

## APPENDIX 2: Instructions on Advanced Excel for Deregulation Project

## ENV-2D02 Deregulation Project - Advice on Extended EXCEL - Part 1

There are two parts to the demonstration which will be held in two separate weeks -

### Object of Session 1

The purpose of this session is to give you some additional tuition in the use of more advanced spreadsheet methods which you may find useful in your project. In this later session you should be able to use the Spreadsheet effectively for your Project.

First, you should obtain the TEMPLATE for this demonstration. This may either be obtained from the ENV-2D02 WEB SITE or from the suite of software accessed by selecting the ENERGY ICON on the computers in Lab D or Lab E. The data in the template were generated from the OFGEM WEB site (<http://www.ofgem.gov.uk/customers/index.htm>) in December 2001 for selected Energy Companies. You should not assume that the prices here are correct when you come to do your study and you should check out the WEB Pages of the Individual Suppliers including those not included on the Template.

Now save the template with a filename of your choosing onto your U: drive for future reference.

The raw spreadsheet does not have any formulae, and though this is fine for the example shown, you need to insert formulae if you wish to explore the different prices. Further more the columns in green which show the results are deliberately left blank at this stage.

### Initialisation of Consumption

First we need to be able to work out exactly what the consumption is.

In this example we shall assume that you want to specify the present cost as charged by Amerada Hess, and see how the other companies compare. You may, alternatively wish to specify a consumption instead. Later (next week) we shall see how we can specify any company we wish.

We shall begin by assuming that the customer is currently supplied with gas from Amerada Hess, and that the annual bill is £300 as indicated in cell **J16**. Also in cell **J17** is the annual consumption corresponding to this annual cost. To be able to work out which company provides the cheapest gas for this annual bill, we must first enter a formula into cell **J17** to compute consumption from the current annual cost. This would allow us to enter any amount in cell **J16**, and the consumption will be automatically computed.

We shall use the Amerada Hess Standard Tariff. First, the standing charge must be subtracted, and then the result divided by the unit charge [note the standing charge is given in pounds and the unit charge in pence!].

so the complete formula to enter into cell **J17** is:-

$$= (J16 - D22)/E22*100 \quad \text{- the 100} \\ \text{arises because of the pence} \quad (1)$$

You only have to do this once, but enter this formula to replace the value in cell **J17** - you should get the consumption value of **19540** kWh if you have entered the formula correctly.

You can now change the annual bill in cell **J16** at will, and the actual consumption is computed in cell **J17**.

### Calculating Tariffs.

In theory, it is quite easy to compute the total bill for any other Tariff, by inserting the appropriate formulae in the cells in column **M** for Standard Credit or Column **N** for Direct Debit. However, there are complicating factors, and it is easier to do this in stages. Let us use column **T** to compute the actual tariffs, [it is convenient to use more than one column, so we shall use columns **S** as an intermediate stage - also choosing columns **R - T** allows us to insert data in between at a later stage if need be.]. However, for the moment enter the formula  $=T22$  into cell **M22**, and copy this to all cells in column **M**. There should be a column of **0's**. Now go to cell **T22**.

The total consumption for Amerada Hess Gas can be computed in a similar way to equation (1)

First we have the standing charge [cell **D22**], then the actual cost of units consumed [cell **E22 \* cell J17**]. However, since we shall be copying formulae, and we need to keep the consumption constant in all rows we need to modify the formula to [ **E22 \* J\$17** ] - (the **\$** indicates that this cell is fixed during copying). The same issue arises regarding the VAT cell **J18**

$$\text{So the formulae for cell } T22 \text{ is} \quad = (D22 + E22 * J\$17 / 100)$$

If you now copy this formula to all other cells in column **T** you will find that column **M** has the computed consumptions for all companies displayed.

You can now change the values in cell **J16** and see what the effect is for the different companies. These figures are for Non Direct Debit (Standard Credit).

### IF statements

At present, all companies offer both a Direct Debit and a Standard Tariff, but even as recently as the middle of last year, there were some companies falling in this category, although at the present time (1<sup>st</sup> January 2002), no companies have only one tariff. With tariffs changing frequently, there is the possibility that some may revert to this position, and thus the "Hypothetical Company" has been included. Equally, in the past, other companies have had tariffs which are only valid if the number of units exceeds a given amount, and if the value is less, then the computed cost is clearly invalid.

We can solve this problem using an **IF** formula. This takes the general form

$$=IF(\text{condition}, \text{true formula}, \text{false formula})$$

The formula is in three parts. The condition can be any test such as a number or cell value being greater than or less than, or equal to another. The true formula is what to do if the condition is true, while the false formula is what to do if the condition is not met.

