An Assessment of APS's New Bill Comparison Web Tool

PREPARED FOR

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Revised January 23, 2020

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I. Executive Summary

Arizona Public Service (APS) intends to roll out a new web-based bill comparison tool ("web tool") to customers this year. In preparation for that rollout, APS commissioned The Brattle Group ("Brattle") to verify the accuracy of the web tool's output (referred to as the "audit"). Specifically, using customer data and rates information provided by APS, we verified the accuracy of the tool's recommendations regarding the rates that would have minimized customers' historical bills by independently replicating the underlying calculations supporting those recommendations.

In order to validate the accuracy of the web tool within a feasible timeframe and cost, the audit was conducted for a random sample of 55,343 customers. Based on a review of APS's sampling methodology and analysis of the customer characteristics represented in the sample, we concluded that the sample is likely to represent a range of customer billing characteristics similar to those of the broader customer population, and is therefore sufficient for auditing purposes.

Of the 55,343 customers in the sample, 46,045 were identified by APS as eligible to use the web tool, with sufficient data to conduct the audit. There is a variety of reasons that APS will restrict certain customers from using the web tool. Examples include having less than three months of historical billing data, being a landlord rather than a tenant, or being enrolled in a distributed generation rider. Additionally, data limitations will temporarily prevent APS from being able to accurately develop historical comparative bill calculations for some customers. Until those data limitations are resolved, APS will restrict those customers from using the web tool and direct them to the call center. Of the 9,298 excluded customers in the sample, 1,395 were considered ineligible for these data limitation reasons. The same eligibility restrictions that were applied to the sample in our audit will be applied by APS to the full population of customers when the web tool is rolled out.

For the remaining 46,045 eligible customers in the sample, our independent calculations have produced the same historical rate recommendations as APS for all but one of those customers. For that one remaining customer, we have determined that the discrepancy is due to an anomalous data issue unrelated to the accuracy of the web tool. In other words, **we have confirmed the accuracy of the rate recommendations in APS's web tool for each eligible customer in the sample.**

For some customers in some months, the web tool produces a comparative historical monthly bill calculation that is different than our calculation. This difference affects less than 0.02% of the roughly 3 million monthly bills in our sample. Among those limited cases where there is an unresolved discrepancy, the average difference between Brattle's and APS's monthly bill calculation is less than 4%. Due to the small magnitude of this difference and its restriction to a limited number of months per year, the discrepancy does not affect the rate recommendations for any customers in the sample. APS reports that it has addressed the causes of this discrepancy for all comparative bill calculations for customers eligible to use the web tool going forward. Further,

this discrepancy has not resulted in the inaccurate billing of customers; it is only related to estimates of what customers' historical bills would have been under alternative rate options.

Based on our audit, APS's new web tool is accomplishing the company's intended objective of providing customers with accurate information about the rates that would have minimized their bills based on historical usage patterns. We have not identified any errors in the web tool's bill calculations that would result in customers being given misleading information.

II. Introduction

Arizona Public Service (APS) intends to roll out a new web-based bill comparison tool ("web tool") this year. The web tool will provide eligible residential customers with information about the rate(s) that would have minimized their historical bills, including estimates of what their historical bills would have been under each available retail rate.

On November 18, 2019, APS commissioned The Brattle Group ("Brattle") to verify the accuracy of the web tool. We refer to this verification process as the "audit." The purpose of this report is to summarize the scope, methodology, and findings of Brattle's audit of APS's web tool.

III. About the Web Tool

Eligible APS customers will be able to access the new web tool by logging into their APS account online. The web tool will provide customers with information that includes the following:

- For the current billing cycle, an estimate of what the customer's bill would have been under each rate option available to that customer
- An estimate of the difference between the customer's bill under their current rate and their bill under each alternative rate
- Identification of the rate that would have minimized the customer's bill for the current billing cycle
- For each of the past 12 billing cycles[1], an estimate of what the customer's bill would have been under each rate option available to that customer
- For each of those same billing cycles, an estimate of the difference between the customer's bill under their current rate and their bill under each alternative rate
- Identification of the rate that would have minimized the customer's bill over that historical one-year period

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[1]   Or fewer, if the customer has less than 12 consecutive billing cycles of billing data.

IV. Scope of Audit

The purpose of our audit was to verify the accuracy of the web tool's historical bill calculations and the associated identification of the rate that would have minimized those historical bills, as described above. The scope of our audit consisted of the following elements, as directed by APS:

- The audit was conducted for a sample of 55,343 customers. As described later in this report, the sample was determined to be a reasonable representation of the billing conditions observed in the broader population of APS's residential customer base.

