00818		0.00664		0.71828	0.20894		0.01931		**$0.94653**		
	25,001-50,000	0.70982		-0.00818		0.00664		0.70828	0.20894		0.01931		**$0.93653**		
	over 50,000	0.70652		-0.00818		0.00664		0.70498	0.20894		0.01931		**$0.93323**		
11/01/06	Minimum	$42,500.00	3rd	0	6th		7th	42500.00		12th		6th	**$ 42,500**	PGA+DSM	UG-061531 & UG-061529
	1st 10,000	0.76056		0		0.07310		0.83366	0.20894		0.01931		**$1.06191**		
	10,001-25,000	0.71982		0		0.07310		0.79292	0.20894		0.01931		**$1.02117**		
	25,001-50,000	0.70982		0		0.07310		0.78292	0.20894		0.01931		**$1.01117**		
	over 50,000	0.70652		0		0.07310		0.77962	0.20894		0.01931		**$1.00787**		
01/01/06	Minimum	$42,500.00	3rd	0	6th		6th	42500.00		10th		5th	**$ 42,500**	GRC	UG-050483
	1st 10,000	0.76056		0		0.02688		0.78744	0.23061		0.00819		**$1.02624**		
	10,001-25,000	0.71982		0		0.02688		0.74670	0.23061		0.00819		**$0.98550**		
	25,001-50,000	0.70982		0		0.02688		0.73670	0.23061		0.00819		**$0.97550**		
	over 50,000	0.70652		0		0.02688		0.73340	0.23061		0.00819		**$0.97220**		
Schedule 146															
11/01/08	Minimum	$15,900	5th		7th		9th	15900.00		14th		7th	**$ 15,900**	PGA	UG-081672
	Customer Charge	$200	plus												
	1st 20,000	0.07134		0		0.00008		0.07142	0.00000		0.0000		**$0.07142**		
	20,001-50,000	0.06352		0		0.00008		0.06360	0.00000		0.0000		**$0.06360**		
	50,001-300,000	0.05730		0		0.00008		0.05738	0.00000		0.0000		**$0.05738**		
	300,001-500,000	0.05302		0		0.00008		0.05310	0.00000		0.0000		**$0.05310**		
	over 500,000	0.03995		0		0.00008		0.04003	0.00000		0.0000		**$0.04003**		
01/01/08	Minimum	$15,900	5th		7th		8th	15900.00		13th		7th	**$ 15,900**	GRC	UG-070805
	Customer Charge	$200	plus												
	1st 20,000	0.07134		0		0.00008		0.07142	0.00000		0.0000		**$0.07142**		
	20,001-50,000	0.06352		0		0.00008		0.06360	0.00000		0.0000		**$0.06360**		
	50,001-300,000	0.05730		0		0.00008		0.05738	0.00000		0.0000		**$0.05738**		
	300,001-500,000	0.05302		0		0.00008		0.05310	0.00000		0.0000		**$0.05310**		
	over 500,000	0.03995		0		0.00008		0.04003	0.00000		0.0000		**$0.04003**		
11/01/07	Minimum	$14,950	4th		7th		8th	14950.00		12th		6th	**$ 14,950**	PGA	UG-071864
	Customer Charge	$200	plus												
	1st 20,000	0.06716		0		0.00008		0.06724	0.00000		0.0000		**$0.06724**		
	20,001-50,000	0.05980		0		0.00008		0.05988	0.00000		0.0000		**$0.05988**		
	50,001-300,000	0.05394		0		0.00008		0.05402	0.00000		0.0000		**$0.05402**		
	300,001-500,000	0.04991		0		0.00008		0.04999	0.00000		0.0000		**$0.04999**		
	over 500,000	0.03761		0		0.00008		0.03769	0.00000		0.0000		**$0.03769**		
11/01/06	Minimum	$14,950	4th	0	6th		7th	14950.00		12th		6th	**$ 14,950**	PGA+DSM	UG-061531 & UG-061529
	Customer Charge	$200	plus												
	1st 20,000	0.06716		0		0.00187		0.06903	0.00000		0.0000		**$0.06903**		
	20,001-50,000	0.05980		0		0.00187		0.06167	0.00000		0.0000		**$0.06167**		
	50,001-300,000	0.05394		0		0.00187		0.05581	0.00000		0.0000		**$0.05581**		
	300,001-500,000	0.04991		0		0.00187		0.05178	0.00000		0.0000		**$0.05178**		
	over 500,000	0.03761		0		0.00187		0.03948	0.00000		0.0000		**$0.03948**		
01/01/06	Minimum	$14,950	3rd	0	6th		6th	14950.00		10th		5th	**$ 14,950**	GRC	UG-050483
	Customer Charge	$200	plus												
	1st 20,000	0.06716		0		0.00190		0.06906	0.00000		0.0000		**$0.06906**		
	20,001-50,000	0.05980		0		0.00190		0.06170	0.00000		0.0000		**$0.06170**		
	50,001-300,000	0.05394		0		0.00190		0.05584	0.00000		0.0000		**$0.05584**		
	300,001-500,000	0.04991		0		0.00190		0.05181	0.00000		0.0000		**$0.05181**		
	over 500,000	0.03761		0		0.00190		0.03951	0.00000		0.0000		**$0.03951**		

Data Request 10, Question 18

Please provide a response to the following requests for clarification along with any additional salient information.

18. The weather normalization calculations for UG-070805 Method Weather Normalized Sales in worksheet Calculation includes an adjustment for unbilled. How do we reconcile the Schedule 101 unbilled adjustment with the decoupling report unbilled for the same period? For Example:

		Decoupling Report Unbilled		
Month	Calculation	Previous Mo	Current Mo	Net
Jan-07	652,094	(-11,318,911)	12,417,092	1,098,171
Feb-07	(-4,280,920)	(-12,417,092)	8,476,763	(-3,940,329)
Mar-07	(-2,744,478)	(-8,476,763)	6,557,935	(-1,918,828)

Avista's Response:

The unbilled usage values from the two sources are not directly comparable.

The unbilled adjustment for Weather Normalized Sales is the unbilled usage adjustment for all customers per the general ledger journal entries. The per books unbilled calculation is estimated in total based on unbilled cycle day gas purchases for sales customers and assigned to customer groups based on the following month forecasted billed usage.

The unbilled values on the decoupling report represents only base test year (2004) customers and is calculated from the weather normalization regression equations (baseload use/customer/month and use/customer/ddh) utilized in the base test year (2004) applied to the unbilled cycle day heating degree days and the unbilled cycle day percentage of baseload for each current month (2007). The billed usage of new customers since the base test year is excluded from the decoupling mechanism , therefore both unbilled and weather adjustments in the mechanism reflect only the impact from base test year customers.