

Appendix A: Analysis of Rate Design Options

Data Collection and Compilation

The rate-impact analysis in this section was developed using one year's worth of hourly consumption data that was provided by the Coalition of Large Distributors (CLD). There are approximately 103 thousand commercial and industrial customers within the rate design sample with a majority of the sample (~94%) consisting of general service with less than 50kW of demand (GS<50) customers. A breakdown of the number of customers by class is available in Table 1 below:

Table 1: Breakdown of Number of Customers within the OEB's Rate Design Sample

Customer Class	Number of Customers in the Sample	Number of Customers in the Population
General Service Less than 50kW	97,013	430,842
General Service Greater than 50kW	5,525	54,688
Intermediate User	257	
Large User	78	117
Total Customers	102,873	485,647

All the data that was provided to the OEB was checked to ensure that customers had the appropriate number of hourly counts for the year and those counts were properly allocated within each month of the year. Customers that did not have an appropriate number of counts were either corrected through consultation with technical staff at the LDC level or removed from the analysis.

It is also worth noting that in order to guarantee the anonymity of the large customers in the sample, all the customers were compiled into a single sample and sent to the OEB. Charges and rates were constructed for this sample by taking an average of the status quo charges and rates for all the distributors that were able to provide the OEB with data.

Explanation of Status Quo and New Rate Design Calculations

Post data-cleaning, calculating status quo¹ and new rates can be broken down into the following steps for each of the hourly consumption samples distributors provided to the OEB.

Construction of status quo distribution revenue requirement:

1. Each customer's monthly consumption or demand (depending on class) is determined and then averaged over the year which is equivalent to 12 bills.
2. Each customer's average demand or consumption is used to calculate their status quo distribution bill
3. Each customer's bill is summed to come up with what a distributor would have collected under status quo rates (necessary for revenue neutrality in new rate designs)

Construction of new distribution rates for each of the options:

Option 1: Fully Fixed Charge

Fully fixed charge is each distributor's in-sample distribution revenue divided by the number of customers within the sample.

Option 2: Time of Use Energy Rate

Prior to calculating an off-and-on-peak rate each customer's consumption in the off-and-on-peak times² has to be collected and averaged over the year.

In this option the off-peak charge was set as each distributor's current variable rate divided by an adjustment factor (typically the factor was three). Off-peak revenue was then generated by multiplying the sum of the off-peak consumption in each distributor's sample by the off-peak rate.

An on-peak rate was created by subtracting each distributor's off-peak revenue from their status quo revenue and dividing by total on-peak consumption within each distributor's sample.

Option 3: Energy Usage Blocks (Cell phone plan)

Under this option, each distributor's customer sample is broken down into percentiles based on their on-peak consumption and then separated into five blocks. Fixed charges

¹ The status quo charges and rates used throughout the analysis section are taken from each distributor's most recent cost allocation model.

² Under options 2 to 5 on-peak refers to the 7am-7pm period, whereas under options 6b and 7b the on-peak period is from 3pm to 9pm.

are created within each block by allocating the amount of revenue generated within each block under status quo rates and dividing by the number of customers within that block. Charges are then allocated to customers conditional on what block they fall within.

It's worth noting that this option is difficult to model as customers are placed into groups that they should be placed within and not what they would place themselves into. This option inherently relies on customer choice but the impacts can only represent what would happen if customers were placed within a specific group and did not allow them to change their consumption afterwards.

Option 4: Minimum Bill

Each distributor's class-specific sample is broken down by percentile based on their average monthly consumption or demand and a percentile cut-off was set for all the customers who are subject to the minimum bill.

The customers subject to the minimum bill are all charged what the customer at the cut-off would be charged under the new minimum bill rate. The remaining customers are charged the variable rate.

Option 5: Three Part Demand Rate

Under this option customers are identified as either "peaking" or "non-peaking" depending on whether their maximum demand in the coincident period is greater than or equal to their maximum demand in the any-time period (for option 6a the coincident period is 7am to 7pm and for option 6b it is from 3pm to 9pm, any-time period refers to any hour in the day).

Once customers have been allocated into groups a non-peaking rate is formed by taking the difference of a distributor's status quo revenue and its new fixed revenue and then dividing this difference by the total anytime demand in the sample and an adjustment factor. A distributor's non-peak revenue is then the sum of the non-peak rate multiplied by the sum of each non-peaking customer's any-time demand and each peaking customer's coincident demand.

A peaking rate is then constructed by subtracting the non-peaking and new fixed distributor revenue from the status quo distributor revenue and dividing this remaining distributor revenue by the sum of each peaking customer's coincident demand.

In order to account for potential gaming between moving up from the GS>50 regular to intermediate class and incurring significant bill savings, a new fixed charge had to be created for each intermediate class that was not the Minimums System with PLCC adjustment charge. The new intermediate fixed charge is the difference between a

customer's bill had they been one KW below the regular-intermediate boundary and one KW above.

The intermediate classes block rates are then re-calculated in order to maintain revenue-neutrality due to the fixed revenue generated by the new charge.

Option 6: Time-of-Use Demand Rate

This rate design option groups customers into two groups, depending on whether their average monthly maximum on-peak demand is greater than or equal to their average monthly maximum off-peak demand (option a) or simply sets the off-peak rate equal to zero (option b) and customers are charged only their average monthly on-peak maximum demand.

Option A:

Once customers have been grouped, an off-peak rate is calculated as the difference of total status quo distribution revenue and fixed distribution revenue using the minimum system charge with PLCC adjustment. This difference is then divided by the total average monthly maximum demand and an adjustment factor. Off-peak revenue is the sum of the off-peak rate multiplied by the total average monthly off-peak maximum demand for the sample.

An on-peak rate is developed similarly to the off-peak rate, except that the off-peak revenue that was generated previously is subtracted from the total status quo distribution revenue in addition to the fixed distribution revenue using the minimum system charge with PLCC adjustment. This difference is then divided by the sum of the total average monthly on-peak maximum demand and the average monthly off-peak maximum demand for customers whose on-peak maximum demand is greater than their off-peak maximum demand. Customer's whose on-peak maximum is greater than their off-peak maximum are charged the on-peak rate for both sets of demand, customer's whose off-peak is greater are charged the on-peak rate for their on-peak demand and the off-peak rate for their off-peak demand.

Option B:

Customers under this option are subject to an on-peak rate that is the difference of the total status quo distribution revenue and the new fixed distribution revenue using the minimum system charge with PLCC adjustment. This difference is then divided by the total average monthly on-peak maximum demand. Customers are

then charged the on-peak rate multiplied by their on-peak demand plus the minimum system PLCC adjusted charge³.

New Rate Design Option Impacts

All impacts discussed in the staff discussion paper are presented below; each class-option combination has two figures showing the bill impact on customers in percentage terms (LHS) and then the bill impacts on customers in dollars (RHS). The table below each set of figures contains information on the status quo charges and rates used in the analysis and the new charges and rates developed under that class-option combination.

³ This is the case for all the distributors except for Enersource Hydro Mississauga Inc. whose intermediate customers are charged a significantly higher fixed charge due to the difference between the minimum system with PLCC adjustment charge between GS>50 regular and intermediate customers being too small and opens up the possibility for subclass boundary issues.

D. GENERAL SERVICE UNDER 50 KW OF DEMAND

D.1 – Option 1: Fully Fixed Charge

Under this option customers are subject to a fully fixed charge per month.