We note that with the Hypothetical Company, there is no Standard Tariff, and this is indicated by blank cells in both **D26** and **E26**. We can thus specify a condition that if cell **E34** is blank then we would wish to have "n/a" as the value rather than 0.00 as the computed result.

If we change the formula in cell **T26** to

=IF(E26="", "n/a", (D26+E26\*J\$17/100)).....(2)

we will find that the situation is rectified and it also looks more professional.

[note since n/a is not a number it must be in quotes – equally the way to denote a blank cell is "" i.e. there is nothing between the quotes.

For completeness we should copy the formula in cell T26 throughout the range T22 to the bottom of the Table.

**The IF condition is a very powerful tool and as a slight digression, the following box shows other applications which can be helpful in some EXCEL Applications**

In the conditional part of the formula we can use any combination of arithmetic operators we like for instance if we wished to test whether the number in say cell F23 was greater than 1000 we could write the formula (say in cell Z22) as

**=IF(F23>1000,"true","false")**

or we could be more adventurous and write **=IF(F23>1000,5\*1000,0)** - i.e. we would multiply the value in cell F23 by 5 only if it is greater than 1000 otherwise we would set the value to zero.

Sometimes the condition has two requirements. For instance if we want only to identify numbers between 1000 and 2000 we would write the expression

**=IF(AND(F23>=1000,F23<2000),.....true statement , .....false statement)**

Alternatively we might have a condition that we would wish to be true if the number in F23 was less than 1000 or greater than 2000. In this case we would write

**=IF(OR(F23<=1000,F23>2000),.....true statement , .....false statement)**

**The use of an IF condition thus improves matters.**

**We can now replicate the same procedure for the Direct Debit Prices as follows:-**

- 1) Enter the formula =W22 into Cell N22 and copy the formula throughout column N
- 2) Enter the following formula into cell W22

**=IF(I22="", "n/a", (H22+I22\*J\$17/100)).....(3)**

**and copy this throughout column W**

At this stage you may find it helpful to format the cells to ensure that only 2 decimal places are displayed and that the values are centralised in the cells.

**We still have two issues to address**

- 1) For PowerGen, there is no difference in the Standard and Direct Debit Standing Charges and Unit Charges, but there is a one off annual payment of £10.50 for Direct Debit.
- 2) Several Tariffs have a Break Point Tariff in which Unit Charges are higher for Units consumed below the Break Point, but are lower thereafter. It is thus necessary to identify the a formula to correctly deal with this.

Before we deal with these, try using the Spreadsheet by entering different current annual charges into cell J16 and check that the computed values all change accordingly.

Try entering a value of £500 – you should see changes accordingly. you will notice that for PowerGen, both Direct Debit and Standard Credit Charges are the same whereas it is normal to get a discount for Direct Debit.

Now try entering say £20 (a low bill). You will notice that several of the bills are now negative which is clearly impossible. The reason for this is that Amerada Hess has a Standing Charge or £40.25 and if you enter a value less than this, you will end up with a negative consumption.

It is thus helpful to Enter into cell L17 the formula

**=IF(J17<0,"ERROR", "")**

You will see that ERROR is displayed warning of the error. You can make it stand out by formatting the FONT Colour to RED say.

- To make the display more professional it would be sensible to ensure that results are not displayed if you enter an invalid number as above.
- Change the formula in Cell M22 to **= IF(IS17<>"", "", T22)**

- Similarly change the formula in Cell N22 to  
= IF(I\$17<>"", "", W22)
- Now copy cell M22 throughout column M and N22 throughout column N
- **All the results cells should now be blank and will only change when you enter a value in cell J16 which is above £40.25**

Returning to the outstanding point

We shall deal with the first problem –i.e. the discount of PowerGen first before attempting the more complex issue of Break Points

This is straightforward as all we need to do is to change the formula in cell W22 to

$$=IF(I22="","", "n/a", (H22+I22*J$17/100-L22))$$

.....(4)

**Now copy this formula throughout column W and you will now see a difference in the two PowerGen Prices**

Solving the BREAK POINT Issue

A break point tariff such as illustrated in the British Gas Tariff does not have a standing charge (although sometime Break Point Tariffs do). The first 4572 units are charged at 2.61p per kWh, but above that amount, the charge is 1.460p per kWh - i.e this tariff becomes progressively cheaper for large consumers. But even the lower unit charge is not as low as many tariffs with a standing charge. For large consumers it usually pays to have a tariff with a standing charge to benefit from the lower unit charges.

