SAS® GLOBAL FORUM 2018

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#SASGF

Improving Financial Reporting Accuracy Using Smart Meter data

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Introduction: What is Unbilled Usage

➢ Utilities typically bill their customers based on the usage during the respective customers' billing cycle. The start and stop date for a billing cycle may not coincide with that of a calendar month. As a result, the utility has to estimate the customer usage during the portion of the calendar month that has not been billed yet, but appears as goods sold in the utility's financial books. This is defined as "Unbilled Usage."

➢ Traditionally utilities have relied upon either regression model-based approach or "Prior Unbilled" (or, Carry Forward) method to estimate the current month's unbilled usage and revenue. These methods also uses loss estimates for the purpose of calibration. All these may result in erroneous financial entry.

➢ Automated Metering Infrastructure (AMI) or Automated Meter Reads (AMR) is able to provide daily or hourly consumption data enabling utilities accurately calculate the unbilled usage rather than estimating it. The daily or interval meter readings need to be validated and edited for erroneous data.

➢ This poster proposes an analytical framework to validate, and edit daily meter readings and calculate calendar and unbilled energy consumption and corresponding revenue. Results are presented using SAS VA.
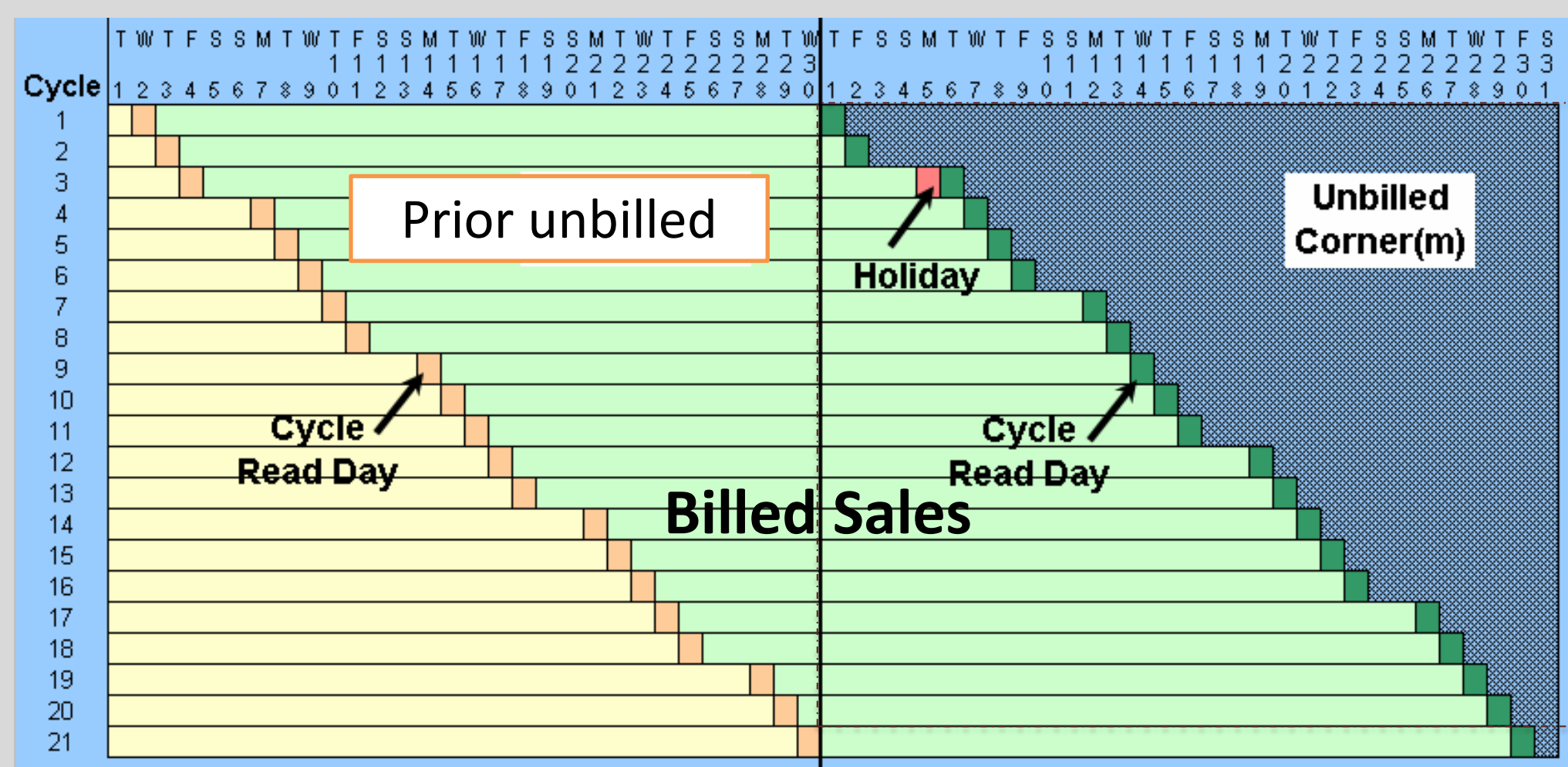