Observations:

- 23% of customers within the sample see a bill decrease and 77% see a bill increase
- Approximately 95% of the sample is contained within the [-200,200] bill difference range

Figure D.1

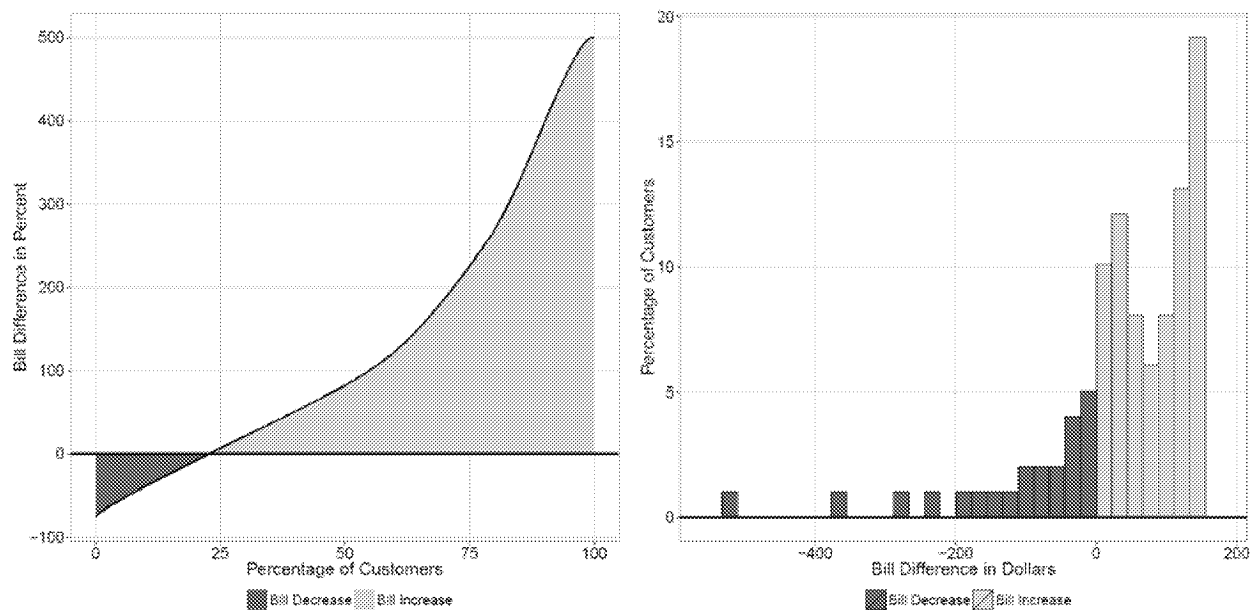


Table D.1: Current and New Distribution Charges and Rates Under Under Option 1

		Current:		New:
		Fixed Charge (\$/month)	Variable Rate (\$/kWh)	Fixed Charge (\$/month)
PowerStream		26.08	.0139	60.76
Hydro One:	Gse	30.08	.053	180.66
	Uge	23.15	.024	83.06

D.2 – Option 2: Time of Use Energy Rate

Under this option customers are subject to a time of use energy rate that takes the form:

$$\text{Bill} = \text{Fixed Charge} + \text{Off-Peak Rate} * \text{Off-Peak kWh} + \text{On-Peak Rate} * \text{On-Peak kWh}$$

Observations:

- 48% of customers within the sample see a bill decrease and 52% see a bill increase
- Approximately 96% of the sample is contained within the [-50, 50] bill difference range

Figure D.2

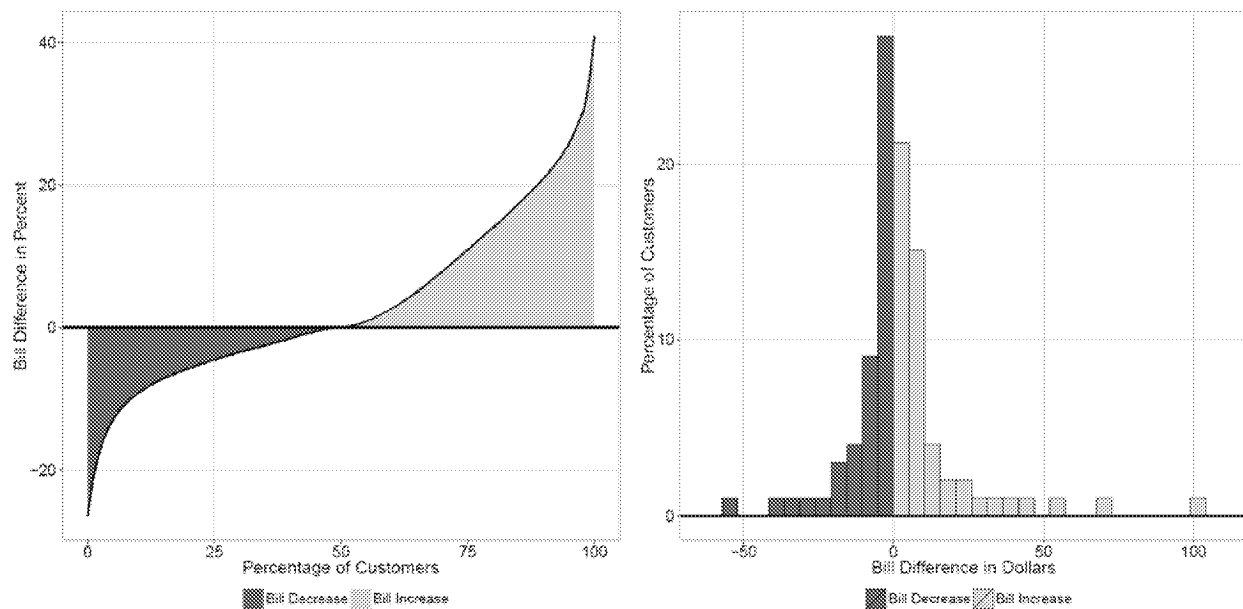


Table D.2: Current and New Distribution Charges and Rates Under Option 2

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kWh)	Fixed Charge (\$/month)	Off-Peak Rate (\$/kWh)	On-Peak Rate (\$/kWh)
PowerStream		26.08	.0139	33.66	.00463	.0347
Hydro One:	Gse	30.08	.053	30.0913	.0179	.2147
	Uge	23.15	.024	"	.008	.0735

D.3 – Option 3: Energy Usage Blocks

Under this option customers are able to choose from a set of plans that require the customer to maintain their consumption below a certain threshold. Each plan would increase in price (a fixed amount or charge each month), but also increase the amount a customer could consume within a given month. If a customer opted into a certain plan and went over their prescribed limit they would be subject to a hefty overage rate for each additional kWh they consumed. Formally, this option takes the following form for each plan i :

$$\text{Bill} = \begin{cases} \text{Fixed Charge}_i & , \text{Lower Boundary kWh}_i \leq \text{Monthly kWh} < \text{Upper Boundary kWh}_i \\ \text{Fixed Charge}_i + \text{Overage Rate}_i, & \text{Monthly kWh} \geq \text{Upper Boundary kWh}_i \end{cases}$$

Observations:

- 68% of customers within the sample see a bill decrease and 32% see a bill increase
- Approximately 90% of the sample is contained within the [-100,100] bill difference range

