

Programming Assignment #1
Calculation of Electric Power Bill

Background:

Monthly Dominion Virginia Power billing amounts can be calculated using various quantities and rates which are available on the billing statement or online. First a few terms should be defined:

Distribution Service Charge – consists of two parts:

- 1) Basic Charge = \$7.00 - this fee is charged regardless of the energy usage
- 2) Distribution kWh Charge
 - = \$0.02233/kW · h for the first 800 kWh
 - = \$0.01260/kW · h for the portion over 800 kWh

Electricity Supply Service Charge – consists of two parts:

- 1) Electricity Supply Charge
 - a) For June – September (“Summer” rates are higher)
 - = \$0.04073/kW · h for the first 800 kWh
 - = \$0.06051/kW · h for the portion over 800 kWh
 - b) For October - May
 - = \$0.04073/kW · h for the first 800 kWh
 - = \$0.03205/kW · h for the portion over 800 kWh
- 2) Fuel Charge (Rider A) - \$0.02232/kW · h

Sales and Use Surcharge - \$0.00026/kWh

State/Local Consumption Tax – (combined state consumption, local consumption, and special regulatory tax)

- = \$0.00148/kW · h for the first 2500 kWh
- = \$0.00094/kW · h for the portion over 2500 kWh, but less than 50000 kWh
- = \$0.00071/kW · h for over 50000 kWh

Virginia Beach Utility Tax - \$3.00

Late Penalty: 1.5% of the amount before taxes

Energy Used = Final meter reading - Initial meter reading (add 100000 if negative) - see note below

Average Daily Cost =
$$\frac{\text{Bill Amount before taxes and not including late penalties}}{\text{Number of days in the billing period}}$$

Number of days in billing period – Varies from 26 to 35.

Rounding – Note that all monetary values on power bills are rounded down to the nearest cent.

Note: the reading on the meter displays 5 digits, so the meter reads counts 99998, 99999, 00000, etc. So if the final meter reading is less than the initial reading (or if the Energy Used is negative), 100000 must be added.

Example: (See attached Virginia Power bill)

Month Number: 8 (i.e., August, so “Summer rates”)

Number of days in billing period: 29

Previous month’s Bill: \$132.61 (paid late)

Initial meter reading = 28420 kW · h

Final meter reading = 29844 kW · h

Energy Used = Final meter reading - Initial meter reading = 29844 – 28420 = 1424 kW · h

Cost summary:

| | |
|--|----------|
| Balance Forward: | \$132.61 |
| Distribution Service Charge | |
| = \$7.00 + (\$0.02233/kWh)(800 kWh) + (\$0.01260/kWh)(1424-800 kWh): | \$32.72 |
| Electricity Supply Service | |
| = (\$0.04073/kWh)(800 kWh) + (\$0.06051/kWh)(1424-800 kWh) | |
| + (\$0.02232/kWh)(1424 kWh): | \$102.12 |
| Sales and Use Surcharge = (\$0.00026/kWh)(1424 kWh): | \$0.37 |
| State/Local Consumption Tax = (\$0.00148/kWh)(1424 kWh): | \$2.10 |
| Virginia Beach Utility Tax: | \$3.00 |
| Late Payment Charge * = (0.015)(132.61): | \$1.98 |
| Total Current Charges: | \$142.29 |
| Total Account Balance: | \$274.90 |
| Average Daily Cost = (\$142.29 – \$1.98 – \$3.00 – \$2.10)/29 | \$4.66 |

* Note the late charge is actually on the amount before taxes, but an exact calculation would also require knowing the previous month’s energy usage.

Program Requirements:

- The program should display a descriptive program title initially and then request the following information from the user:
 - Month Number (1 - 12)
 - Initial meter reading (an Integer)
 - Final meter reading (an Integer)
 - Number of days in the billing period (26 to 35)
 - Was last month’s bill paid late? If so, enter the amount.
 - Include clear variable names and plenty of comments.
- Check for improper inputs. If an improper input is entered, display an error message and terminate the program (**return 1** in the main program). Failure paths should include:
 - a valid month number must be entered
 - a valid number of days in the billing period must be entered
 - initial and final meter readings must be between 00000 and 99999
 - if the user enters the amount for the last month’s bill, it must be positive

3. The output should display the following information (appropriately formatted):

Your name
 Month (name, not number)
 Initial meter reading
 Final meter reading
 Energy Used (total kWh)
 Distribution Service Charge
 Electricity Supply Service Charge
 Sales and Use Surcharge
 State/Local Consumption Tax
 Virginia Beach Utility Tax
 Late Charge
 Total Current Charge
 Total Account Balance
 Average Daily Cost

Note: Meter readings and energy used should be expressed in kW · h and all monetary values should be expressed in dollars and cents using the \$ symbol. Additionally, all monetary values should be rounded down to the nearest cent.

