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TARIFF DESIGN MODEL USERS GUIDE

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1. INTRODUCTION

This model facilitates the evaluation of alternate tariff structures for a given tariff class, and given the desired revenue responsibility for the tariff class under evaluation. Basically, once the desired revenue responsibility is specified, as are the relevant details of the tariff structure (number of blocks, block sizes, prices for each block, demand charge), the model calculates the estimated yield and the corresponding typical bill impacts. If this yield deviates from the specified target yield and/or the bill impacts for some consumer segments are not in line, the user must appropriately revise one or more parameters of the tariff structure and recompute the yield and the corresponding bill impacts. In this iterative manner, the user can finally arrive at a tariff design that yields the desired revenue responsibility and also reflects, as closely as feasible, economic and any social objectives.

The tariff design model is embedded in several Lotus 123 spreadsheets to calculate the average yield and bill impacts of proposed tariffs for each of the tariff categories. Data entry and analysis are automated in these spreadsheets using macros and Lotus 123-style menus. This users manual will explain how to use the menus to test tariff options. Six spreadsheet models were created:

<u>SPREADSHEET</u>	<u>TARIFF CLASS</u>
DIRECT.WK1	EEA bulk sales
RESIDENT.WK1	EDA sales to residential customers
COMMERCE.WK1	EDA sales to commercial customers
SMALL.WK1	EDA sales to small industrial customers
LARGE.WK1	EDA sales to large industrial customers
MEDIUM.WK1	EDA sales to medium industrial customers

To facilitate access to each of these models, a controlling or master spreadsheet, MENU.WK1, was created. By loading this spreadsheet first, the user can more easily locate and load the other spreadsheets. Each of these spreadsheets will be discussed in turn after the following brief discussion of features common to all spreadsheets.

2. COMMON FEATURES

Several things are common to all of the spreadsheet models:

- An automatic macro brings up the main menu when the spreadsheet is first loaded.

- The same macro recalls the main menu in all spreadsheets: press the **Alt** key and the **M** key simultaneously (Alt-M).
- Cells that contain data that the user can change have been "unprotected." These cells are displayed in bold (or color on a color monitor) and are the only cells that the user should change under normal circumstances in the models. All other cells are "protected" to safeguard them from accidental changes.
- Most spreadsheets have an option entitled "GoTo" in the main menu. This option presents a menu of choices to allow the user to quickly move around the spreadsheet.
- Most spreadsheets have an option entitled "Return" in the main menu. This option allows the user to exit the current spreadsheet and re-load the MENU.WK1 spreadsheet. The program will ask the user to confirm before exiting the spreadsheet since it will not save the current spreadsheet before loading MENU.WK1.
- Most spreadsheets have an option entitled "Quit" in the main menu. This option simply exits the main menu, leaving the user in the spreadsheet.
- In most spreadsheets, printing can be done on a Laser printer with Allways or on a dot matrix printer; however, the print routines work best on a Laser printer using Lotus 123 version 2.2 with Allways attached. If Allways is to be used with these models, it should be attached to 123 before loading the models to preserve the Allways format instructions. If Allways is attached when a print command is issued, the print macro will automatically use it for printing. If Allways is not attached, the print macros will assume that a dot matrix printer is to be used.

3. CONTROLLING SPREADSHEET: MENU.WK1

This is a simple spreadsheet that facilitates identifying and loading the other tariff design spreadsheets. When loaded, it presents a menu showing the names and descriptions of the other spreadsheets (Exhibit 1). Choosing one of the menu options automatically loads the selected spreadsheet.

4. EEA BULK SALES: DIRECT.WK1

The DIRECT.WK1 spreadsheet performs tariff design and bill impact analysis functions for direct sales from EEA to individual customers and to the distribution companies.