Figure D.3

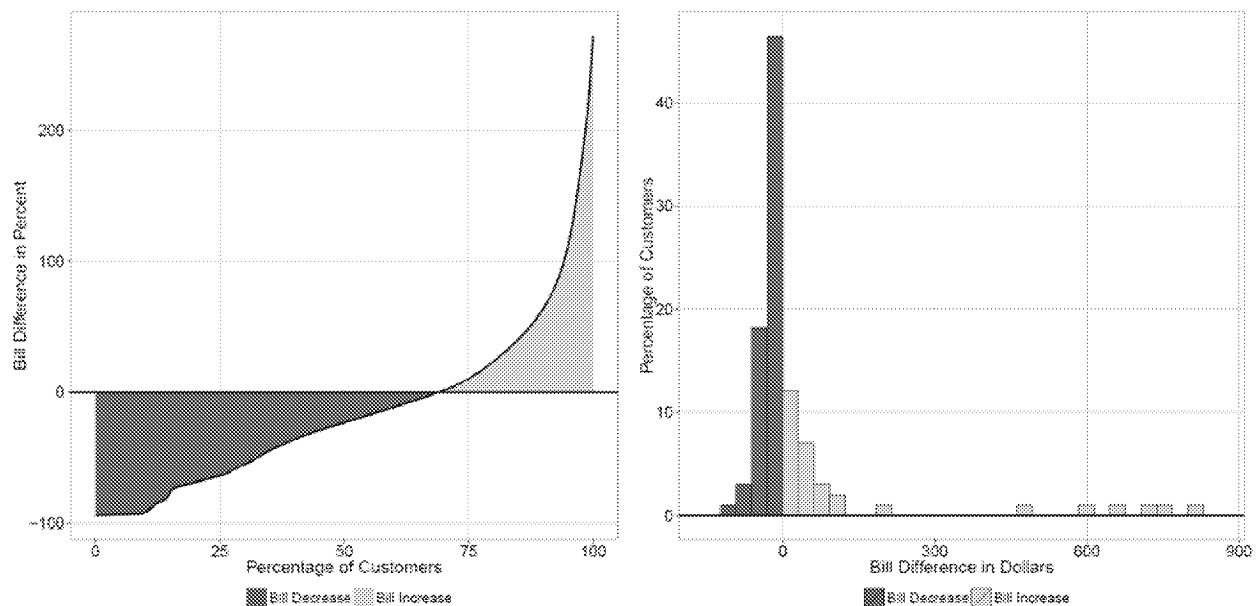


Table D.3: Current and New Distribution Charges and Rates Under Option 3

		Current:		New:				
		Fixed Charge (\$/month)	Variable Rate (\$/kWh)	First Block Charge (\$/month)	Second	Third	Fourth	Fifth
PowerStream		26.08	.0139	4.85	14.96	35.98	90.3	226.13
Hydro One:	Gse	30.08	.053	2.11	13.48	55.87	193.26	1,104.5
	Uge	23.15	.024	2.72	12.81	41.6	119.11	363.76

D.4 – Option 5: Minimum Bill

Under this option customers are subject to a fixed minimum bill charge conditional on their being below a distributor-specific consumption threshold, otherwise customers are subject to a fully variable rate. This charge takes the functional form:

$$Bill = \begin{cases} \text{Minimum Bill Charge,} & \text{Monthly kWh} < \text{Threshold} \\ \text{Minimum Bill Rate} * \text{Monthly kWh,} & \text{Monthly kWh} \geq \text{Threshold} \end{cases}$$

Observations:

- 23% of customers within the sample see a bill decrease and 77% see a bill increase
- Approximately 95% of the sample is contained within the [-50, 50] bill difference range

Figure D.4

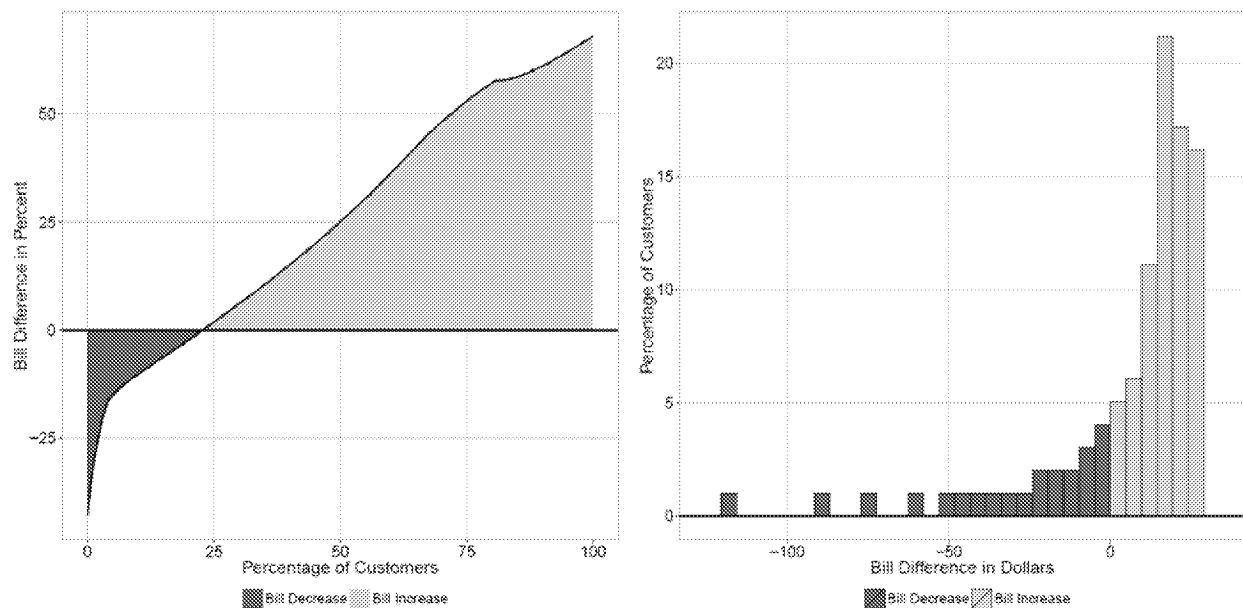


Table D.4: Current and New Distribution Charges and Rates Under Option 5

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kWh)	Minimum Bill Cut-Off (kWh/month)	Minimum Bill (\$/month)	Variable Rate (\$/kWh)
PowerStream		26.08	.0139	584.5	14.23	.0243
Hydro One:	Gse	30.08	.053	196.7	12.69	.0645
	Uge	23.15	.024	365.2	12.15	.0332

E – General Service Over 50 kW

E.1 – Option 5: Minimum bill

Observations:

- 38% of customers within the sample see a bill decrease and 62% see a bill increase
- Approximately 96% of the sample is contained within the [-400,200] bill difference range

Figure E.1

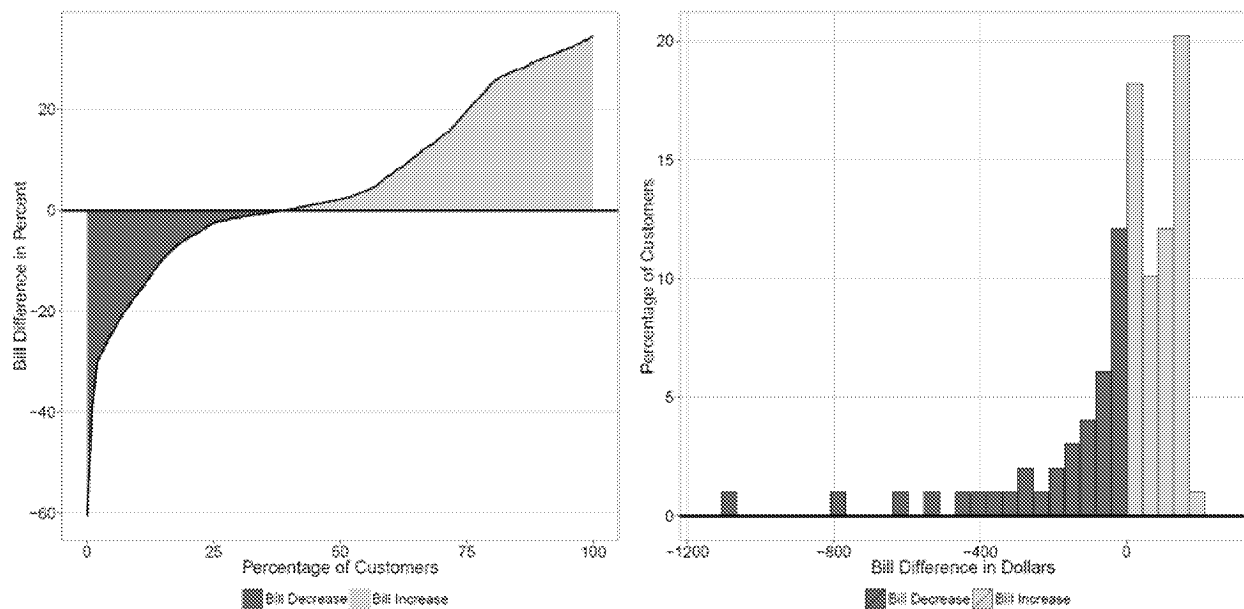


Table E.1: Current and New Distribution Rates Under Option 5

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Minimum Bill Cut Off (kW/month)	Minimum Bill (\$/month)	Variable Rate (\$/kW)
PowerStream		138.48	3.327	155.96	556.03	3.565
Hydro One:	Gsd	83.96	13.72	98.48	1,390.92	14.123
	Ugd	85.01	7.85	105.39	870.35	8.258
Enersource		69.86	4.31	168.05	765.97	4.558
Hydro Ottawa		260.82	3.56	66.27	323.66	4.884
Veridian		103.06	3.18	103	362.09	3.515
Horizon		358.02	2.43	69.26	265	3.825