In theory we could include a further formula to include tariffs of the Break Point type in the formula in T22 and W22 but they are already getting quite complex. We shall do this in two stages.

Let us use column S, and if we place the following formula in S22, we can identify those tariffs which have a break point:-

Enter this formula in cell S22

$$=IF(OR(F22="","", J$17<F22), "n/a", D22+F22*E22/100+(J$17-F22)*G22/100)$$

**Note**

if the total number of units consumed is less than the break point value, then the normal formula applies. This is the second of the conditions in the OR part of the formula.

**Before the next session, please repeat the above analysis for the Direct Debit Tariffs, using columns V and W instead of S and T above.**

**Multiple Runs - Macros**

Once you have set up the basic spreadsheet, it is a simple task to enter different values into box J16 to see effects of changes. However, each time you do this it will overwrite the previous version. Perhaps you would like to make a copy of the data set. A simple way to do this is to generate a macro

This is best done using the onboard key-stroke facility.

$$=IF(F22="","", "n/a", "break point formula needed")$$

[NOTE: the expression break point formula needed requires you to enter the relevant formula. It is used for illustration only here].

Copy this to all relevant cells in Column S – the Tariffs with a Break Point should now be identified.

What we are doing here is looking for a NON Blank entry in column F. If such a condition is met then we have identified a tariff with a break point

You can do the same in column V for the Direct Debit Tariffs – this time pointing to the cells in column J

Finally we need to modify the formulae in column T and W

- If we have n/a in a cell in column S, then we should use the normal formula already existing in cell T22, otherwise we need to use a value computed in column S, so modify equation 4 as

$$=IF(E22="","", "n/a", IF(S22="n/a", (D22+E22*J$17/100), S22))$$

- You will notice that we have nested IF statements. In fact we can nest up to 7 such IF statements if we wish.
- Looking at this equation: it means
- First we check cell E22, and if we find it is blank, then we enter “n/a” as before. Next we check cell S22, and if its contents are "n/a" we use the standard formula as in (3) above, otherwise we copy the contents of cell S22 into T22.
- OK you have to work out what formula to put in to S22, but this is to illustrate the principle.
- Copy this formula through out column T.

Remember to specify the breakpoint formula in the last section of the formula in cell S22.

**Have a look at the following formula and see if this is the correct formula for cell S22.**

**Select Tools Menu - then Record Macro**

You will be asked for a name for this macro - you could enter - Copy - or any other name. Note you cannot include blanks, but one way around this is to write copy\_data, for example. After this everything you do will be recorded, until you select the tools menu again and select stop recording.

- **Highlight cells A1 to R68 - these are cells needed for copying**
- **select Edit \_\_\_\_\_ copy**
- **Now select Insert \_\_\_\_\_ Worksheets**

- **move to cell A1**
- **Edit \_\_\_\_\_ paste**
- **click on the DATA sheet tab**

**WARNING:** if you do not copy cells to include the header, errors may occur, so be sure you copy everything from cell A1 to W68

You now have copied the data to a new sheet

Stop recording of the macro

> **Tools > Record Macro > Stop Recording**

Now select the Button tool from the Drawing Tool bar, and outline a button -at any convenient blank space in worksheet - say **M2 – N3**. You will be presented with a menu of macros. Since you only have one macro, click on this.

Finally, instead of "Button", you may wish to give a name to the button. Move the cursor to the button, and swipe across the word "button" - type in something to remind you of what the function of the button is -e.g. copy data (note this time you can have a space.

If you want to copy your results in future, all you have to do is to click on the button, and you can repeat this as many times as you want. You will generate a separate worksheet each time.

### Freezing Panes

In a Spreadsheet with many rows, a problem arises when you scan down in that you can no longer see the column headers. One way to overcome this problem is to first highlight cell A1 - to make sure you are at the top left of the page. Now highlight Cell **P22**. The select Window \_\_\_\_\_Split form the menu, and finally Windows\_\_\_\_\_Freeze Panes. In this way you will freeze the header and ensure that the column headings remain even when you scan down the Spreadsheet.

### Two Issues to thin about before the Second Demonstration

1. How can you easily select either Direct Debit or Standard Credit?
2. How can you easily select any Company as the reference?

## ENV-2D02 Deregulation Project - Advice on Extended EXCEL - Part 2

It is assumed that you have access to the work completed in the previous session. You probably stored it on the U-Drive - so load that from EXCEL in the normal way.