The main menu presents 7 choices:

1. Tariff: This option moves to the relevant portion of the spreadsheet to allow the user to enter proposed tariffs.
2. Consumption: This option moves to the relevant portion of the spreadsheet to allow the user to enter new electricity consumption data for the projected year (the year the proposed tariffs will come into effect).
3. Assumptions: This options allows the user to set some common assumptions for use in the tariff design areas of the spreadsheet (see Exhibit 2). For example, if the user enters a peak energy charge in the common assumptions input area and adds a formula in each line of the tariff design area referring to this common peak energy charge, then any change to the common peak energy charge will automatically be reflected in the tariff design section.

ASSUMPTIONS	
Peak/OffP Ratio kWh	0.26
Cust. Charge (LE/Yr)	0
Energy Charge (P/kWh)	
Peak	4.000
Off-Peak	4.000
Demand Charge (LE/kW)	
Peak	0
Off-Peak	0
Fuel Adjustment (P/kWh)	0.000
Power Factor	0.85

Exhibit 2

4. Print: The print routines are set up to use either Allways on a Hewlett-Packard Laserjet printer or a dot matrix printer. The Print option in the main menu produces a menu with the following 5 choices:

1. **Print everything**: Prints the entire spreadsheet
2. **Summary**: Prints the main section of the spreadsheet, where all the calculations are performed.
3. **BillImpact**: Prints the bill impact summary table. This is the same printout as seen in exhibits in chapter 7.
4. **TariffDesign**: Prints the tariff design summary table. This is the same printout as seen in exhibits in chapter 7.

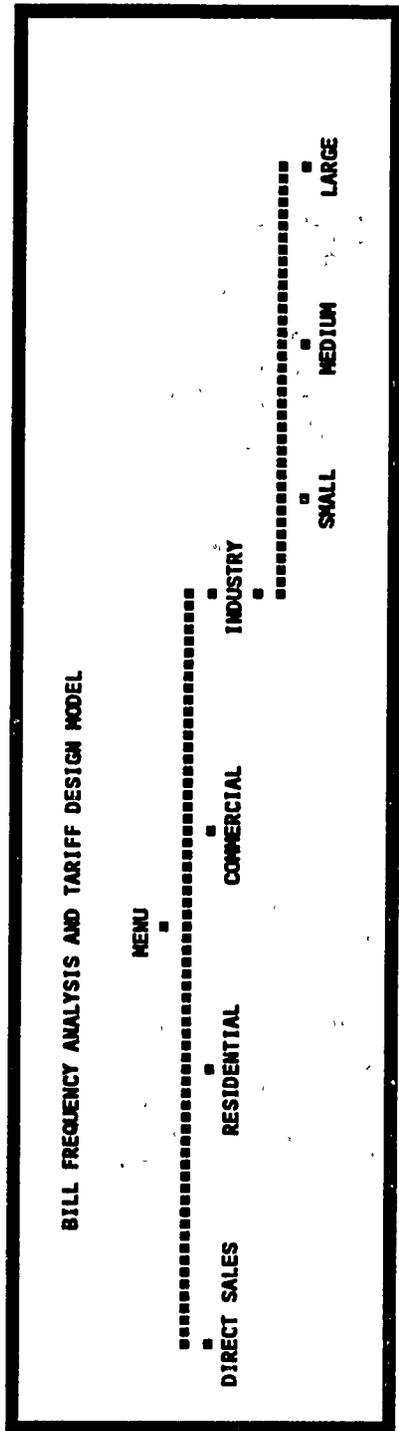


Exhibit 1

5. **Return:** Returns control to the main menu.

5. GoTo: This option allows the user to quickly move to the following areas of the spreadsheet:

1. **Impacts:** The bill impact calculation section of the spreadsheet
2. **Home:** The top left cell in the spreadsheet
3. **Percent:** The bill percent change column
4. **Bill Impacts:** The bill impact summary section
5. **Design Tariffs:** The tariff design summary section
6. **Macros**
7. **Title:** The title sheet for the spreadsheet
8. **Return:** Returns control to the main menu.

