Process

The current Lag Study is based on analysis of South Dakota electric jurisdiction twelve-months ended December 2023 revenue receipts. The revenue lag analysis was calculated based on a census of the total population of billing records information available for each rate group. The census contained all the customers and all revenue with metered consumption or lighting loads in that rate class.

1. Select and aggregate the population census customers (debtor number) records for each customer rate class. The South Dakota lag study's debtor number records list is based on the total unique records population for the twelve months ended December 2023 as a "census" of the rate codes. No rate code records are sampled in the analysis.

2. Send census debtor accounts to IT to extract all billing and payment records for the test year data.

3. Include all premises as a census of each rate class.

4. Restrict data to non-reversed invoices with amounts>$0.

5. Match the payment records with the billing records based on the debtor number, premise number and service number.

6. Determine the rate of each invoice:
   a. For non-metered classes, use the tariff from the invoice.
   b. For metered classes, determine the rate group from the population data (table "Rates" and relate to the invoice data by debtor (account), premise and service numbers.

7. Calculate lag days for each invoice:
   a. Calculate service days and midpoint date.
   b. Relate payment and transaction data to invoices. Calculate lag days for each invoice and the payment weight of each invoice.
   c. Calculate the weighted lag days for each invoice by applying the payment weight to the lag days of each payment/transaction.
   d. Sum weighted lag days for each invoice.
   e. Adjust lag days for any invoices that were not paid in full, using the date of the CRS data extraction as the date that the remaining invoice amount was paid.

8. Invoices with an Account Status Code equal to 4 or higher (which indicates the balance is "In Receivership or Bankrupt", "To be Written Off", or "Has been Written Off") were excluded from the analysis.

9. Calculate results:
   a. Calculate mean lag days and variance by rate group.
   b. Apply percent revenue weight to rate group average and variance and total across all rate classes.

Analysis Calculations

Lag days for each revenue invoice are calculated by first determining the lag days for each payment using the following equations:

$$ServiceDays_i = InvoiceToDate_i - InvoiceFromDate_i + 1$$
$$MidptDate_i = InvoiceFromDate_i + ServiceDays_i / 2$$
$$LagDays_{i,j} = PaymentDate_{i,j} - MidptDate_i + 0.5$$

where *i* denotes the invoice and *j* the payment applied to the invoice.

Since multiple payments and transactions can occur for each invoice, the lag days for each payment are then weighted by the payment amount, such that

$$LagDays_i = \frac{p_{i,j}}{q_i} LagDays_{i,j}$$

where

$p_{i,j}$ = payment *j* for invoice

q_i = invoice amount for invoice *i*

If any payments were not paid in full, then the date the data extraction was performed (4/5/2025) is used as the payment date for any remaining balance on the invoice, such that

$$LagDaysTotal_i = \frac{p_{i,j}}{q_i} LagDays_{i,j} + (1 - \frac{p_{i,j}}{q_i})(4/5/2022) - MidptDate_i + 0.5)$$

Once the lag days for each invoice have been determined, the estimate of the stratified mean lag days can then be calculated as

$$\bar{x}_{st} = W_h \bar{x}_h$$

where

W_h = rate group revenue stated as a percent of total revenue across all rate groups

$\bar{x}_h$ = mean lag days by rate group

The variance of the stratified estimate of the mean lag days is

$$v(\bar{x}_{st}) = \sum_h W_h^2 \frac{s_h^2}{n_h}$$

where

s_h^2 = variance of the mean lag days by rate group

n_h = rate group size (invoices)

Census sizes by rate group are shown in Table 1.

Table 1. Electric Retail Revenue Lag Population Statistics by Rate Class

Rate Code	Rate Description	Total Revenues	% Total Revenues	Average Lag Days	Weighted Average Lag Days	Number Invoices
E01	Residential Service (Overhead)	$51,894,760	19.37%	25.3098	4.9034	542,508
E02	Residential Time of Day Service (Overhead)	$15,115	0.01%	35.3666	0.0020	109
E03	Residential Service (Underground)	$68,052,336	25.41%	32.2469	8.1925	494,627
E04	Residential Time of Day Service (Underground)	$23,755	0.01%	32.4584	0.0029	143
E06	Residential Heat Pump Service (Two Meter Rate)	$168,751	0.06%	33.7475	0.0213	889
E10	Energy Controlled Service (Non-Demand Metered)	$110,499	0.04%	34.2463	0.0141	817
E11	Limited Off Peak Service	$33,306	0.01%	31.7363	0.0039	21
E12	Automatic Protective Lighting Service	$486,087	0.18%	26.7016	0.0485	6,983
E13	Small General Service	$11,301,774	4.22%	33.9995	1.4345	78,597
E14	Small General Time of Day Service (Metered)	$349,076	0.13%	39.0143	0.0508	4,190
E15	General Service	$78,158,675	29.18%	37.1842	10.8498	40,408
E16	General Time of Day Service	$42,237,272	15.77%	37.0014	5.8345	2,430
E20	Peak Controlled Service	$6,694,919	2.50%	37.8525	0.9461	621
E21	Peak Controlled Time of Day Service	$5,019,897	1.87%	37.7504	0.7075	131
E22	Energy Controlled Service	$1,458,828	0.54%	36.2456	0.1974	71
E30	Street Lighting System Service	$1,015,115	0.38%	30.2884	0.1148	774
E31	Street Lighting Energy Service	$233,024	0.09%	14.4589	0.0126	72
E32	Street Lighting Energy Service - Metered	$553,779	0.21%	38.3750	0.0793	3,715
E33	Street Lighting - Ornamental - Metered Energy Only	$52,289	0.02%	31.7476	0.0062	1,062
E40	Fire and Civil Defense Siren Service	$3,785	0.00%	NA	NA	NA
Total		**$267,863,040**	**100.00%**		**33.42**	**1,178,168**