4. Run your program for at least the following cases and include printed results for each case in your report.

| Initial meter reading (kW · h) | Final meter reading (kW · h) | Month | Number of Days in Billing Cycle | Last month's bill late? | If late, amount was |
|--------------------------------|------------------------------|-----------|---------------------------------|-------------------------|---------------------|
| 28420 | 29844 | August | 29 | Yes | \$132.61 |
| 99856 | 00631 | September | 32 | No | |
| 98212 | 00000 | January | 27 | No | |
| 76892 | 79599 | February | 33 | Yes | \$293.25 |
| 10000 | 13000 | May | 35 | No | |
| 10000 | 70000 | June | 26 | No | |

Note: Case 1 above is the same example as shown on page 2. Your results should match.

Report

Follow the guidelines in the handout Format for Programming Projects (available on the instructor's web page).

Extra Credit Suggestions:

You can earn up to 10 additional points on this program's grade. The number of points awarded depends on the complexity or creativity of the feature. In general you should include extra text cases to illustrate your new features. Here are a few ideas:

1. Rather than terminate the program for invalid inputs, display an error message for invalid inputs and allow the user to correct the inputs. This can be done fairly easily using a **do while loop** (covered in Ch. 6).
2. Rather than requiring the user to enter the number of days in the billing period, require the user to enter the starting date and ending date (month and day only) for the period and let the program calculate the number of days. Check to be sure the number of days is from 26 to 35. Assume that February has 28 days. Use the ending date to determine whether summer rates or winter rates apply.
3. Create a data file containing Usage History similar to the table seen on the bill below. Calculate the average energy usage for the last 12 months and compare it with the current energy usage (print the results).
4. Use your imagination!

Aug 24, 2007

Customer Bill

Billing and Payment Summary

Account # Due Date: **Sep 18, 2007**

Total Amount Due: \$ 274.83

To avoid a Late Payment Charge of 1.5% please pay **by Sep 18, 2007**.

Previous Amount Due: \$ 132.61
 Payments as of Aug 24: \$ 0.00

For Dominion Virginia Power service emergencies and power outages, please call 1-888-667-3000. Visit us at www.dom.com.

Meter and Usage

Current Billing Days: 29

Billable Usage

Schedule 1 07/23-08/21
 Total kWh 1424

Measured Usage

Meter: 0069508286 07/23-08/21
 Current Reading 29844
 Previous Reading 28420
 Total kWh 1424

Usage History

| Mo | Yr | kWh |
|-----|----|------|
| Aug | 06 | 1480 |
| Sep | 06 | 1182 |
| Oct | 06 | 852 |
| Nov | 06 | 1323 |
| Dec | 06 | 1440 |
| Jan | 07 | 1741 |
| Feb | 07 | 1957 |
| Mar | 07 | 1437 |
| Apr | 07 | 1323 |
| May | 07 | 1098 |
| Jun | 07 | 1336 |
| Jul | 07 | 1357 |
| Aug | 07 | 1424 |

Explanation of Bill Detail

| Dominion Virginia Power | | 1-888-667-3000 |
|---|--------|----------------|
| Previous Balance | 132.61 | |
| Payment Received | 0.00 | |
| Balance Forward | | 132.61 |
| <i>Residential Service (Schedule 1) 07/23-08/21</i> | | |
| Distribution Service | | 32.72 |
| Electricity Supply Svc | | 102.12 |
| Sales and Use Surcharge | | 0.37 |
| State/Local Consumption Tax | | 2.10 |
| VIRGINIA BEACH Utility Tax | | 3.00 |
| Late Payment Charge | | 1.91 |
| Total Current Charges | | 142.22 |
| Total Account Balance | | 274.83 |

Visit our website or call our office for rate schedule prices.

Price to Compare

| | ¢/kWh |
|----------------|--------|
| Jun-Sep | 6.75 ¢ |
| Oct-May | 5.54 ¢ |
| Annual Average | 5.90 ¢ |

Use these prices to compare to offers from competitive service providers.

Important Customer Information from Dominion Virginia Power

Your previous bill has not been paid in full. Please make payment immediately or call us if there is a problem.

Help EnergyShare - add \$1,2,5,10,20,25 or 35 to your payment or mail a separate check payable to EnergyShare to PO Box 11186, Richmond, VA 23230-1186.

If you would like to receive and pay your bills electronically - sign up for this service at 'Manage Your Account' on www.dom.com and select start e-bill.