- The audit utilizes billing determinant data provided to Brattle by APS for each customer in the sample. The billing determinant data is a processed form of raw customer meter data, aggregated into the usage and demand components that are necessary to calculate bills under each available rate option.

- Our audit is designed to verify that the web tool calculates bills consistent with APS's bill calculation protocols. In other words, we have verified that the bills shown in the web tool are being calculated using the methodology that APS intended. A description of APS's intended bill calculation methodology was provided to Brattle by APS.

- A portion of APS customers (i.e., approximately 17%) will not be eligible to access the web tool. Examples of customers that are excluded from using the web tool include those on a distributed generation rider and those with billing data for fewer than three historical billing cycles. Further, there are specific customer eligibility requirements for various rate options and rate riders. Brattle relied on information from APS indicating the eligibility of each customer for the web tool as well as their enrollment in rate options and riders.

V. Methodology

The audit was designed to produce an independent replication of the web tool's bill calculations for each customer in the sample, and was organized around the following five steps:

- Step 1: Establish a representative sample of customers
- Step 2: Obtain customer data for the sample
- Step 3: Independently develop a customer bill calculator
- Step 4: Obtain APS web tool output for full sample of customers
- Step 5: Compare and reconcile APS web tool output to Brattle's independent calculations

The remainder of this section of the report describes those five steps in detail.

Step 1: Establish a representative sample of customers

In order to validate the accuracy of the web tool within a feasible timeframe and cost, the audit was conducted for a representative sample of customers. The concept of sampling is common for ensuring quality control of consumer products, among other applications. Further, sampling is regularly used by utilities in the form of load research samples, for the purposes of cost allocation, rate design, load forecasting, and other activities.

To establish the representative sample of customers, APS randomly selected 55,343 service accounts from its residential customer base.[2] Of these customers, 47,440 were initially determined by APS to be eligible for use of the web tool and had sufficient data for the purposes of our audit. Examples of reasons for web tool ineligibility include being a customer with less than three months of billing data history, being enrolled in a distributed generation rider, or being a landlord rather than a tenant.

We reviewed the dataset and confirmed that it represents a range of billing characteristics similar to those of the broader population of residential customers. First, the number of customers in the sample significantly exceeds utility industry sampling standards for load research. Specifically, a utility the size of APS would typically utilize a residential load research sample consisting of a few thousand customers. By contrast, the sample used for the audit is an order of magnitude larger.

Second, the sample and the full customer base exhibit a similar distribution of customers across rate classes. And for each of those rate classes, average customer usage in the sample is similar to that of the full residential customer base. Table 1 summarizes this comparison for the sample and the full customer base, as provided by APS.

Table 1: Comparison of Sample to Total Population

	Total Population		Sample	
	Share of total count	Avg customer kWh/month	Share of total count	Avg customer kWh/month
R-2	7%	1,202	7%	1,159
R-3	18%	1,659	14%	1,637
R-BASIC	11%	780	11%	785
R-BASICL	3%	1,438	3%	1,449
R-TOU-E	36%	1,098	36%	1,073
R-XS	25%	441	28%	445

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[2]   Specifically, account data was extracted for customers in bill cycles 15 and 16 with service account IDs less than 5000000000. APS has 19 bill cycles, which differ according to the default end date of each billing cycle. Our sample included 678 customers who had elected to select their own bill due date (a customer billing option provided by APS), which ensured that our analysis would include customers whose billing cycles spanned a broad range of billing cycle end dates. The service account ID numbers are effectively random identifiers for the purposes of this analysis.

Based on this review, we concluded that the sample is likely to represent a range of customer billing characteristics similar to those of the broader customer population, and is therefore sufficient for auditing purposes.

Step 2: Obtain customer data for the sample

APS provided Brattle with information necessary to calculate monthly bills for each applicable rate option for each eligible customer in the sample. The data was provided for the period from November 2017 into December 2019. For customers that had more than 12 billing cycles of data, the 12 most recent billing cycles were used.

APS provided monthly billing determinant data for each customer. Billing determinants are the measures of usage (kWh) and demand (kW) which, when multiplied by the various charges in the applicable rate, produce the total dollar amount billed. Examples of billing determinants provided to Brattle include monthly kWh usage, measured kW demand, and number of days in the billing period.

Additional customer information was ultimately needed to accurately calculate each customer's bill. This data included the following, which was provided by APS:

- Applicability of taxes (i.e., some customers are exempt from certain taxes)
- Rate eligibility (e.g., average monthly customer usage must be below a 600 kWh threshold level to qualify for rate schedule R-XS)
- Enrollment in low income and medical discount riders (Riders E-3 and E-4)
- Applicability of AMI opt-out fee
- Status as Partial Requirements customer (i.e., applicability of EPR-2 or EPR-6 rider) for customers with on-site distributed generation system
- Relevant city and county tax codes by customer
- Applicable bill credits for participation in APS Solar Partner, Solar Communities, and Cool Rewards programs

Additionally, APS provided Brattle with the applicable rates, taxes, adjustors, and other applicable fees necessary to calculate bills for the analysis period.