Figure 1: Geometry of Unbilled Usage (Ref 1, 2)

Daily Consumption Data from AMR/AMI

➢ AMR (Automated Metering Reading) provides daily usage for each customer while AMI (Automated Metering Infrastructure) is capable of providing interval (e.g.: 15 minute/hourly) usage for the customer.

  ➢ However, its unrealistic to assume 100% accurate readings for millions of customers everyday. Its possible for AMR or AMI to collect erroneous data (Figure 2).

  ➢ The data used in the final analysis should be "billing quality data" since the analysis impacts financial report.

➢ Ameren Missouri collects one "billing quality" meter reads every month for customers who are not billed based on interval usage and hence AMR data for those customers are not validated and edited for billing purpose.

  ➢ Daily AMR data should be validated and edited if necessary, prior to being used in financial reporting.
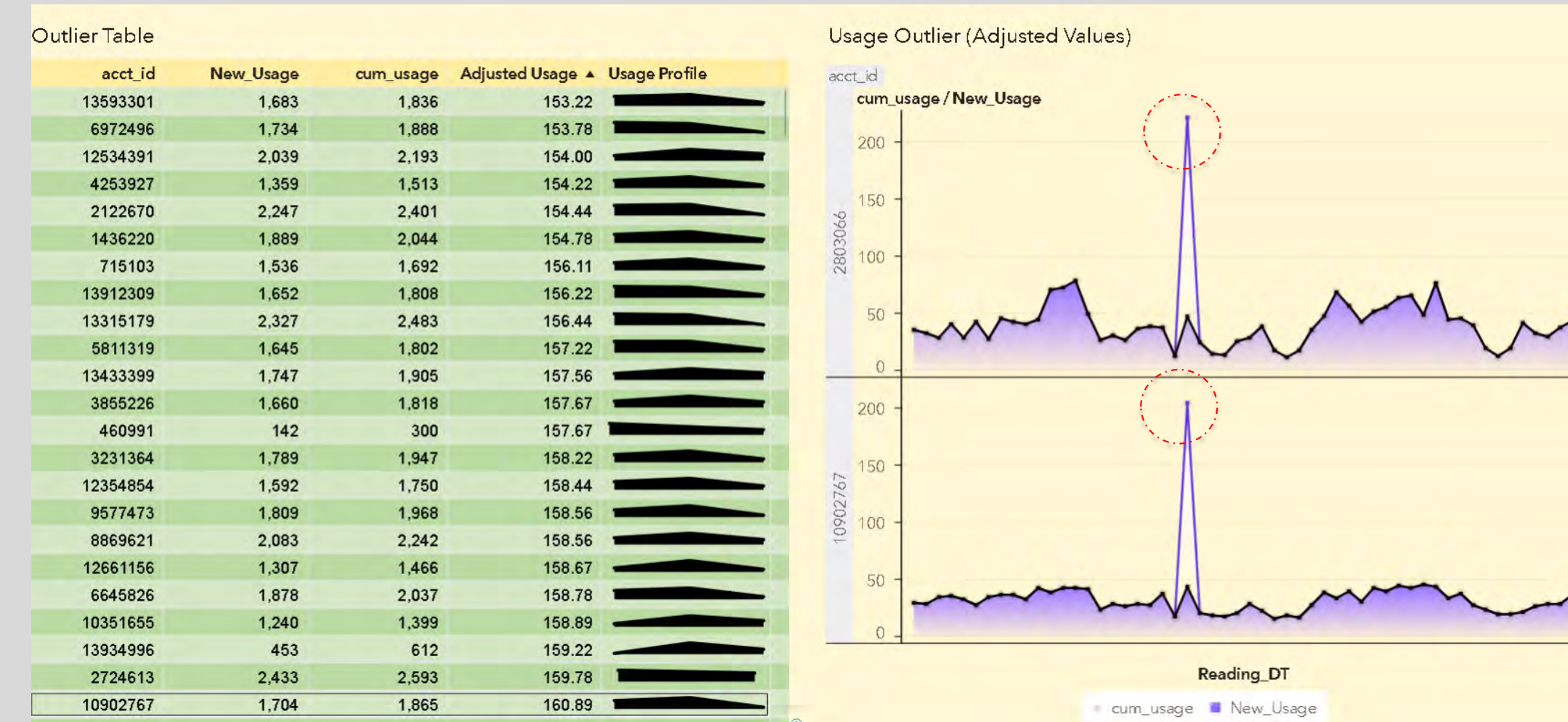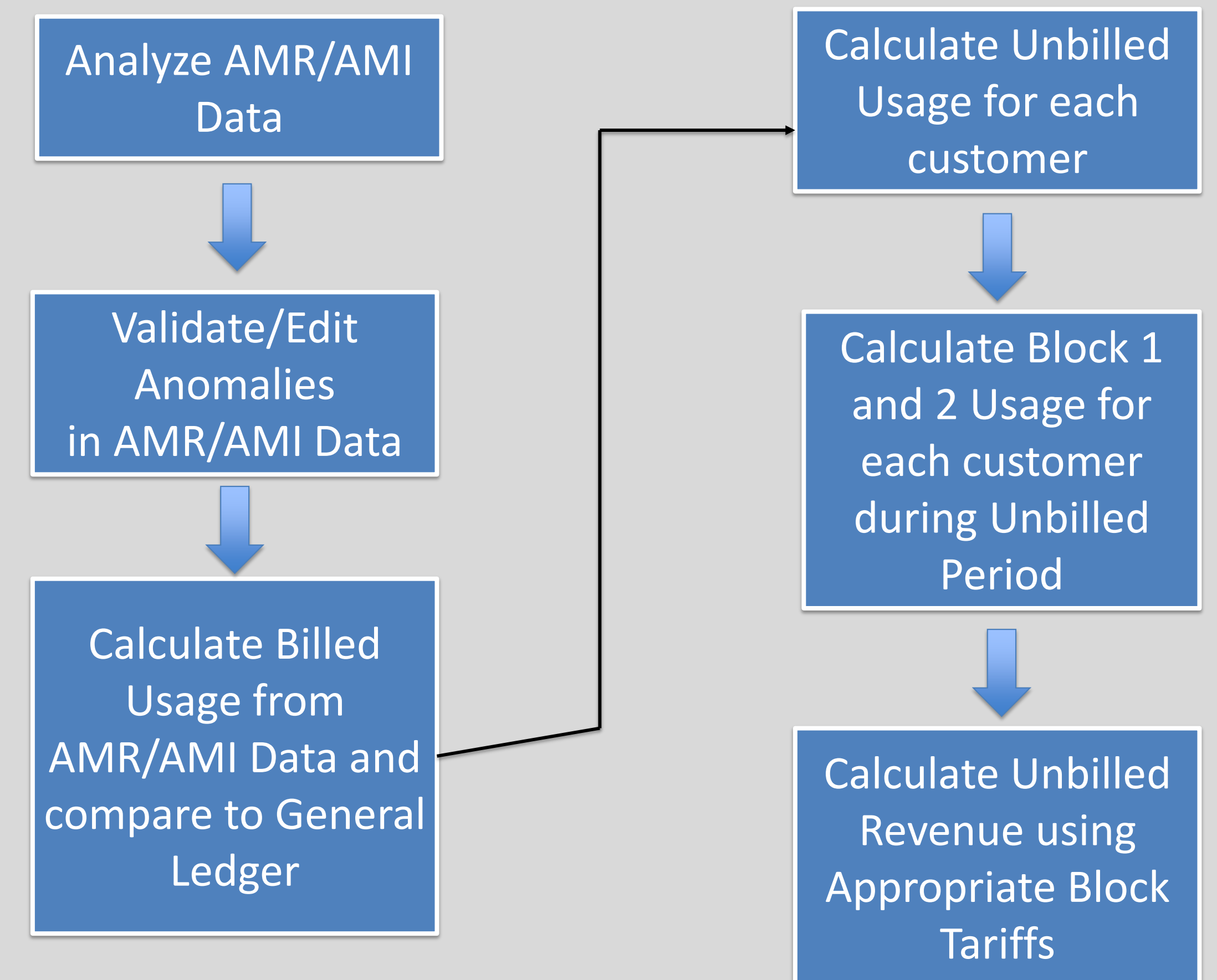

