ENV - 2D02 Energy Conservation 2006

Details of Project Assignments

1. Management Report for UEA

2. Design of Low Energy House

3. Deregulation Project

Summary of Course Work Options [Deadline Dates are subject to confirmation as submision on a Friday is no longer permitted as of this year]

	Default Option	Low Energy House	De-regulation
17.6%	Management Study of UEA. Hand in Friday Week 8	Management Study of UEA. Hand in Friday Week 8	Deregulation Project Hand in Friday Week 11.
11%	Practical Write-up Hand in Friday Week 11	Low Energy House Design. Hand in Friday Week 11	Practical Write-up. Hand in Friday Week 8
4.4%	Management Study Group Seminar Presentation: Thursday Week 10 or 11	Group Seminar on House Design: Thursday Week 10 or 11	Poster Presentation: Thursday Week 11
67%	Examination		

Note: This section should be read in conjunction with the Assessment Details given in the main Course Description Handout.

The purpose of this section is to specify more details of the requirements for each project.

Module Assessment

The Module as a whole generates 20 credits, and the percentage derived from Course Work is 33%. There will be 2 items of course assessment as follows:-

Throughout all assignments you will work in groups of typically 3. There will be individual and group components to assignments.

1) **An assignment constituting 17.6% of the marks generated by the whole Course (including the exams).**

Either

> The task for your group is to act as an Energy Consultant Firm and produce a report on energy use within the University, making recommendation etc. where relevant on possible savings. This project will normally involve data collection in a manner similar to that in some of the earlier practicals, possibly additional analysis, and possibly an economic analysis. You will be given a separate specific document on this piece of work giving further details. The final report will contain both joint and individual components must be bound as one and submitted by **Friday of Week 8 [this is subject to confirmation].**
>
> As a further **4.4%** of the course you will also give a group seminar presentation on your findings/recommendations to approximately half the class in WEEK 10.

Or

> **Y**our group should analyse the issues arising from the current deregulation of the Energy Market. You should acquire data on price structures and determine the "BEST Option" for different types of domestic customer for GAS and possibly Electricity. A report will be required which will be handed in on **Friday Week 10 [this is subject to confirmation].**
>
> As a further **4.4%** of the Course your group will be required to produce a poster which will be displayed in Week 11. You WILL NOT give a verbal presentation, and will have to follow the special guidelines under the practical work below.
>
> NOTE:
> i) the deadline is different for this option because the study represents an issue which is rapidly changing at present.
> ii) The maximum number of groups of three who will be permitted to select this option will be restricted to 10 (i.e. 30 persons). If there is over subscription for this option, then a first come first served basis will apply. A decision to pursue this option must be made by Wednesday week 4 otherwise the first option will apply. Neither will you be able to change to the alternative after Week 4.

2) **Practical Work**

For those doing the UEA Management Project

You may choose to do either:-

1) write up **three** of the formal practicals (one by each member of the group). Details of which practicals are to be written up are given in the Assessment Details at the end of this handout. This describes, in full, the detailed requirements of the Projects. The deadline for submission for these is **Friday Week 10 [this is subject to confirmation].** You will thus be able to complete half the work well in advance, while the second practical will have one week for completion. Since the practicals will be written up after the sessions you should keep all the data in a logical manner and have them available for later access.

OR

2) Design a house which is efficient in conserving Energy. This design should encompass heat lost calculations, an economic and an environmental analysis. Some of these techniques will not be taught until later in the course. The hand in date will also be **Friday Week 10 [this is subject to confirmation].**

i) If you choose this option, you will be exempted from the practicals in **Weeks 5 and Week 7** (although you may of course attend them.
ii) A maximum of 10 groups (i.e. 30 people) may select this option
iii) If you choose to do this option, then you must discuss the matter with Dr. N.K. Tovey by week 4. **IF YOU DO NOT DECIDE TO DO THIS OPTION BY THE END OF WEEK 4 THEN YOU MUST DO OPTION 1.**
iv) **You cannot combine this option with the Deregulation Project**

For a further **4.4%** of the assignment your group will be expected to give a presentation (15 minutes) on either the design of the house and any issues arising, or the Management Study whichever is relevant.

For those doing the Deregulation Project

Because of the nature of the Deregulation project, the deadline of which is later in the Semester (unlike for the Management Project), you will be expected to complete a practical write up by Friday Week 8 **[this is subject to confirmation]**. Each member of the group will write up a different practical as indicated in the Assessment Details at the end of this handout.