6. Return: See the discussion above under Common Features.

7. Quit: See the discussion above under Common Features.

5. RESIDENTIAL TARIFF: RESIDENT.WK1

The RESIDENT.WK1 spreadsheet performs tariff design and bill impact analysis functions for sales from the distribution companies to individual residential customers.

The main menu presents 6 choices:

1. Tariff Design: This option moves to the relevant portion of the spreadsheet to allow the user to enter proposed tariffs (Exhibit 3). The user can enter a new block: ending kWh, tariffs, and customer charges. While entering the new tariff structure, the screen will display the calculated average yield for that tariff structure in the bottom line of the screen. It will also display the impact on individual customers' bills on the right side of the screen. The option number (displayed in the top line in the middle) and the Average Yield Target (bottom middle) are entered by using the "Data Entry" option from the main menu.

To reduce the number of blocks, enter the new tariff structure and erase any old block "Ending kWh" numbers beyond the last block. The formulas require both starting and ending block numbers; the starting kWh numbers are calculated by referring to the

RESIDENTIAL TARIFF DESIGN NEW Block Structure		Option 1, 210		***** CALCULATION)	
Starting kWh	Ending kWh	New Tariff (P/kWh)	Customer Charge (LE/Year)	Old Block Ending kWh	Bill Percent Change
0	100	11.000	0	0	0.0%
101	250	22.000	0	40	266.7%
251	600	26.000	0	50	266.7%
601	1,000	28.000	0	60	266.7%
1,001	100,000	30.000	0	70	266.7%
				80	266.7%
				90	266.7%
				100	266.7%
				150	319.0%
				200	340.0%
				250	309.3%
				300	307.1%
				350	305.8%
				400	295.2%
Average Yield Target (P/kWh):			15.52		
Calculated Average Yield (P/kWh)			15.72		

Exhibit 3

ending kWh numbers. The user must enter 100,000 as the last block ending kWh in order for the formulas to calculate correctly.

2. Data Entry: This option moves to the relevant portion of the spreadsheet to allow the user to enter historical data, projections, and targets used in the calculations in the spreadsheet (Exhibit 4). The Average Yield Target seen in Exhibit 3 is entered in the first line of this screen (all other tariff data points are calculated). The revenue generated by the present tariff is entered, as are the kilowatt-hour sales and total number of customers for the current tariff.

Historical Data, Projections, and Targets			
	Present Tariff	Proposed Tariff	Target Yield
Average Yield (P/kWh)	2.84	15.72	15.52
Revenue Generated (1000 LE)	308,194	1,875,791	
	1990 Actual	1992 Projected	Ranges
kWh Sales (10^6)	10,835	11,931	92kWh
Number of Customers	9,195,096	10,820,000	92NbrBills
TITLE FOR TARIFF CASE:	Option 1, 210		

Exhibit 4

Projected kilowatt-hour sales and number of customers are entered for the projected year as well. Finally, a title for the tariff case currently under study is entered. (The "Option 1, 210" title seen in Exhibit 3 is a copy of the title entered here.)

3. BillImpact: This option allows the user to test the impact of the currently proposed bill on a customer sample of any size (Exhibit 5). The user enters the kilowatt-hours consumed and the spreadsheet will calculate the remaining numbers in the screen, showing the total bill and percent change in the bill.

BILL IMPACT ANALYSIS			
	Enter kWh Consumed:		200
	-----TARIFFS-----		Percent Change
	EXISTING	PROPOSED	
Cost of last block (P/kWh)	5	22	388.9%
Total Bill (LE/Month)	90	154	71.1%

Exhibit 5

4. Print: The print routines are set up to use either Allways on a Hewlett-Packard Laserjet printer or a dot matrix printer. The Print option in the main menu produces a menu with the following 5 choices:

1. **Key Data:** This option will print the underlying or working data set from the spreadsheet, including the tariff design structure, historical data inputs and targets, the bill frequency analysis, and the calculation sections for the proposed tariffs.
2. **Bill Impact:** This option will print the typical bill impact section of the spreadsheet as seen in Exhibit 7-12.
3. **Impact & Tariff:** This option will print the same typical bill impact section referred to above and the tariff design sheet.
4. **Miscellany:** This option will only work on a dot-matrix printer. It prints everything in the spreadsheet that is not printed by the Key Data choice.
5. **Return:** Returns control to the main menu.