Figure 2: Analyzing Daily AMR Data (Dashboards in SAS VA)

Proposed Analytical Framework

```
Analyze AMR/AMI Data
        ↓
Validate/Edit Anomalies in AMR/AMI Data
        ↓
Calculate Billed Usage from AMR/AMI Data and compare to General Ledger
        →
Calculate Unbilled Usage for each customer
        ↓
Calculate Block 1 and 2 Usage for each customer during Unbilled Period
        ↓
Calculate Unbilled Revenue using Appropriate Block Tariffs
```

Validation Rules/Tests

➢ **Rule # 1: Energy Test**: Sum of daily AMR consumption during billing window for the customer should equal to actual billed energy for the period
  ❖ No further test is required, if Rule # 1 is validated

➢ **If Rule # 1 Fails:**
  ➢ **Rule # 2:** No negative daily reading unless the customer is a "net meter" customer
  ➢ **Rule # 3:** No zero usage, unless outage flags exist for the customer
  ➢ **Rule #4 :** Daily energy Spike or Dip > 50% based on Moving Average over four days prior and four days after

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PROC Expand to Edit Errenous AMR Reads

➤ PROC EXPAND is used to edit erroneous data (spikes/dips/missing values in AMR readings)

```
proc expand data=billing.billingdailyinput out=Billing.Usage
method=none;
   id Reading_DT;
   by acct_id;
    convert cum_usage = CMA   / transform=(cmovave 9);
run;
PROC SQL;
   CREATE TABLE BILLING.USAGEMA_EVT AS
   SELECT t1.acct_id,
        t1.Reading_DT,
        /* New_Usage */
         (CASE
            WHEN t1.CMA / t1.cum_usage < .5 and t1.cum_usage > 50
            THEN t1.CMA
            ELSE  t1.cum_usage
          END) FORMAT=COMMA6. AS New_Usage,
        t1.cum_usage,
        t1.CMA FORMAT=COMMA6. AS CMA,
        /* BillEvent */
         (CASE
/*find running average spikes */
            WHEN t1.CMA / t1.cum_usage < .5 and t1.cum_usage > 50
            THEN 1
            ELSE  0
          END) AS BillEvent
    FROM BILLING.USAGEMA t1
    WHERE (CALCULATED New_Usage) NOT IS MISSING;
QUIT;
```
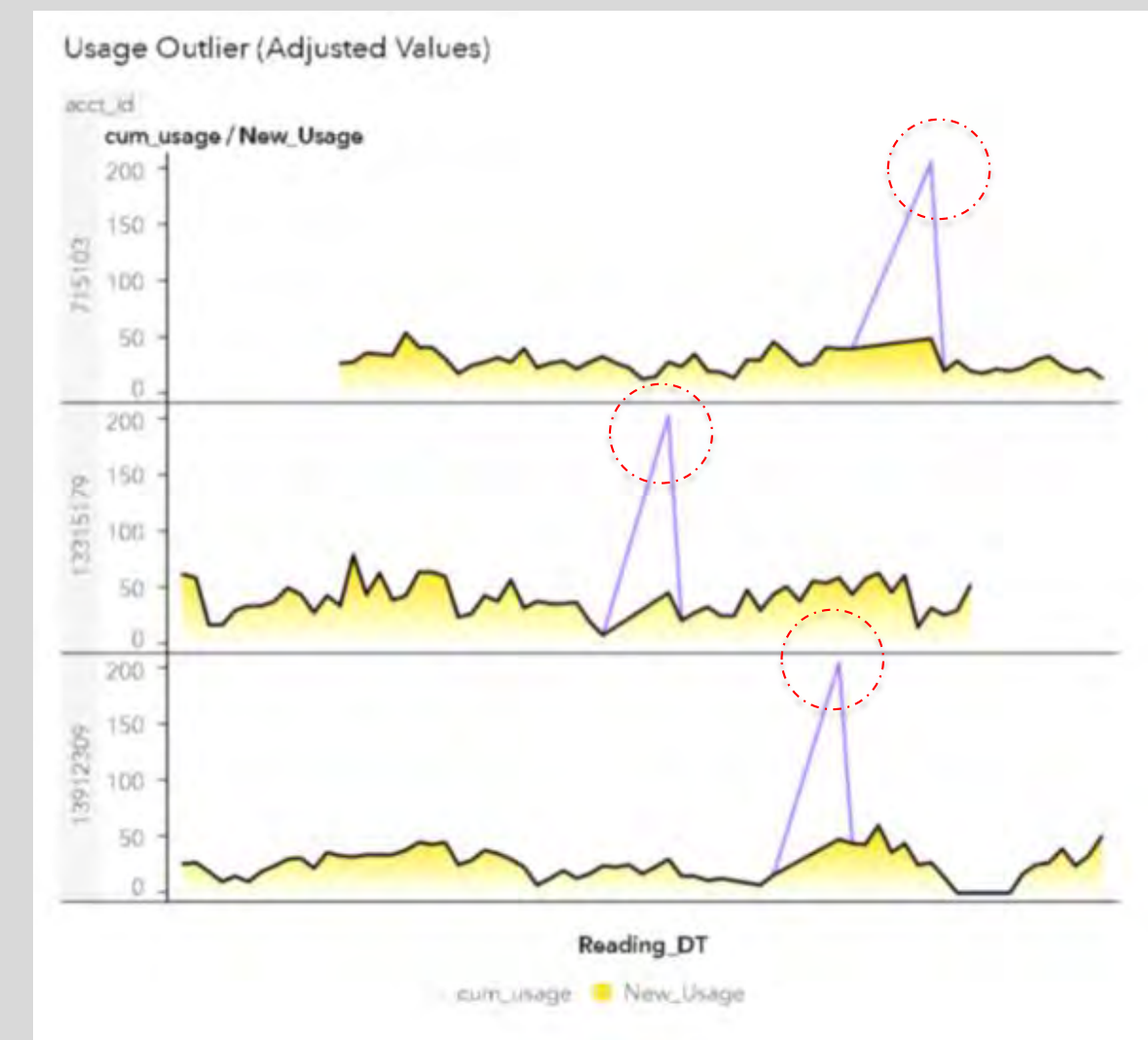
Validation and Editing AMR for Anomalies