1. Energy Management Report for UEA (3 – recommended Group size, 2 in a group also possible, but if you have a group of 4 you should consult NKT first)

> **Note: If you choose this option you cannot do the Deregulation Project**

Deadlines:-

        Report Submission: **Friday Week 7 for submission of report**
        Presentation: **Thursday Week 10**

Your group of three are to assume that you are acting as a group of Energy Management Consultants - see letter attached, and you should respond accordingly.

In weeks 1 - 3 data about thermal comfort in the University will have been collected by the whole class, and you should use this as a starting point for your management report. You may wish to collect further data if you target specific buildings [such data should also be added to the database]. Information on building dimensions etc will be given to you and you can examine strategies for conservation.

Your group may decide

Either

    to provide a general overview of the University. If you choose this option, then one person should consider the Teaching Areas, one the Residences, and one the communal areas such as the Library etc. Such an analysis should be a general overview, and much of the data collected may be adequate.

Or

    to concentrate on a specific issue or building. If you choose this option, you may wish to consider a single building, or merely the lighting in a range of buildings. However, each person should have a clearly identifiable task which will be written up separately within the group project

Whichever approach you take, you should agree the actual project during Week 6 practical session which is devoted solely for that purpose. In the past, projects have been varied from detailed temperature profiling in the Library - before the stairwell doors were fitted to surveying the light fittings (for low energy fluorescent fittings) in ENV or ARTS, to detailed studies of particular blocks of residences. - Nothing has yet been done on Village.

Requirements:-

Unusually, 2 copies of the report will be required. This is so that one copy can be archived and discussed with University Management.

The Management report should consist of sections as follows:-

1) Introduction - (group) giving basis and rationale of work done and a statement about the nature of UEA etc [20%]
2) Individual report on an agreed [with NKT] aspect of the report [60%]
3) Conclusions - (group) summarising the key issues, conclusions, and recommendations [20%]
4) Any supplementary Thermal Comfort Data collected must be entered into the UEA Data Base.

If you do not opt to do the House Design Project then you will be expected to give a seminar presentation on your findings in Week 10 (Thursday).

Your group will be expected to write up ALL the practical reports as follows. [each person should do one practical only so that all practical are written up by one person in the group]

1) Heat Pump Practical
2) Transport Practical and Seminar
3) Either
        Steady State Heat Loss Practical
   Or
        Dynamic Heat Loss Practical

If unusually your group has 4 members, then the final practical should be

4) Analysis of Thermal Comfort Data

School of Environmental Sciences
University of East Anglia
NORWICH
NR4 7TJ

Energy Consultants Anonymous
74 Causeway Bay Road
Newtown
Wessex
NT1 1AA

Attn: Senior Energy Manager

Dear Sir/Madam

I am pleased to inform you that your tender to carry out an Energy Conservation Survey of the University of East Anglia has been accepted, and that you should submit your completed report to the School of Environmental Sciences by 14:00 on Friday 8th March 2002 at the latest.

You are reminded that the University has limited capital resources and will normally expect a pay back on any scheme proposed in no more than two to three years at most except in exceptional circumstances.

The University agrees with your suggestion that a team of three people be employed, and suggest that each person be responsible for a specific area or topic within your study.   Dr N.K. Tovey in the School of Environmental Sciences will be available on Thursday mornings (7th, 14th and 21st Febraury, 2002) to discuss detailed matters on this. Please contact him if you need to arrange a meeting.

The University wish the format of the report to be as follows. An introduction and conclusion with general recommendations to be a joint report from all three members of the investigating team. There should also be a separate account about the work done by each individual member.   All sections of the report should be bound together. In this way the University can conform to the requirement that the different members of the team can be remunerated differently should the standard of their work be different. The University propose that 20% of the remuneration should come from a joint presentation to be given to members of the University on Thursday 18th April 2002 at 14:00 in a venue to be notified. Of the remaining 80%, the remuneration will be divided as 40% for your Company with the remaining 60% paid directly to the individual members of your group.

Should you have any queries you should contact Dr Tovey as indicated above.

Yours sincerely,

(N.K. Tovey MA, PhD, CEng, MICE)
Energy Science Director,
Low Carbon Innovation Centre

2. Course Work Assignment: House Design Alternative: 3 People recommended (2 man groups have done successful projects in the past. With four people, you will need to discuss the matter iwht NKT. before starting

> **If you choose this option you will do the Management Plan, but will be exempt from practical write-ups. You also will not need to come to practical in weeks 7 and 8 (although you may wish to attend part of week 7 as illustrative material not covered in the lectures will be included in that session).   YOU CANNOT COMBINE THIS OPTION WITH THE DEREGULATION PROJECT.**

DEADLINES: SEMINAR PRESENTATION in Week 10 (Thursday)
                 Final Report by Friday Week 10 [17:00]

Introduction

As indicated in the handout describing the course you may opt (instead of two practical write-ups to design an energy efficient house.   This is a new idea which has not been attempted before and may thus have some teething problems. For this reason, and for the limits on relevant software, and also the need for significant individual supervision, the maximum number who may opt for this alternative will be limited to 24 (or 8 groups) on a first come first served basis.