Step 3: Independently develop a customer bill calculator

Using the data provided in Step 2, we calculated monthly bills for each customer in the sample, for each applicable rate schedule. This amounted to estimates of approximately 3 million monthly bills across all customers and rate schedules. Brattle performed the analysis using Microsoft Excel and R, a free statistical software package commonly used by statisticians for analyzing large datasets.[3]

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[3]   See: https://www.r-project.org/.

Bill calculations were performed in accordance with the various protocols in APS's bill calculation methodology, as defined by APS. Examples of APS's protocols for calculating customer bills include the following:

- In the event that rates or adjustors change mid-billing cycle, APS does not pro-rate bills. Instead, the entire bill is computed using the updated rate.
- If the number of bill days is less than 25 days or greater than 35 days, APS pro-rates specific line items assuming a 30 day month. For example, if a customer on a demand rate has a bill of 20 days, their demand charge components, $/kW LFCR adjustor, and applicable fixed REAC cap will be scaled down by a factor of 20/30.
- Discounts for low income and medical discount riders (E-3 and E-4) are applied on the total pre-tax bill, excluding any AMI opt-out fee.

After calculating the monthly bills, we reproduced other specific relevant outputs that would be presented to customers in the web tool. Those outputs are described in Section II of this report and relate to identification of the rate that would have minimized each customer's bill for the relevant historical period, and a comparison of bills under that rate to bills under alternative rates.

Step 4: Obtain APS web tool output for full sample of customers

APS provided Brattle with its own calculations of the web tool output for each customer in the sample. APS's calculations were provided to Brattle in Microsoft Excel format. APS confirmed that the database of web tool output provided to Brattle is the same information that would have been presented to customers using the web tool.

Step 5: Compare and reconcile APS web tool output to Brattle's independent calculations

We compared each of Brattle's bill calculations, bill comparisons, and bill-minimizing rate identifications to those of APS for each eligible customer in the sample. We compared approximately 3 million monthly bill calculations for 47,440 customers.[4]

In cases where our calculation initially did not match that of APS, we flagged the service account ID and relevant monthly bills, and presented that information and a description of our bill calculation methodology for that service account to APS. APS then compared our calculation to theirs to identify the root cause of the discrepancy.

In most cases, the discrepancies were resolved by providing Brattle with additional relevant information that was needed to calculate bills accurately for the customer in question. For instance, in cases where customers are exempt from certain taxes, Brattle needed additional information about the specific taxes that do and do not apply to the customer. APS provided this information, and Brattle recomputed the bills and re-checked for any discrepancies.

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[4] We considered Brattle's calculated monthly bill to match that of APS if the total amounts of the two bills were within one cent of each other. Differences in rounding practices and in the precision of different software packages are likely causes of very minor differences in the bill calculations.

In some cases, discrepancies were due to a data issue that cannot be resolved in the near term. Specifically, some customers' tax codes, AMI opt-out status, and enrollment in certain rate riders (e.g., the low income discount) changed during the study period. Most of these cases were addressed by APS through a manual adjustment to the historical customer bill or account data provided to Brattle, throughout the study period. As a result, the customer's status information is correct for the purposes of calculating the customer's current bill under their current rate, but for some customers there was not enough information readily available to accurately determine what that customer's bill would have been historically under the alternative rate options.

It is important to note that this issue has not resulted in the inaccurate billing of customers. It is a temporary issue that is only related to the ability to present customers with accurate estimates of what their historical bills would have been under alternative rate options.

To address these cases, APS has informed us that it has updated its practices going forward, such that these issues will be resolved for all *future* bill calculations. However, until the *historical* bills under alternative rates are correct for customers affected by this issue, APS will make these customers ineligible for use of the web tool. To identify and treat those customers as ineligible in our audit, APS provided Brattle with service account IDs that correspond to the following conditions:[5]

- Customers whose historical bills under alternative rates were being computed assuming different status codes and flags than those that were used to compute the actual bill
- Customers that were disconnected for fewer than 5 days, but then resumed service under the same service account ID

Among customers analyzed in the sample, 1,395 customers meet the above criteria and therefore are treated as ineligible for the web tool. This is incremental to customers who are otherwise treated as ineligible for the standard reasons described earlier in this report (such as having less than three months of historical billing data). Excluding these customers brings the total number of customers analyzed in the sample to 46,045.