5. Export: This option exports the tariff design and bill impact summary sections to a new spreadsheet (named by the user). It can be used to save options for future reference or for future use with a graphics package to prepare graphs. After selecting this option, the user will be prompted to enter a name for the new spreadsheet.

6. GoTo: This option allows the user to quickly move to the following areas of the spreadsheet:

1. **1992 BFA:** The projected BFA, in the base case assumed to be 1992, but it can refer to any year

2. **Impact:** The bill impact section
3. **BFA 1989:** The BFA for the base case year.
4. **Revenue:** The revenue impact section
5. **DataEntry:** The data entry section described above
6. **Macros**
7. **Title:** The title sheet for the spreadsheet.

Since the block structure of the residential tariff is so important to the revenue collected, the **RESIDENT.WK1** spreadsheet contains a detailed bill frequency analysis (BFA) section. This section is used to compute both the revenue generated and the bill impact of the proposed tariffs. The driving data in the BFA section are the number of consumers in each tariff block and their consumption. BFA data from Cairo and South Delta were used to prepare the estimated BFA for all of Egypt used in this model (as explained in Appendix A to this users manual).

If the user wishes to modify the model to incorporate new BFA data, the formulas in each cell in the range B7 through C44 must be modified to include the revised percent of total customers for column B, and percent of total consumption for column C for each block interval. Each cell multiplies the percentage times the grand total to calculate the relevant number for each block. The total number of customers ("Customer Bills") value in cell B46 and kilowatt-hour consumption in C46 can be changed to use a different base year for the analysis. (To change the values in these cells, choose the "Data Entry" option from the model's menus and change the base year data for "kWh Sales" and "Number of Customers". Cells B46 and C46 contain formulas referring to the values in these cells.) The corresponding current tariffs in column M should be changed accordingly.

6. COMMERCIAL TARIFF: COMMERCE.WK1

The **COMMERCE.WK1** spreadsheet performs tariff design and bill impact analysis functions for sales from the distribution companies to individual commercial customers. **COMMERCE.WK1** is functionally identical to **RESIDENT.WK1** and all directions given above apply to it as well.

7. SMALL POWER SERVICE TARIFF: SMALL.WK1

The SMALL.WK1 spreadsheet performs tariff design and bill impact analysis functions for sales from the distribution companies to small industrial customers.

The main menu presents 5 choices:

1. Enter Tariff: This option moves to the relevant portion of the spreadsheet to allow the user to enter new proposed tariffs (Exhibit 6). The user can enter energy and demand charges for the current and proposed tariffs and can enter a title for this case on the bottom line.

Consumption Ending kWh/Year	Small Power Service		Demand Charge (LE/kW/Mo)	Energy Charge (M/kWh)
	Present Tariff Energy Charge (M/kWh)	Demand Charge (LE/kW/Yr)		
70,000	169.4	0.0	0.00	280.4
170,000	138.5			
10,000,000	131.9			
CASE:	Sample			

Exhibit 6

2. View Results: This option moves the cursor to the top left cell and exits the macros, allowing the user to examine the results of the tariff design entered.

3. Print: This option brings up a menu with two choices, to print both the bill impact analysis and the tariff design sections from the spreadsheet. The first option, "STANDARD," should be used when a demand charge has been entered (it prints results for a variety of load factors). The second option, "NO DEMAND CHARGE," should be used when no demand charge has been entered (it prints results for a wider range of consumption, with no variation of load factor). (See Exhibit 7-23.) The printing macros are set up to use Allways. If printing with a dot-matrix printer is desired, standard Lotus 123 commands can be used to print the range name "PRINTRESULTS2" for the first option and "PRINTRESULTS3" for the second option.