### Aim

In the previous session we saw how we could set a particular annual Bill in cell J16 and see how the prices offered by the different companies would vary. We explored the use of fixed cell formula copying, and IF conditional formulae.

One problem with the above is that we can only vary the tariff if the person is currently using British Gas, whereas up to 25% have already changed. In this session we shall explore ways to do this.

Today we shall examine two different methods for choosing options and also we shall make use of **INDIRECTION**.

### Option choices

Before we attempt this, we need to do some preliminaries and generate a list of options. What we need is a list of all the available Tariffs. To do this we need to combine the Company Name in Column **B** with the Tariff in column **C**.

- 1) Enter into cell S22 the formula **=B22** and then copy this formula in the range **S22:S68**

[ the purpose of this is not immediately apparent - but wait until after we have done the next step]

- 2) Enter into cell **T22** enter the formula **=S22&": "&C22**  
[note there are spaces after the : - you can add as many as you like]

- 3) Now copy this formula in the range **T22:T68**

The cells in column **T** contain both the Company and the tariff, except that on the second line of each company, only the tariff appears. This is inconvenient, so we need to modify the entry ion cell **S22**.

- 4) Change the formula in **S22** to **=IF(B22="",S21,B22)**

What this does is to copy the Company Name from **B22** if it exists, but if it does not it copies the name from the cell above.

- 5) Copy the contents of **S22** in the range **S22:S68** and you should find all cells in column T now have both the company name and the tariff.

We have now completed the preliminaries so we can now set up an option box

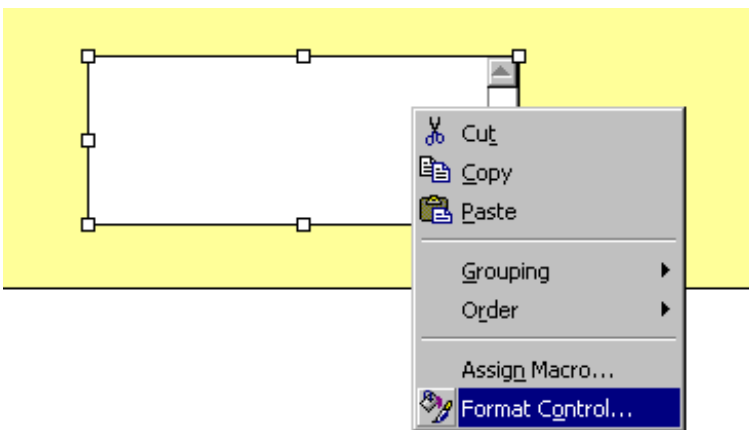
### List Option Boxes

- 1) Highlight the text in the Yellow Box - i.e. "**This is a possible .....**" and delete the complete text in the box.
- 2) Now Highlight the box itself and use the normal drag method to reduce the height of the box. Grab the lower edge and move the line up until it is approximately midway in row 12.
- 3) Select Menu **View, Toolbars, Forms -**



- 4) Select the button shown and draw a rectangle starting in cell **B6** (top left), and going to **E11**. - the exact size does no matter, but keep it within the height of the yellow box.
- 5) Now click on the box you have drawn with the **RIGHT MOUSE** button and select **FORMAT CONTROL**

You should see a box such as that shown below appear



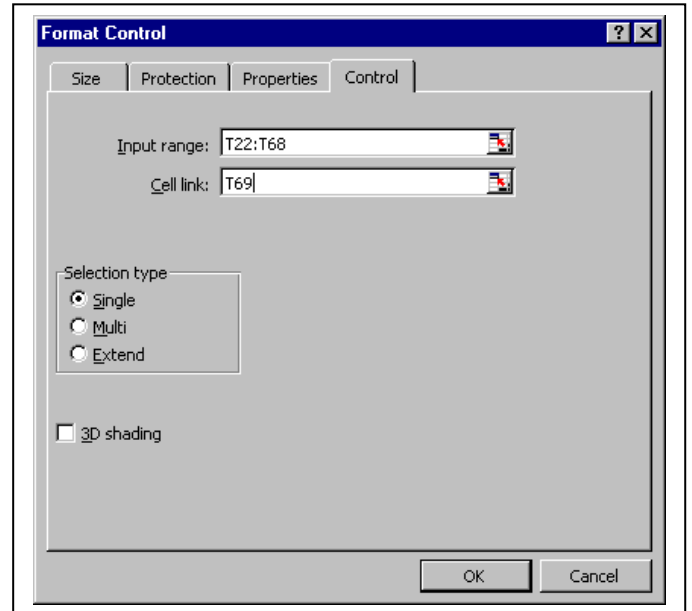
- 6) Now enter **T22:T68** into the Input Box dialog, and **T69** into the Cell Link.