VI. Findings

For the remaining 46,045 eligible customers in the sample, our independent calculations have produced the same historical rate recommendations as APS for all but one of those customers. For that one remaining customer, as discussed in further detail below, we have determined that the discrepancy is due to an anomalous data issue unrelated to the accuracy of the web tool. In other

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[5] In defining these conditions to include the customers for whom there is a web tool issue, some customers with correct comparative billing calculations will also be made ineligible. The conditions have been selected as a conservative measure by APS, and customer eligibility for the web tool will increase as the data issues are resolved.

words, **we have confirmed the accuracy of the rate recommendations in APS's web tool for each eligible customer in the sample.**

Of the approximately 3 million individual monthly bill calculations for the eligible customers in the sample, there is a match for all but 378 monthly bills (i.e., 99.99% match). Those 378 monthly bills are associated with 47 customers in the sample. The cause of each of the remaining 47 customer discrepancies is known and is not due to an error in the web tool, is reported by APS to have been addressed, or otherwise has resulted in the affected customer being restricted from using the tool. A discussion of each case is provided below:

- The customer dataset provided to Brattle came from what is referred to as a "test environment," which serves as a platform for APS to conduct quality control tests. In three isolated instances, APS modified customer data in the test environment in order to conduct such quality assurance tests. As a result, those three customers' bills in the *test environment* data do not match the *actual data* that would be presented to the customer in the live web tool. For those customers, APS provided Brattle with supplemental data reflecting the actual web tool output, and Brattle has replicated this output and verified that it is accurate. Therefore, we have confirmed that this discrepancy is not attributable to inaccuracy of the web tool.[6]

- Changes to the Lost Fixed Cost Recovery Mechanism (LFCR) adjustor and certain county taxes were implemented by APS mid-month. In accounting for this mid-month change, the web tool uses a different approach when calculating some customers' actual bills versus when calculating what their bills would have been under alternative rates. This inconsistency results in incorrect alternative bill calculations for 28 customers in the sample in the relevant historical month. The average bill discrepancy for these customers is 0.7%. The discrepancy is too small to affect the rate recommendations for those 28 customers in the sample, though additional customers in the broader population will also be affected by this discrepancy. To address this issue, APS has reported that it will identify any customer in the total population for which the rate recommendation is affected by this discrepancy, and make those customers ineligible for use of the tool until the issue can be resolved. Additionally, it is important to note that this issue has not resulted in the incorrect billing of any customers; it only relates to the web tool's calculation of what customer bills otherwise would have been under alternative rate options.

- Some customers have selected the date on which they want their bill to be due (APS's "Preferred Due Date" option). Under specific circumstances, this resulted in the web tool utilizing rates that were applicable in the month proceeding or following the selected due date when calculating bills under alternative rate options. This issue affected the remaining

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[6] As referenced above, we identified one customer for which there was a discrepancy in the rate recommendation due to an anomalous data issue. That customer is included in this category of issues with the test environment data. We have determined that customer's rate recommendation in the actual web tool output is accurate.

16 customers in the sample for whom we identified a monthly bill discrepancy, though the impact is too small to affect their rate recommendation (4% on average). As with the mid-month charge adjustment issue described above, APS has reported that it will identify any customer in the total population for which the rate recommendation is affected by this discrepancy, and make those customers ineligible for use of the tool until the issue can be resolved. Similarly, this issue has not resulted in the incorrect billing of any customers.

In summary, Table 2 briefly describes how the full sample of 55,343 customers is allocated across the various customer categories discussed in this report.

Table 2: Audit Summary

Number of customers	Description of customer category	Resolution for full-scale rollout
45,998	Web tool output fully reconciled	N/A
7,903	Standard ineligibility reasons or insufficient data (e.g., less than 3 months of billing history)	Restrict eligibility for all customers with these characteristics
1,395	Comparative bill calculations cannot yet be verified due to data limitations	Restrict eligibility for all customers with these characteristics
28	Discrepancy in alternative bills due to inconsistent treatment of charges which change mid-month for some customers	Restrict eligibiltity if rate recommendation is impacted
16	Discrepancy in alternative bills related to bill cycle timing for some Preferred Due Date customers	Restrict eligibiltity if rate recommendation is impacted
3	Discrepancy with test environment data, but no error in web tool	N/A
55,343	**Total sample**	

Based on our audit, APS's new web tool is accomplishing the company's intended objective of providing customers with accurate information about the rates that would have minimized their bills based on historical usage patterns. We have not identified any errors in the web tool's bill calculations that would result in customers being given misleading information.

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