Figure 3: Editing Spikes
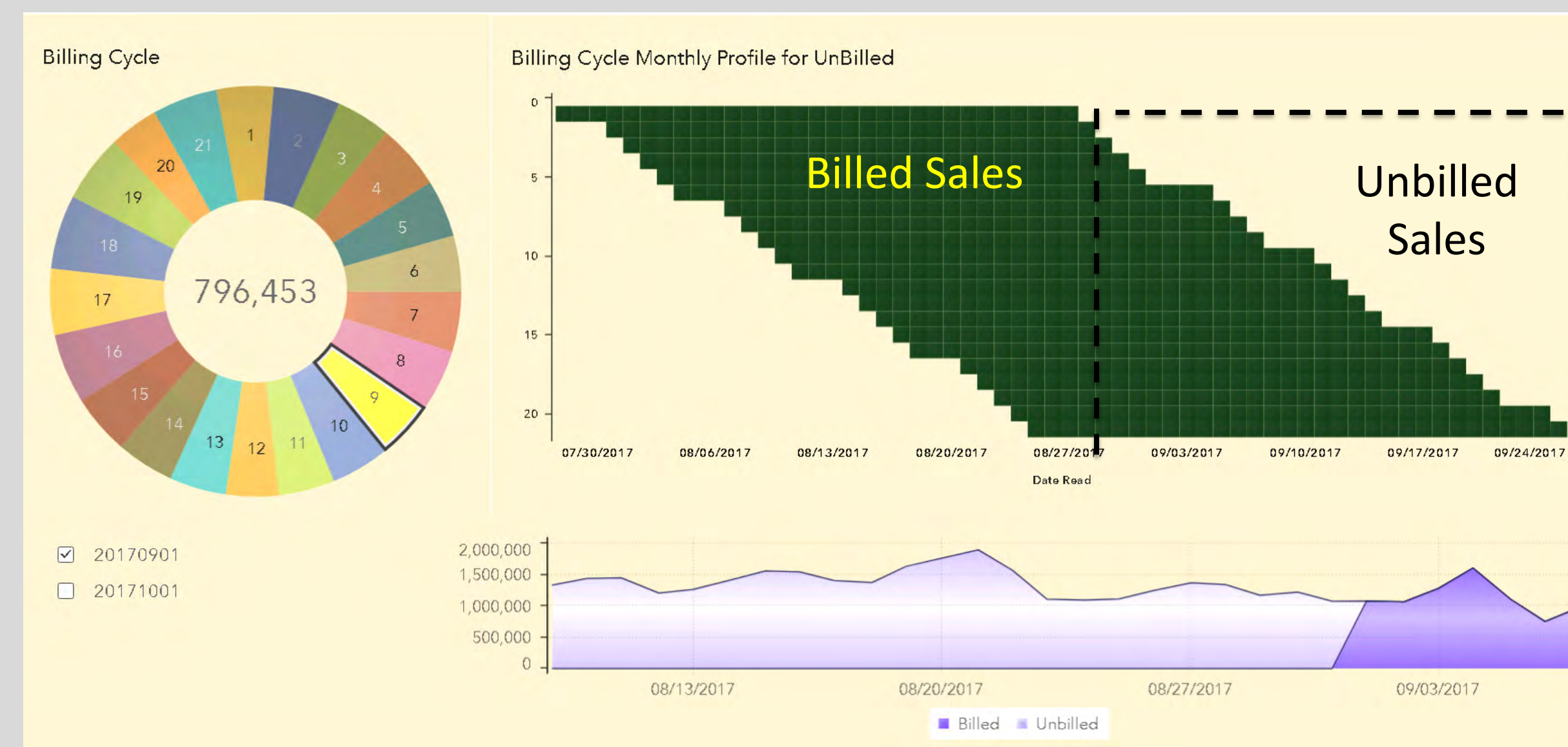
Calculating Unbilled Usage and Revenue