E.2 – Option 5: Three part demand rate

Under this option customers are subject to a three part demand rate that charges customers more if their monthly on-peak demand is greater than or equal to their monthly any-time demand:

$$Bill = \begin{cases} Fixed\ Charge + Non\ Peak\ Rate * Non\ Peak\ kW + \\ Peak\ Rate * On\ Peak\ kW, & Peak\ kW < Any\ Time\ kW \\ Fixed\ Charge + Peak\ kW * (Non\ Peak\ Rate + Peak\ Rate) \\ , & Peak\ kW \geq Any\ Time\ kW \end{cases}$$

Option 5a - A broad peak coincident with transmission peak

Observations:

- 54% of customers within the sample see a bill decrease and 46% see a bill increase
- Approximately 94% of the sample is contained within the [-250,250] bill difference range

Figure E.3a

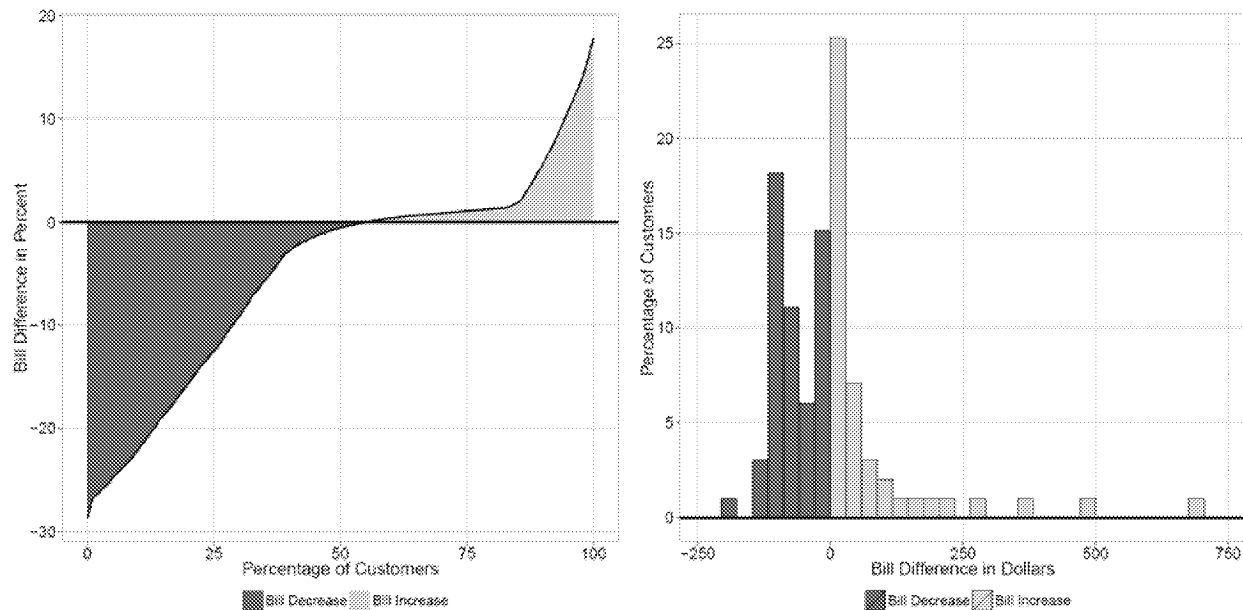


Table E.3a: Current and New Distribution Rates Under Option 5a

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Non-Peak Rate (\$/kW)	Peak Rate (\$/kW)
PowerStream		138.48	3.327	125.05	1.12	2.26
Hydro One:	Gsd	83.96	13.72	81.19	4.58	9.34
	Ugd	85.01	7.85	84.53	2.62	5.3
Enersource		69.86	4.31	121.59	1.38	2.78
Hydro Ottawa		260.82	3.56	101.67	1.45	2.95
Veridian		103.06	3.18	108.83	1.05	2.13
Horizon		358.02	2.43	94.16	1.17	2.41

Option 5b - A narrow peak to match a specific distribution peak

Observations:

- 56% of customers within the sample see a bill decrease and 44% see a bill increase
- Approximately 94% of the sample is contained within the [-250,250] bill difference range

Figure E.3b

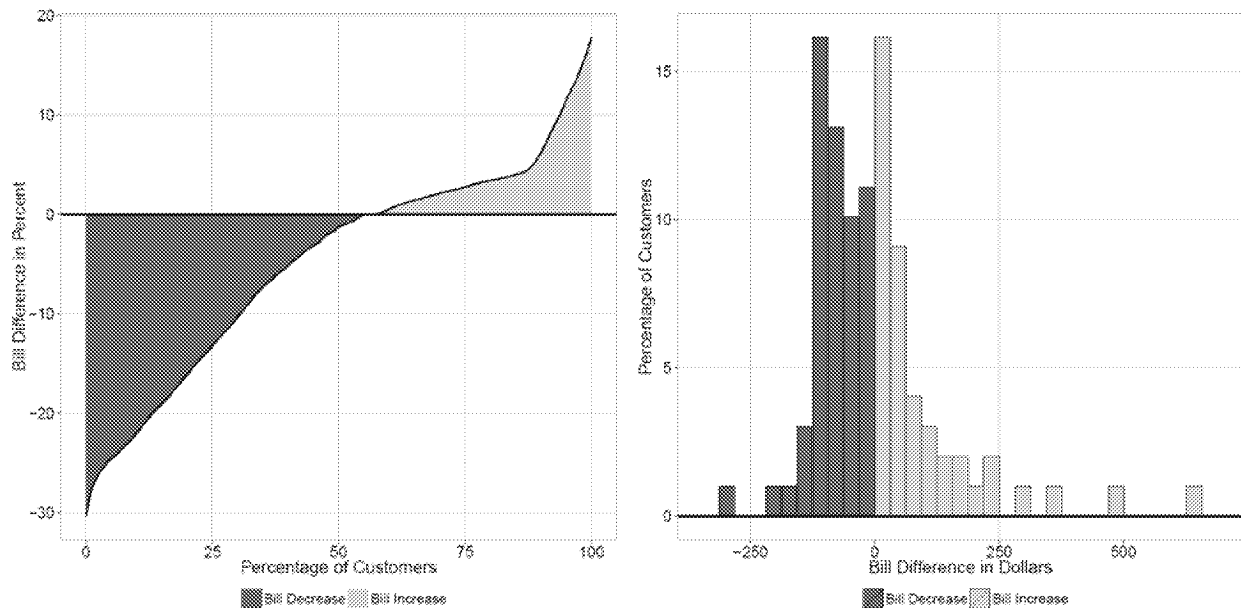


Table E.3b: Current and New Distribution Rates Under Option 5b

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Non-Peak Rate (\$/kW)	Peak Rate (\$/kW)
PowerStream		138.48	3.327	125.05	1.12	2.35
Hydro One:	Gsd	83.96	13.72	81.19	4.58	9.82
	Ugd	85.01	7.85	84.53	2.62	5.24
Enersource		69.86	4.31	121.59	1.38	2.89
Hydro Ottawa		260.82	3.56	101.67	1.45	3.1
Veridian		103.06	3.18	108.83	1.05	2.24
Horizon		358.02	2.43	94.16	1.17	2.5

