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Instructor: Samuel Chukwuemeka
Project: Power Bill: Residential Rates
Company: Union Electric Company Company website homepage for Missouri Residential rates for Missouri
Objectives: (1). I will calculate the cost of electricity for the residential customers of Union Electric Company in Missouri for winter season (October to May). (2). I will write a piecewise function that will accurately model the cost of electricity for the residential customers of Union Electric Company in Missouri for winter season (October to May). (3). I will recalculate the cost of electricity for residential customers of Union Electric Company in Missouri for winter season (October to May) using the piecewise function.
Information from website: Winter Rate (October through May)(1) Customer Charge - per month $9.00 Low-Income Pilot Program Charge – per month $0.14 Energy Charge - per kWh First 750 kWh 9.34¢ Over 750 kWh 6.27¢ I will be ignoring the Low-Income Pilot Program Charge – per month.

Conversion:

Cents can be converted to dollars by multiplying by 0.01

$$9.34¢(0.01) = \$0.0934$$

$$6.27¢(0.01) = \$0.0627$$

Arithmetic method:

The different numbers of hours tested will be 0 KW, 600 KW, and 900 KW.

The number 0 is within the first 750 Kilowatt hours range. Therefore the $0.0934 per hour rule will be used with the additional $9.00 charge.

$$\$0.0934\ (0) = \$0.00$$

$$\$0.00 + \$9.00 = \$9.00$$

Therefore 0 Kilowatt hours will have a bill of $9.00

The number 600 is also within the first 750 Kilowatt hours range. Therefore the $0.0934 per hour rule will be used with the additional $9.00 charge.

$$\$0.0934(600) = \$56.04$$

$$\$56.04 + \$9 = \$65.04$$

Therefore 600 Kilowatt hours will have a bill of $65.04

The number 900 exceeds the 750 Kilowatt hour range. Therefore, we calculate the cost of the first 750 Kilowatt hours with the \$0.09 and add the remaining 6.27¢ per hour to that total with the additional charge of \$9.00

$$\$0.0934\ (750)\ = \$70.05$$

Now we find the number of Kilowatt hours exceeding the 750 Kilowatt hour range.

$$900 - 750 = 150$$

Now we calculated the cost of the 150 Kilowatt hours exceeding the 750 Kilowatt hours range.

$$\$70.05\ + \$0.0627(150)\ = \$79.455$$

$$\$79.455\ +\ \$9.00\ =\ \$88.455$$

Rounding to nearest cent gives us \$88.46

Therefore 900 Kilowatt hours will have a bill of \$88.46

Piecewise function:

For this function the variable "c" will represent the cost, and the variable "x" will represent the number of Kilowatt hours.

The function for Kilowatt hours within the 750 Kilowatt hour range is:

$$c(x) = 0.0934x\ +\ 9.00$$

This rule applies to values within the 750 Kilowatt hour range. In order to write the second rule we must calculate the total cost of 750 Kilowatt hours and add that to the function including the \$9.00 monthly charge.

$$0.0934(750) = 70.05$$

$$70.05 + 9.00 = 79.05$$

Applying the $0.0627 per Kilowatt hour rule we get the following function:

$$c(x) = 0.0627(x - 750) + 79.05$$

$$c(x) = 0.0627x - 47.025 + 79.05$$

$$c(x) = 0.0627x + 32.025$$

After simplifying the function second part of the piecewise function is define as:

$$c(x) = 0.0627x + 32.025$$

Combining these two functions gives us this piecewise function:

$$c(x) = \begin{cases} 0.0934x + 9.00\,, & if\ 0 \leq x \leq 750 \\ 0.0627x + 32.025\,, & if\ x > 750 \end{cases}$$

Piecewise function method:

0 Kilowatt hours is within the 750 kilowatt hour range. Therefore the function used will be:

$$c(x) = 0.0934x + 9.00\,, if\ 0 \leq x \leq 750$$

Calculation:

$$c(0) = 0.0934(0) + 9.00$$

$$c(0) = 9.00$$

Therefore 0 Kilowatt hours has a bill of $9.00

600 Kilowatt hours is within the 750 Kilowatt hours range. Therefore the function used will be:

$$c(x) = 0.0934x + 9.00\,, if\ 0 \leq x \leq 750$$

Calculation:

$$c(600) = 0.0934(600) + 9.00$$

$$c(600) = 65.04$$

Therefore 600 Kilowatt hours will have a bill of $65.04

900 Kilowatt hours exceeds the 750 Kilowatt hours range. Therefore the function used will be:

$$c(x) = 0.0627x + 32.025, \ \ if\ x\ >\ 750$$

Calculation:

$$c(900) = 0.0627(900) + 32.025$$

$$c(900) = 88.455$$

Rounding up gives us $88.46

Therefore 900 Kilowatt hours will have a bill of $88.46

Citations: (APA)

Birk, M. C. (2022, February 14). Electric Service Missouri Service Area. Ameren. Retrieved November 9, 2023, from https://www.ameren.com/-/media/rates/files/missouri/uecsheet54rate1mres.ashx