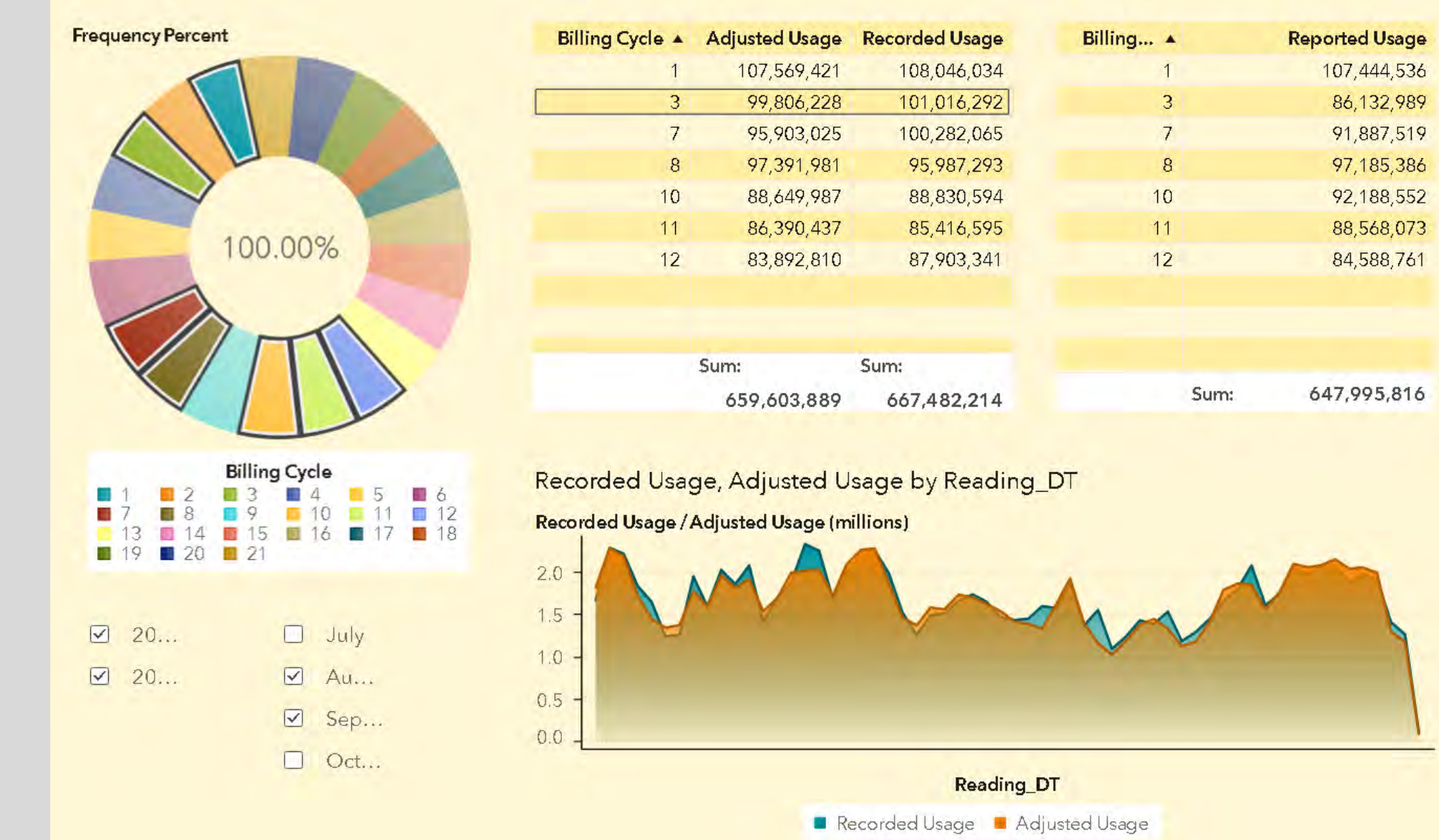**Figure 4: SAS VA Dashboard for Calendar, Billed, Unbilled Sales by Billing Cycle**

Figure 5: Comparing results from PROC EXPAND

➤ Balancing to the reported usage compared to the recorded AMR data. Figure 5 displays the results from using PROC EXPAND to overwrite outliers. Reported Usage from billing is compared to the Recorded Usage from AMR.

Conclusion

➤ Since financial reporting requires accurate and consistent methods for estimating revenue, utilities should consider using daily consumption data from AMI or AMR.

➤ AMI or AMR doesn't only provide accurate usage estimation, but also provide better estimate of realized price and unbilled revenue

References

1. Dr J Stuart McMenamin, "Using Models to Estimate Unbilled Energy", Itron Inc White Paper, 2005
2. Dr J Stuart McMenamin, "Modeling and Accounting Methods for Estimating Unbilled Energy", Itron Inc White Paper

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