E.3 – Option 6: Time of Use Demand Rate

Under this option customers are subject to a time-of-use demand rate that charges customers more conditional on their on-peak demand being greater than or equal to their off-peak demand:

$$Bill = \begin{cases} Fixed\ Charge + Off\ Peak\ Rate * Off\ Peak\ kW + \\ On\ Peak\ Rate * On\ Peak\ kW, & On\ Peak\ kW < Off\ Peak\ kW \\ Fixed\ Charge + On\ Peak\ Rate * (Off\ Peak\ kW + On\ Peak\ kW) \\ , & On\ Peak\ kW \geq Off\ Peak\ kW \end{cases}$$

Option 6a - Peak and off-peak

Observations:

- 58% of customers within the sample see a bill decrease and 42% see a bill increase
- Approximately 93% of the sample is contained within the [-500,500] bill difference range

Figure E.3a

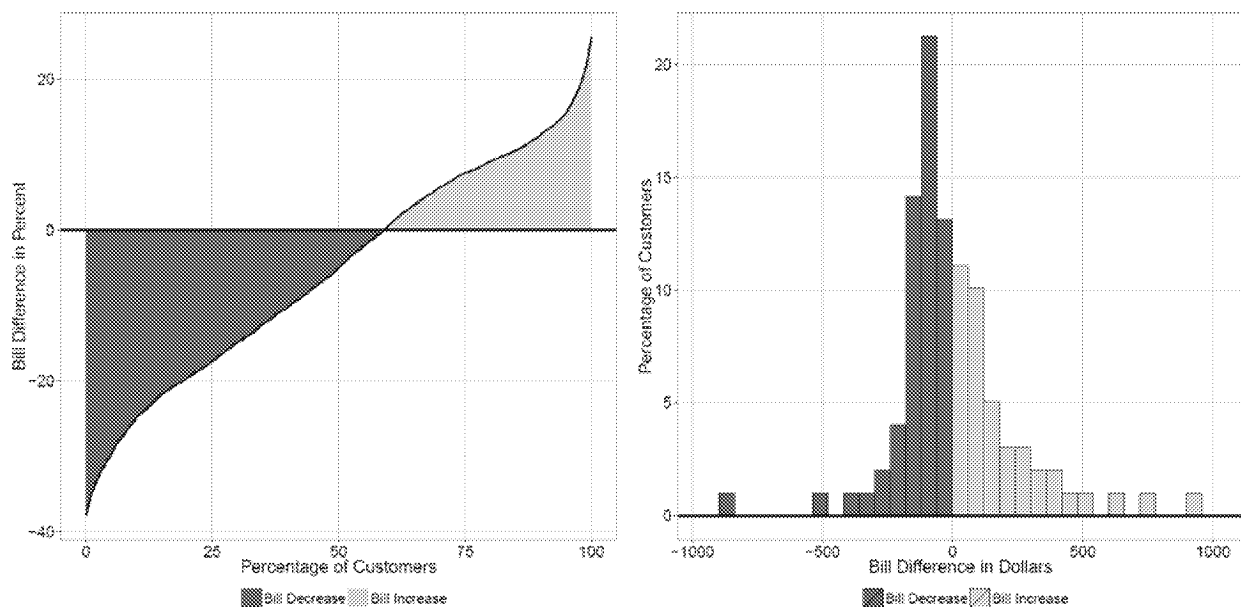


Table E.3a: Current and New Distribution Rates Under Option 6a

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Off-Peak Rate (\$/kW)	On-Peak Rate (\$/kW)
PowerStream		138.48	3.327	125.05	1.12	1.91
Hydro One:	Gsd	83.96	13.72	81.19	4.58	9.34
	Ugd	85.01	7.85	84.53	2.62	4.98
Enersource		69.86	4.31	121.59	1.37	2.28
Hydro Ottawa		260.82	3.56	101.67	1.46	2.5
Veridian		103.06	3.18	108.83	1.05	1.82
Horizon		358.02	2.43	94.16	1.15	2.09

Option 6b – Off-peak is free

Observations:

- 53% of customers within the sample see a bill decrease and 47% see a bill increase
- Approximately 95% of the sample is contained within the [-300,300] bill difference range

Figure E.3b

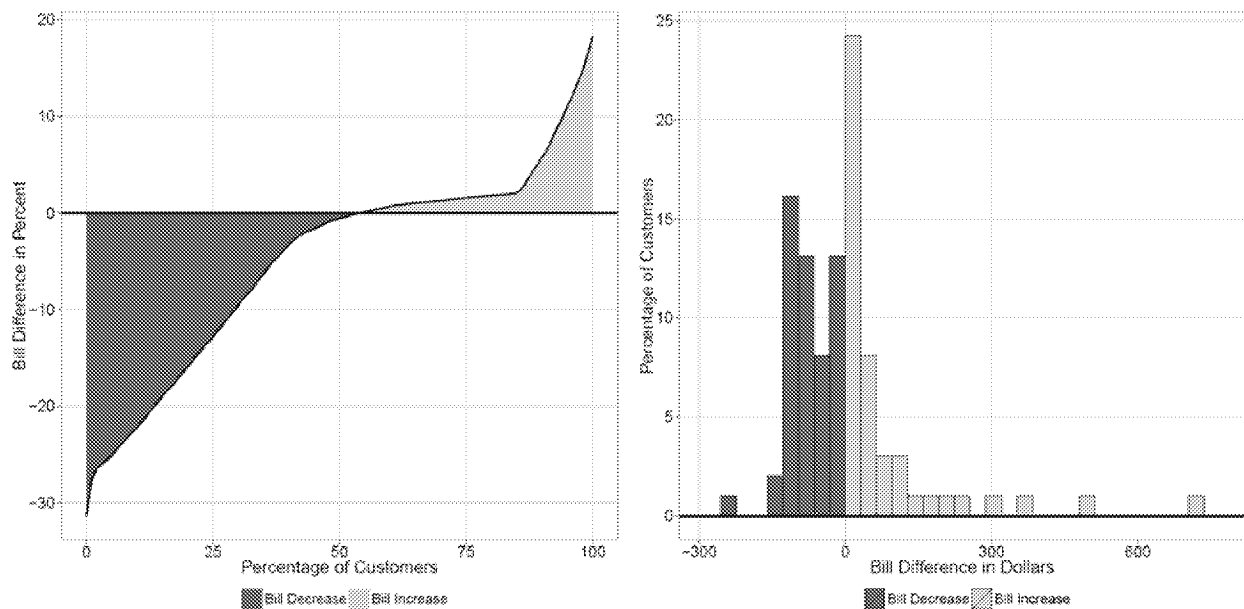


Table E.3b: Current and New Distribution Rates Under Option 6b

		Current:		New:	
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	On-Peak Rate (\$/kW)
PowerStream		138.48	3.327	125.05	3.42
Hydro One:	Gsd	83.96	13.72	81.19	14.01
	Ugd	85.01	7.85	84.53	7.95
Enersource		69.86	4.31	121.59	4.16
Hydro Ottawa		260.82	3.56	101.67	4.43
Veridian		103.06	3.18	108.83	3.19
Horizon		358.02	2.43	94.16	3.7

F – Intermediate Customers

F.1– Option 5: Three Part Demand Rate

Example 5a – Broad peak

Observations:

- 61% of customers within the sample see a bill decrease and 39% see a bill increase
- Approximately 99% of the sample is contained within the [-1000,1000] bill difference range