4. Return: See the discussion above under Common Features.

5. Quit: See the discussion above under Common Features.

8. LARGE POWER SERVICE TARIFF: LARGE.WK1

The LARGE.WK1 spreadsheet performs tariff design and bill impact analysis functions for sales from the distribution companies to large industrial customers. LARGE.WK1 is functionally identical to SMALL.WK1 and all of the directions given above apply to it as well, with the following additions.

The large power service tariff design screen (Exhibit 7) allows the user to specify peak and off-peak energy and demand charges and the peak/off-peak kilowatt-hour ratio for the proposed tariff. The formulas use the peak/off-peak ratio to determine both peak and off-peak shares of energy consumption (kWh) and non-coincident peak demand (kW) to calculate bill impacts.

Consumption Ending kWh/Year	Large Power Service		Large Power Service		Energy Charge (M/kWh)
	Present Tariff Energy Charge (Mil/kWh)	Demand Charge (LE/kW/Yr)	Proposed Tariff Demand Charge (LE/kW/Mo)	Demand Charge (M/kWh)	
1,000	147.1	46.4	Peak	Peak	Peak
1,500	138.4		31.00	184.5	184.5
2,500	120.7		Off-Peak	Off-Peak	Off-Peak
3,500	103.7		0.00	133.6	133.6
5,000	78.8		Peak/Off-Peak Ratio:	0.22	
1,000,000	67.3				
CASE: TOD 2					

Exhibit 7

9. MEDIUM POWER SERVICE TARIFF: MEDIUM.WK1

The MEDIUM.WK1 spreadsheet performs tariff design and bill impact analyses functions for sales from the distribution companies to medium-sized agricultural, industrial, and public industrial customers. MEDIUM.WK1 is functionally very similar to SMALL.WK1 and LARGE.WK1.

The main menu presents 5 choices:

1. Enter Tariff: This option moves to the relevant portion of the spreadsheet to allow the user to enter new proposed tariffs (Exhibit 8). The user can enter energy and demand charges for the current and proposed tariffs for agricultural, industrial, and public industrial customers and a target average yield for the entire sector.

	Medium Power Service			Energy Charge (M/kWh)	Average Yield (M/kWh)
	Percent Share	Load Factor	Demand Charge (LE/kW/Mo)		
Agriculture	5%	0.45	0.0	148.0	148.0
Industry	30%	0.50	55.0	148.0	298.7
Public	65%	0.50	55.0	148.0	298.7
Total	100%				291.2
				Target	290.4

Exhibit 8

2. View Results: This option functions like the "GoTo" options described for other spreadsheets and allows the user to quickly move to the following areas of the spreadsheet:

1. **Home:** The tariff design section (top left section of the spreadsheet)
2. **Ag Impact:** The bill impact results for the agriculture sector
3. **Ind.Impact:** The bill impact results for the industrial sector
4. **Public Impact:** The bill impact results for the public sector
5. **NoDemand:** The bill impact results for all three sectors when no demand charge has been entered. (The data in this section are only correct when no demand charges have been entered in the tariff design screen.)
6. **Macros**

3. Print: This option presents a menu of choices for printing. The macros for this menu are only set up to use Allways. If printing with a dot-matrix printer is desired, standard Lotus 123 commands can be used to print the following range names: AG_IMPACT, IND_IMPACT, PS_IMPACT, DO_D_IMPACT, OVERVIEW, and PRESENTTARIFFS.