You should see that the box is now filled with all the Tariffs, and further more there is a slider to allow you to scan down the range.

you select a different Tariff - the number in cell **T69** changes - i.e. if you select British Gas, the value in T69 is 1 whereas if you select Eastern Energy Quarterly, the value is 18 - or the 18th tariff in the list. It is perhaps a good idea to enter "**Linked Cell**" into cell **S69** to remind you that the cell in **T69** is linked to the option box.

What we now need is to be able to identify the relevant row of a particular tariff so that we can select the appropriate standing charge and unit charge.

- 8) Into cell **T70** enter the formula  $=T69 + 21$  and you will find that this now has the row number of tariff selected.



- 7) Try selecting a particular tariff - then look at cell **T69** - each time **INDIRECTION**

We now introduce the concept of **INDIRECTION** - that is the formula we enter is made up of a reference (which can itself be a formula and can refer to values in a particular cell).

- 1) Enter the formula  $=INDIRECT("T"&T70)$  into cell **B14**. What this is doing is constructing a formula as contained in brackets - i.e. into B14 we place the contents of the cell which is **INDIRECTLY** pointed to by the formula - in this case the column is T and the row is the number contained in cell T70. You should see the selected Tariff name replicated in cell **B14**.
- 2) Into cell **E14** enter  $=INDIRECT("D"&T70)$  - this places the standing charge (non-Direct debit) of your selected tariff in the cell
- 3) Similarly enter  $=INDIRECT("E"&T70)$  into cell **F14** and the correspond Unit Charge will appear.
- 4) Now try varying the option selected and you will see that the standing charge and unit charge will alter appropriately.

You may wish to highlight these two cells in an appropriate colour or perhaps place a border around them. Also to help clarity, you may also wish to place in Cell B13 - Current Supplier, and in cell E14 Stgchg and in F13 Unit charge to help you remember what these are.

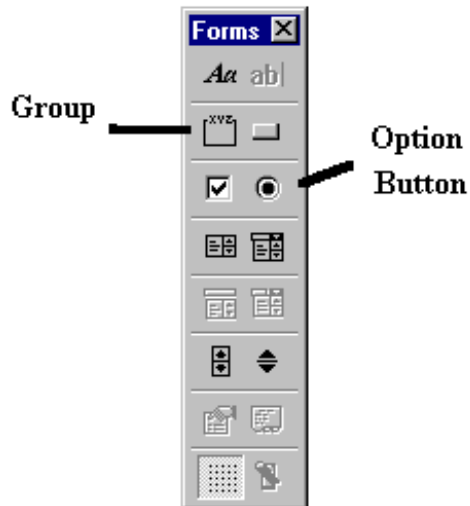
Finally to allow you select any tariff you must change the formula enter last time in cell **J17**. to

$=IF(AND(E14=0,F14=0),"not valid",(J16/J18-E14)/F14*100)$

If you now change either the supplier or the annual bill, you will find that the annual charges for all the other companies will change accordingly in column K.

**Option Boxes**

The only remaining issue you may wish to consider is the provision of facilities to select directly between Non Direct debit and direct debit. The full procedure will not be covered as it follows a form of **INDIRECTION**as indicate above and it would be a useful exercise for you to try.



- 1) First select the Option Button and draw a rectangle somewhere to the right of your list box. You will find that the text **OPTION BUTTON X** appears (where X may be any number. Highlight the text and change it to something more meaningful e.g. **Non-Direct debit**

- 2) Now click on the rectangle just drawn and select **FORMAT CONTROL** - enter a suitable cell reference into the **CELL LINK** - e.g. **U69**.
- 3) Now select a second option button and draw a new rectangle - this time call it **Direct Debit**. [ **DO NOT** enter a Cell Link this time!!]
- 4) Select the **GROUP** tool and draw a rectangle to full surround the two rectangles you have previously draw for the option boxes [ **WARNING this rectangle must NOT be crossed by either of the option box rectangles**]
- 5) If you have got things correct, you should now be able to select one option box, and if you select the other, the first automatically changes. You will also find that the linked cell - i.e. **U69** changes each time. Using this you can automatically provide the option to select form cells **E14** and **F14** either the Direct debit or the Non-Direct Debit Tariffs.

One way to do this last step would be to use an IF statement - i.e.

**if (u69=1,choose Non-Direct debit,choose direct debit)**