Figure F.1a

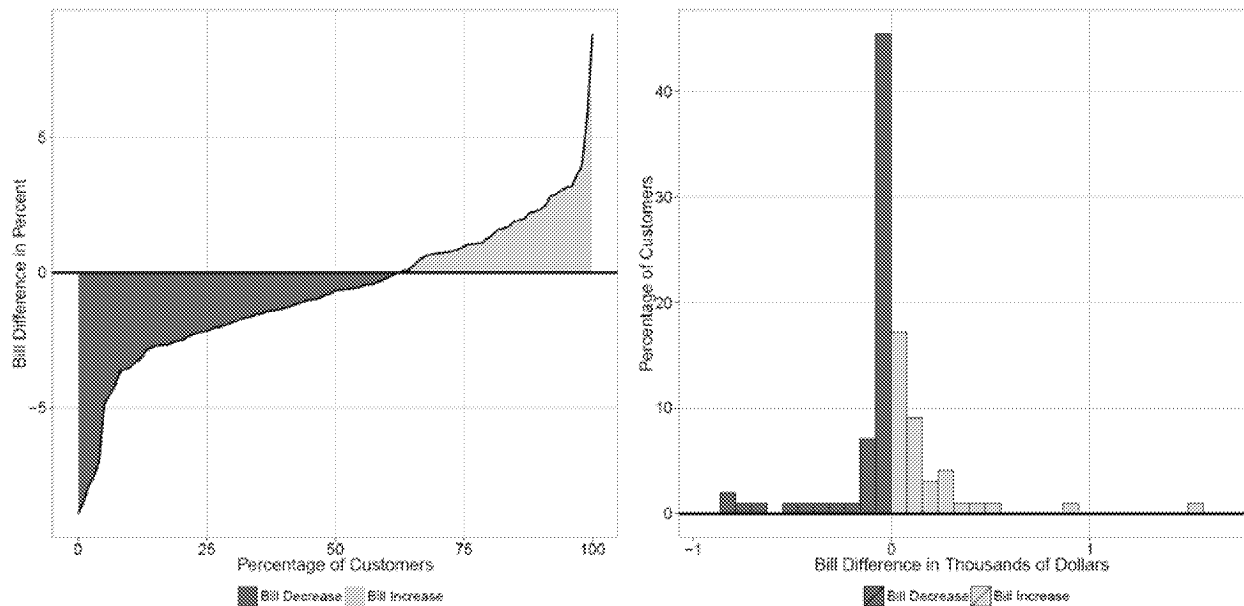


Table F.1a: Current and New Distribution Rates Under Option 5a

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Non-Coincident Peak Rate (\$/kW)	Coincident Peak Rate (\$/kW)
Enersource		1,538.27	2.01	1,401.47	0.73	1.49
Hydro Ottawa		4,193.93	3.49	1,634.52	1.52	3.07
Veridian		5,415.56	2.01	3,152.65	0.86	1.73

Example 5b – Narrow peak

Observations:

- 52% of customers within the sample see a bill decrease and 48% see a bill increase
- Approximately 89% of the sample is contained within the [-500,500] bill difference range

Figure F.1b

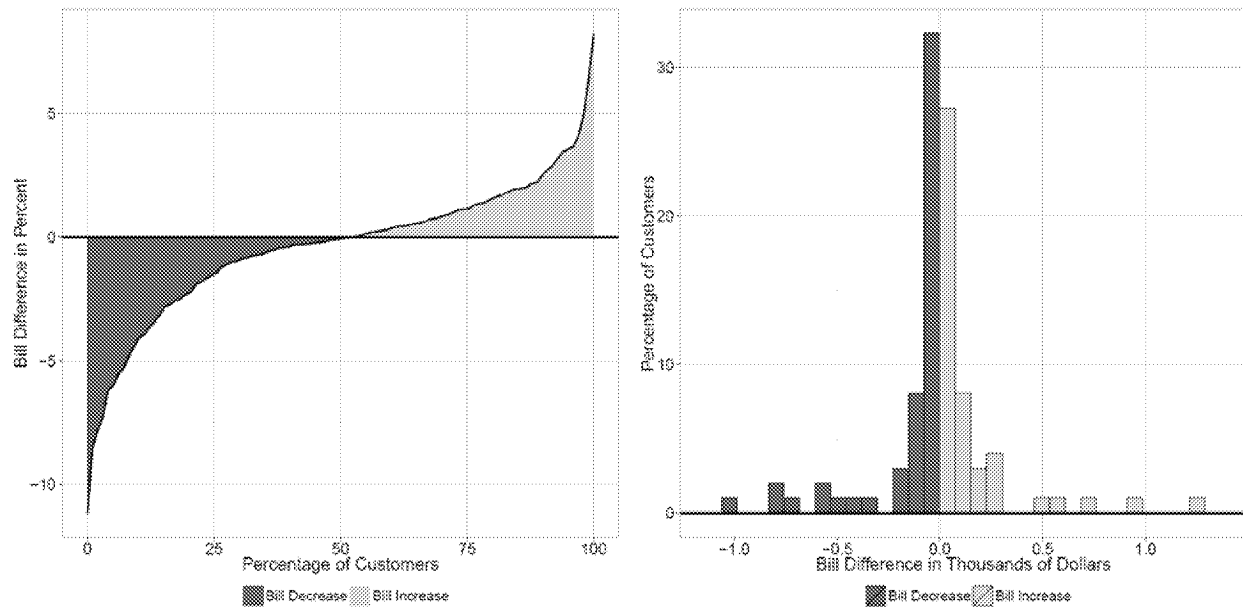


Table F.1b: Current and New Distribution Rates Under Option 5b

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Non-Coincident Peak Rate (\$/kW)	Coincident Peak Rate (\$/kW)
Enersource		1,538.27	2.01	1,529.07	0.70	1.46
Hydro Ottawa		4,193.93	3.49	1,731.02	1.51	3.20
Veridian		5,415.56	2.01	2,874.63	0.89	2.03

F.2 – Option 6: Time of Use Demand Rate

Example 6a – Off-peak charge

Observations:

- 55% of customers within the sample see a bill decrease and 45% see a bill increase
- Approximately 87% of the sample is contained within the [-1000,1000] bill difference range

Figure F.2a

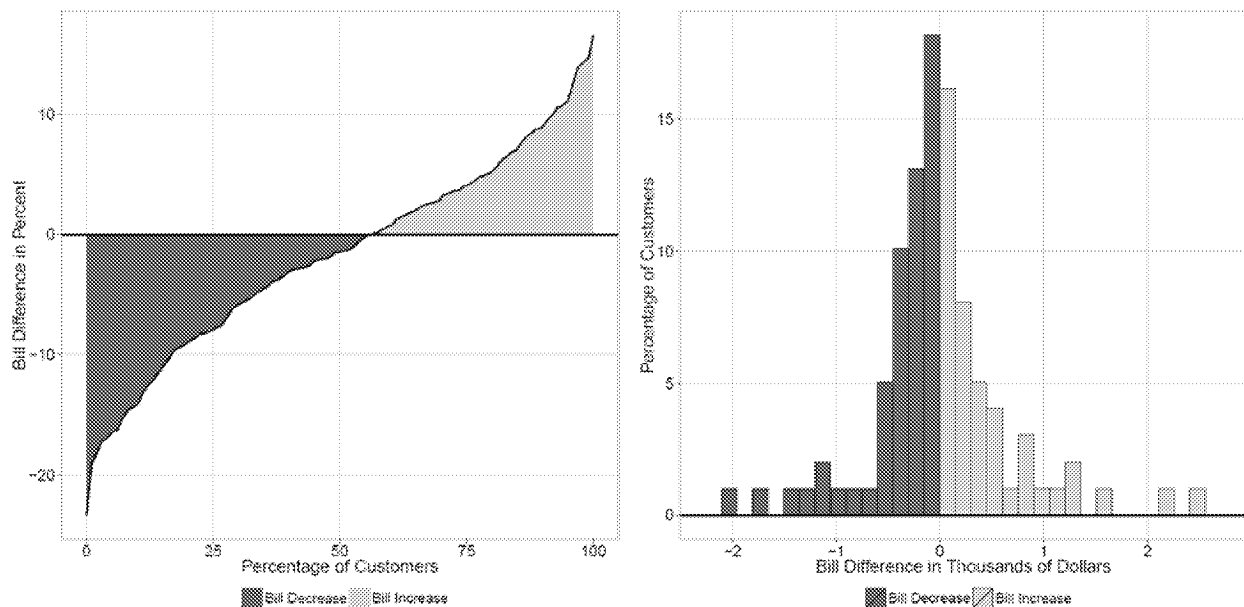


Table F.2a: Current and New Distribution Rates Under Option 6a

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Off-Peak Rate (\$/kW)	On-Peak Rate (\$/kW)
Enersource		1,538.27	2.01	1,241.78	0.58	1.31
Hydro Ottawa		4,193.93	3.49	534.95	1.68	2.92
Veridian		5,415.56	2.01	373.23	1.09	1.85