The print options are as follows:

1. **Overview:** The tariff design screen
2. **AgImpact:** The bill impact results for the agriculture sector (see Exhibit 7-21)
3. **Ind.Impact:** The bill impact results for the industrial sector (see Exhibit 7-21)
4. **PublicImpact:** The bill impact results for the public sector (see Exhibit 7-21)
5. **NoDemand:** The bill impact results for all three sectors
6. **ExistingTariffs:** The existing tariffs section of the spreadsheet
7. **Macros**

4. Return: See the discussion above under Common Features.

5. Quit: See the discussion above under Common Features.

The residential sector bill frequency analysis (BFA) is used for two main purposes in the analysis of proposed tariffs: it provides the data needed for estimating revenues from proposed tariff structures, and it provides a structure for calculating the impact of the proposed tariffs on individual customers. This appendix will provide a short introduction to the use of BFAs in tariff design and will explain how the BFA for the residential sector was developed.

A.1 BFAs IN TARIFF DESIGN

The BFA is based on two sets of data: number of customers in each kWh consumption block, and the total electricity consumption in each block. From this set of data, the consolidated factor is calculated, which represents the cumulative kWh consumed in each block. It is the sum of all kWh consumed in that block by all customers consuming in that block and in all higher blocks. The consolidated factor is used, among other things, to calculate the "Sales in Interval" value (column H in RESIDENT.WK1). Multiplying Sales in Interval by the tariff for each block yields the revenue generated by all sales in that block. Summing that value for all blocks will yield the total revenue generated by the proposed tariff.

A short example will help show how the consolidated factor is calculated and how it is used. Using the example tariff structure shown to the right, the bill for this customer would be calculated as shown in the "Correct Calculation" box below, as follows. If a customer consumes 1,000 kWh per month, the first 300 kWh of consumption is charged at the first level of the tariff, 2 P, for a total of 600 P. The second 300 kWh of consumption (from 301 through 600 kWh) is charged at the second level of the tariff, 4 P, for a total of 1,200 P. Finally, the last 400 kWh of consumption (from 601 through 1000 kWh) is charged at the third level of the tariff, 6 P, for a total of 2,400 P. Adding the three block totals together produces the grand total bill for the customer, or 4,200 P. Simply multiplying the amount consumed (1000 kWh) by the tariff at the last block (6 P) will yield an incorrect result.