The basic requirement is that you design an energy efficient house following a set of minimum guidelines. It is recommended that you work in groups of 3 to achieve this so that one person can concentrate on some aspects, while another looks at other points.   Included in the design must be an appraisal of overall environmental emissions (e.g. CO_2 etc.) associated with the normal running of the house (those of you who are doing ENV-2D06 this year, should consult your notes on this aspect as you will find these helpful as background information). Also there must be an economic appraisal for any measures you employ over and above the minimum guidelines set down.

If you opt to do this rather than the two separate practical write-ups, then you will be exempt from the following practical to give you time to work on the projects:-

- the domestic heat loss practical using computers in weeks 4 or 5 (this practical duplicates what you will be doing in your design)

    Some aspects of the dynamic heat loss practical will also be covered in the project so you may wish to attend only part of this one too.

If you have not confirmed with NKT that you can do this project by Wednesday of week 4 then you will automatically follow Course Work Assignment 1 with the requirement for two practical write-ups.

Report Requirement

The delivered project must include as a minimum:-

1) a plan of all floors drawn to a scale of **1:50.** Key elevations should also be sketched. If a central heating source is to be used, then an indication of the pipe or duct runs should be shown on the plan. Remember ducts are 200x150 mm is size so need more room than hot water pipes. There should be a written account to accompany the plans explaining why the design was chosen (e.g. why kitchen placed where it is), and also a discussion of the thermal properties of the materials to be used (e.g. double-glazing with K-glass etc.). [15%].
2) A presentation of your design of house and the salient point of energy use should be presented to the class in Week 10 or Week 11 [times to be arranged]. This presentation should be no more than 15 minutes and all members of the group should contribute [10%]

3) heat loss calculations to show that the house conforms to the minimum standard laid down This must also include an indication of the Standard Assessment Rating [SAP] of the actual house design with the actual material used as well as the SAP of the identical design but using materials to the standards laid down by the building regulations [1994] [20%]

4) an economic appraisal of the heating system chosen and any features which provide a design which uses less energy than the basic standard. [20%]

5) an assessment of the environmental emissions associated with the running of the house compared to the equivalent emissions for a standard house. You may neglect the energy cost of constructing the house [20%]

6) a conclusion describing the overall benefit (or otherwise) of the house in energy, economic and environmental terms [15%]

Items [1] and [5] should be tackled jointly by the members of the group. It is expected that all member of the group will share the work in all parts of the project, but that individuals will be responsible for writing up different component parts. For a group of 2, item [2] may be done jointly but [3] and [4] should be written individually and indicated as such. For groups of three, items [2], [3], and [4] should be written individually and indicated as such.

The Minimum design requirements (options):-

- The design may be a two storey house or a bungalow. It must be detached. It may be assumed that it is in a sheltered environment (with respect to wind).
- The design may make optimum use of passive solar gain (size of windows etc.), but the design must be either standardised or have a modification to allow for houses built on the north or south side of a road running east - west. The maximum difference in energy consumption between the two locations of house must not exceed 2%.
- The room sizes must all be at least the sizes indicated below
- Ventilation must be provided to the minimum standards laid down [see individual rooms]
- An open fire place must be provided in the lounge for the occasional log fire. You may choose whether to include this as a serious secondary source of heating or whether to neglect it as its annual use would be very limited.
- Fire regulations prevent any part of the proposed building being within 2m of any boundary fence.

Minimum dimensions:-

The term house is intended to refer to either a house or a bungalow in the following:-

- The plot of land on which the house is to stand has a frontage of 15m and depth of 35m. The building line must not be closer than 8m to the front or rear boundary lines of the plot.
- The house must be detached and single or two storey
- There must be four bedrooms, separate lounge, dining room, and kitchen, a cloakroom, bathroom, separate WC, and a bathroom and WC attached to Master bedroom. All rooms must be accessible without the need to pass through another room with the exception of the bathroom in the master bedroom. Storage space for an airing cupboard including a hot water cylinder of the standard 165 litre capacity must be provided.
- Solar hot water heating is optional, but if provided there must be room for two separate hot water storage cylinders.
- The kitchen must not face the front of the house. Access must be provided from the lounge to the back garden via Patio Doors. The front door may be either on the front or one side of the house. There must be a back door from the kitchen.
- The primary (or sole) heating and secondary heating (if any) may be chosen at will as may be any control system used. The systems and controls should be chosen from the lists provided in the Appendix of the Current Building Regulations.
- If central heating boiler or heat pump or equivalent are used, then space for this must be provided in kitchen [600 x 600mm]. If gas central heating (radiator system) the wall mounted boiler may be used.