Example 6b – Off-peak is free

Observations:

- 33% of customers within the sample see a bill decrease and 67% see a bill increase
- Approximately 77% of the sample is contained within the [-1000,1000] bill difference range

Figure F.2b

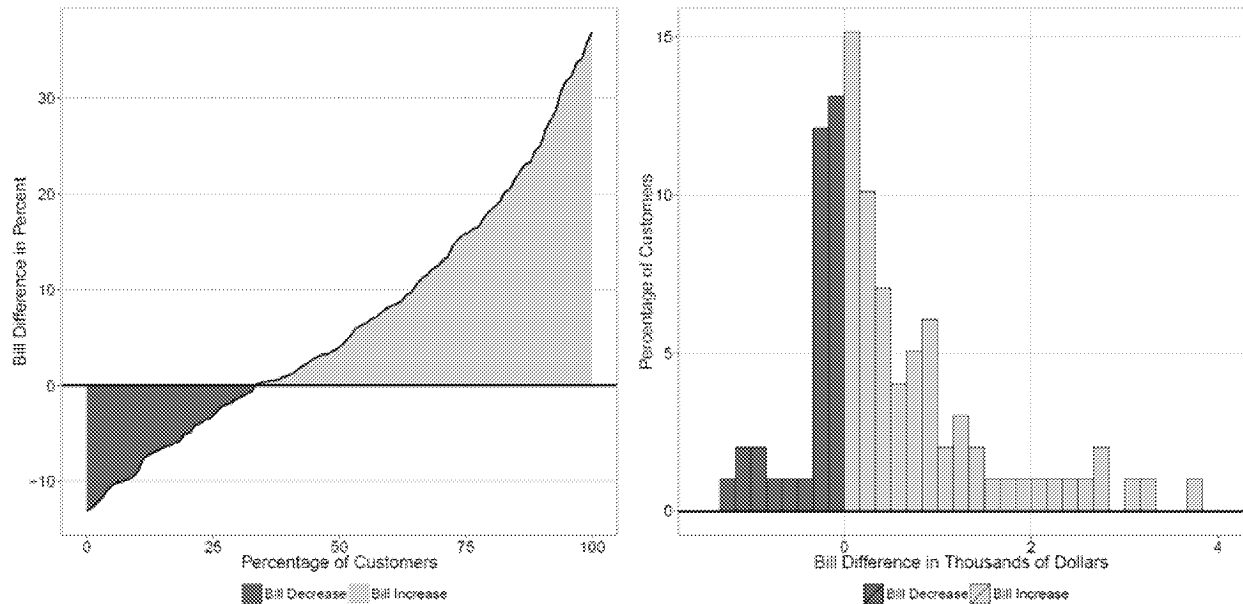


Table F.2b: Current and New Distribution Rates Under Option 6b

		Current:		New:	
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	On-Peak Rate (\$/kW)
Enersource		1,538.27	2.01	701.15	3.25
Hydro Ottawa		4,193.93	3.49	534.95	5.07
Veridian		5,415.56	2.01	373.23	3.31

G – Large Customers

G.1 – Option 5: Three Part Demand Rate

Example 5a – Broad Peak

Observations:

- 27% of customers within the sample see a bill decrease and 73% see a bill increase
- Approximately 85% of the sample is contained within the [-1000,1000] bill difference range

Figure G.1a

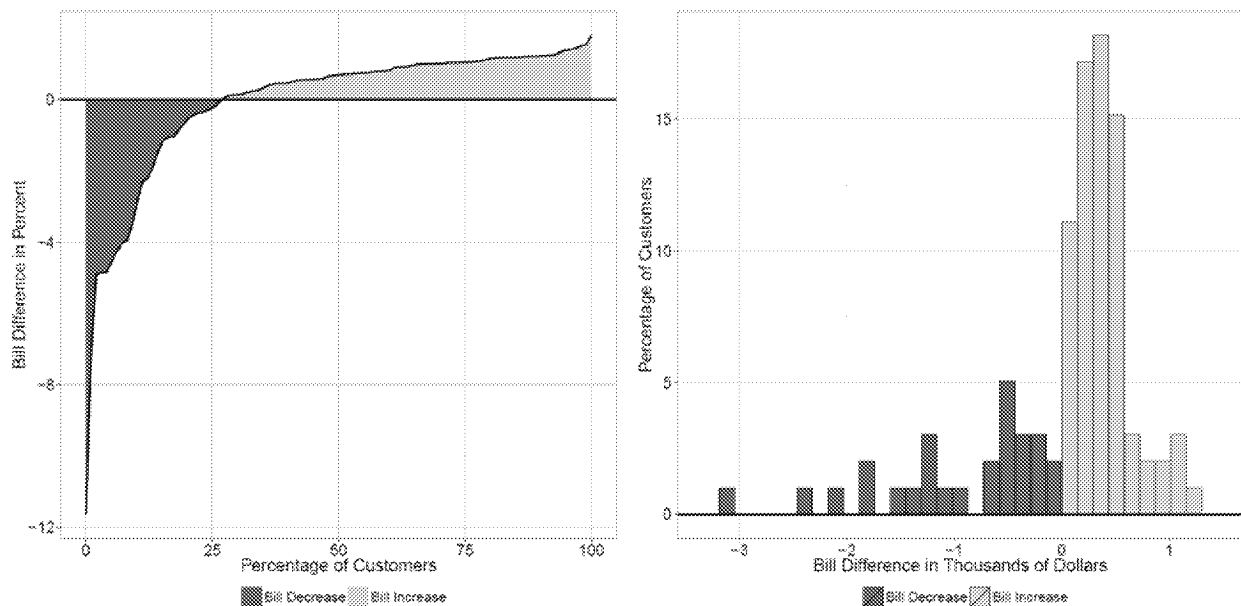


Table G.1a: Current and New Distribution Rates Under Option 5a

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Non-Peak Rate (\$/kW)	Peak Rate (\$/kW)
LDC		7,716.51	4.048	7,716.51	1.349	2.755

Example 5b – Narrow Peak

Observations:

- 27% of customers within the sample see a bill decrease and 73% see a bill increase
- Approximately 77% of the sample is contained within the [-1000,1000] bill difference range