kWh /Month		Price
Start	End	
0	300	2
301	600	4
601	1400	6

INCORRECT

 1,000 X 6 P = 6,000 P

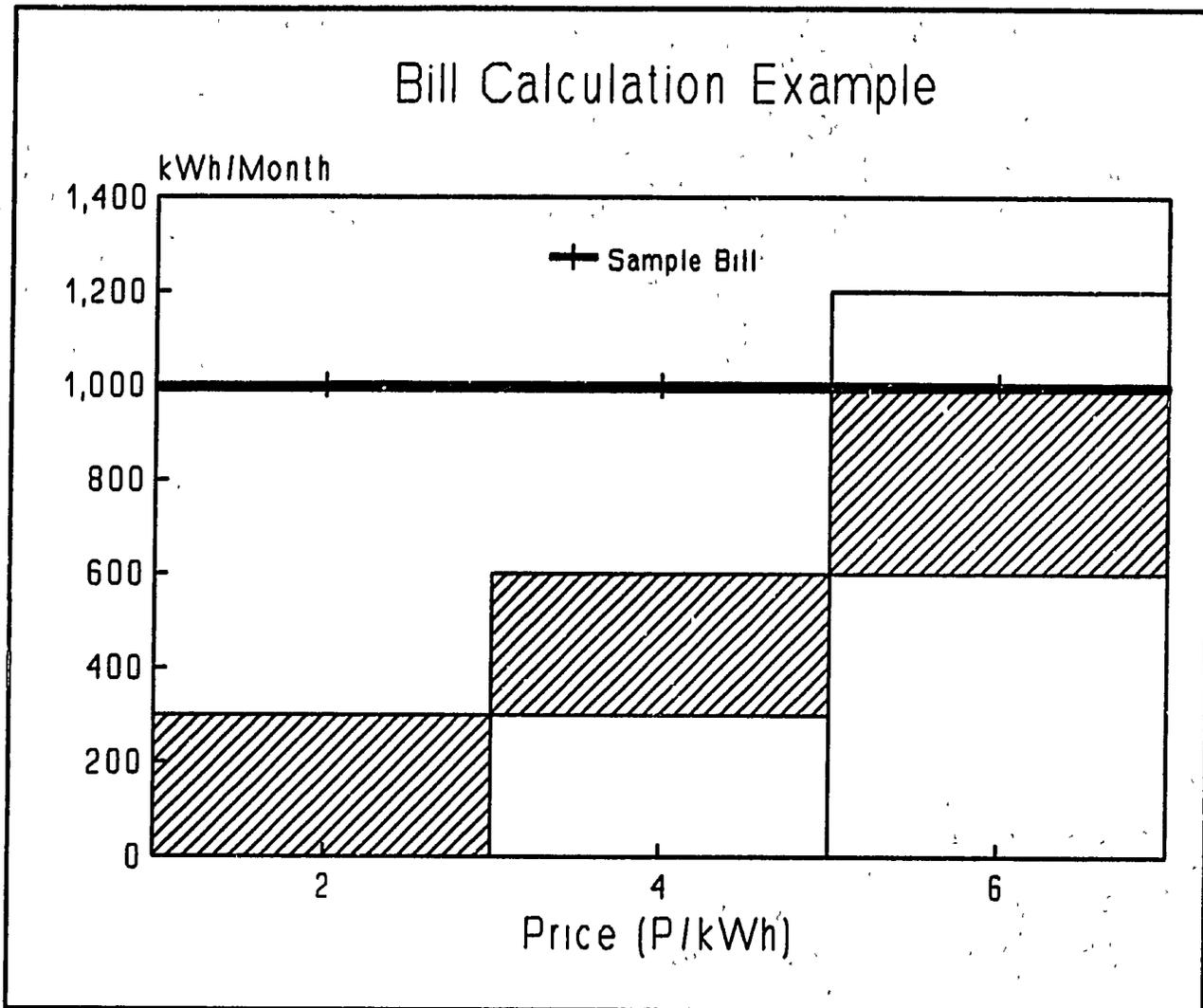
CORRECT

 300 X 2 P = 600 P
 + 300 X 4 P = 1,200 P
 + 400 X 6 P = 2,400 P

 TOTAL 4,200 P

In the following graph, the sum of the areas of the shaded portions represents the total cost for the electricity consumed by this example customer.

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A.2 DEVELOPMENT OF THE RESIDENTIAL SECTOR BFA

To accurately project revenues, the tariff design model depends on accurate statistics on the distribution of customers in the various kWh blocks and their consumption. Since such data for the country as a whole were unavailable to the analysis team, assumptions had to be made to extrapolate from the available data to the nation as a whole. The spreadsheet entitled "RES_BFA.WK1" (for Residential BFA) was used for this process.

Detailed data on electricity consumption and number of customers by block were available from the Cairo and South Delta distribution companies. The EEA annual reports indicate that roughly one half of Egyptian electricity consumption is in urban areas and one half in rural areas. Since South Delta is a predominantly rural area and Cairo is urban, the team assumed that the national electricity consumption and number of customers distribution would

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mirror the average of Cairo and South Delta. The RES_BFA.WK1 worksheet performed this averaging to produce two sets of numbers that were imported into the RESIDENT.WK1 model. The first was the percent of total number of consumers found in each consumption block. The second was the percent of total electricity consumption in each consumption block.

The Cairo and South Delta statistics were from 1989. If newer statistics become available for these two areas, the RES_BFA.WK1 spreadsheet can be updated to create new percent distribution numbers for RESIDENT.WK1. If a different set of numbers is used, a new extrapolation methodology will have to be developed.