Figure G.1b

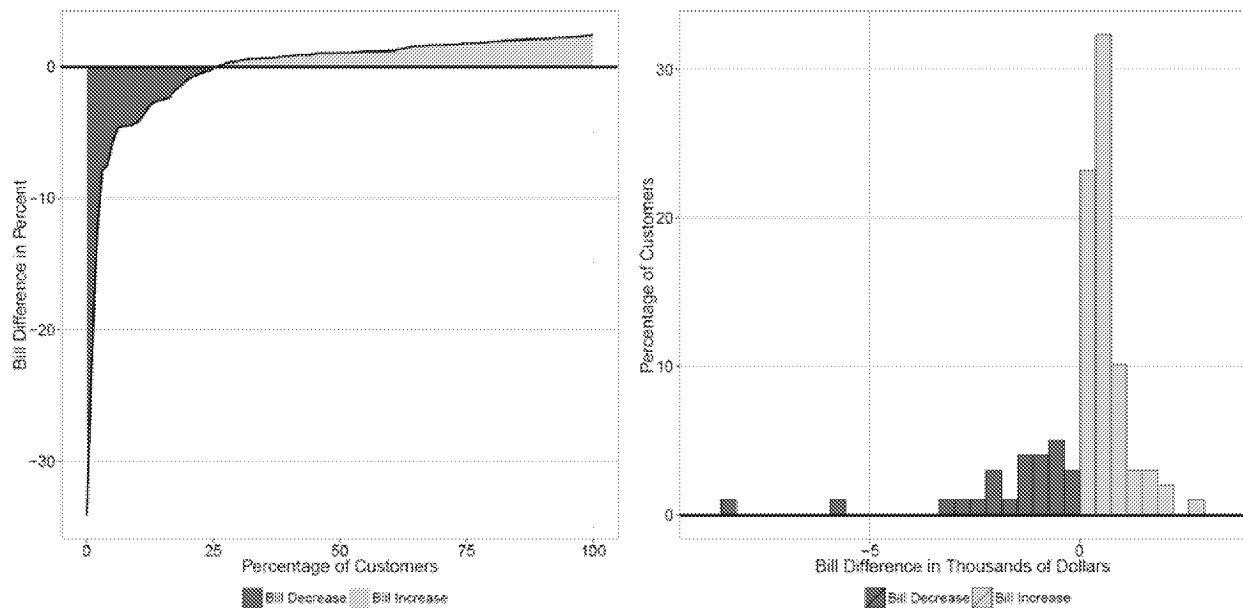


Table G.1b: Current and New Distribution Rates Under Option 5b

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Non-Peak Rate (\$/kW)	Peak Rate (\$/kW)
LDC		7,716.51	4.048	7,716.51	1.349	2.823

G.2 – Option 6: Time of Use Demand Rate

Example 6a – Off-peak charge

Observations:

- 46% of customers within the sample see a bill decrease and 54% see a bill increase
- Approximately 81% of the sample is contained within the [-5000,5000] bill difference range

Figure G.2b

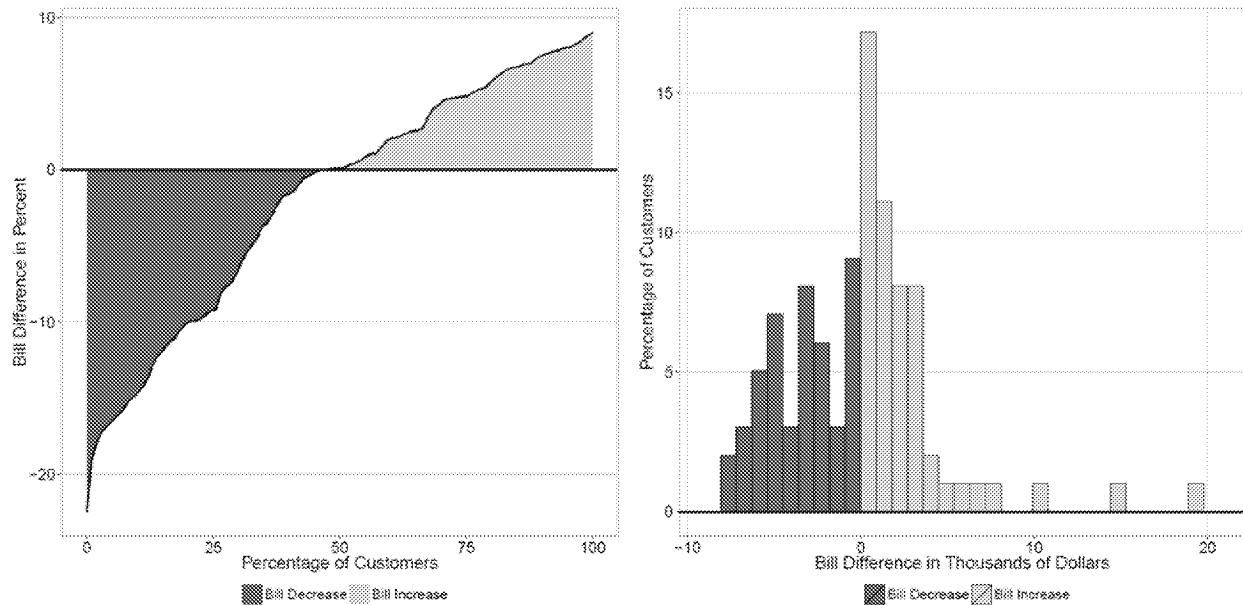


Table G.2a: Current and New Distribution Rates Under Option 6a

		Current:		New:		
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	Off-Peak Rate (\$/kW)	On-Peak Rate (\$/kW)
LDC		7,716.51	4.048	7,716.51	1.349	2.264

Example 6b – Off-peak is Free

Observations:

- 27% of customers within the sample see a bill decrease and 73% see a bill increase
- Approximately 78% of the sample is contained within the [-1000,1000] bill difference range

Figure G.2b

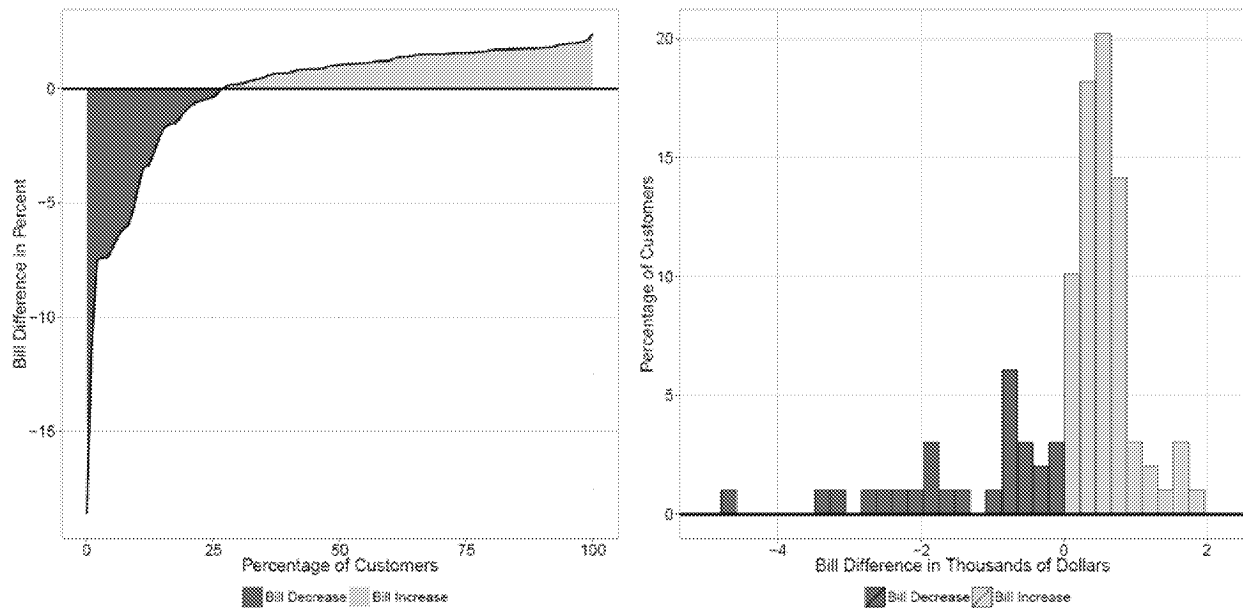


Table G.2b: Current and New Distribution Rates Under Option 6b

		Current:		New:	
		Fixed Charge (\$/month)	Variable Rate (\$/kW)	Fixed Charge (\$/month)	On-Peak Rate (\$/kW)
LDC		7,716.51	4.048	7,716.51	4.135