Room dimensions - minimum requirements:-

Room	Minimum Area (square metres)	Maximum Length - Breadth Ratio	Special Ventilation
Lounge	24	1.5	1 fire place
Dining Room	18	1.5	-
Kitchen	18	2.0	1 vent
Cloakroom	4	2.0	1 vent
Passageways (e.g. hall / landing)	optional but minimum width 1.8m		-
Bathroom	5	2.0	1 vent
WC	2	2.0	1 vent
Master Bedroom	18	1.5	-
bathroom attached to above	4	2.0	-
Bedrooms 2 and 3	10	1.5	-
Bedroom 4	6	2.0	-
Airing Cupboard Space	Optional		-
Enclosed Porch	Optional		

Ventilation may be natural ventilation, mechanical ventilation, with or without heat recovery.

Method

There are no hard and fast rules about design for energy efficiency apart from the fact that the benefit of passive solar gain is greatest if the highest proportion of windows are on the south side of a house. The constraints imposed requiring a design which will satisfy both sides of the road will mean that you will either have to compromise here or have an alternative design for one side as opposed to the other. Most of the energy saving will come from careful selection of the thermal properties of the construction materials and heating system.

- First design a floor layout which will give at least the minimum specification as given above.
- Now consider the elevations. You should note that the maximum permitted area of windows, doors, and roof lights is 22.5% of the total floor area, but this figure may be increase provided that the level insulation increases appropriately (i.e. moving to triple glazing). All rooms except passageways and airing cupboard must have a window capable of being **opened** which is at least 5% of the floor area. The total glazed area in these rooms should not be less than 10% of the floor area. A mechanical extraction system may be used for master bedroom bathroom. Make a provisional design of elevations.
- Consider whether design is suitable for both sides of the road
- Analyse house using newly developed software [see NKT] entering values which just conform to current regulations as a base case. This will also automatically calculate solar gain
- Now consider additional insulation etc. and do a second run on the computer - note the dimensions do not have to be re-entered.
- Check to see how much design on other side of road differs.
- Select heating Method and complete heating calculation for base case and two sides of road to determine SAP.
- Refine level of insulation and/or heating method as appropriate and repeat last three stages to finalise the design.
- Do an economic appraisal of the additional measures employed.
- Do an environmental appraisal of the emissions associated with the house for the base case and the final designs for both sides of the road.

Time scale - the following are target dates.

   This project does require some work, and for this reason two full practical periods have been cancelled for you. However, the project does require you to have time to think and consider each stage before going on to the next, so do try to adhere to the dates, otherwise you will find yourself rushed at the end.

● **Plans/elevations**
   You should make efficient use of the practical period in Week 4 or 5 to ensure that you have a basic layout of plans, and elevations for your house as soon as possible. You should have these checked by NKT before proceeding further.

   Aim to have a design roughly done by mid-week 6 at the latest

● **Initial Heat Loss for standard design - aim to complete by end Week 7**
● **Optimising insulation etc. - complete by beginning of week 8**
● **Economic analysis and Environmental Analysis - week 9**
● **Preparation for Seminar Presentation in Week 10 or 11**
● **Finalise report Week 11**

Economic Information - capital costs

Base case has gas central heating boiler (standard low thermal capacity - fan assisted) with radiators, uninsulated pipe work to hot water cylinder, hot water provided by gas. Control is provided with a programmer and roomstat.

If particular option for heating is not shown below assume that charge is same as for base case

additional cost of loft insulation above base case	50p per square metre for each 25 mm increase in thickness
Argon filled double glazing	£10 extra per pane
K-glass instead of normal glass	£25 extra per pane
extra for triple glazing	£150 per square metre
extra wall insulation	£1 per square metre for each 10mm increase in thickness
extra floor insulation	£2 per square meter for each 10mm increase in thickness
Extra for Gas condensing boiler	£250
Extra for Oil boiler (for tank)	£400
Extra for Oil Condensing Boiler	£650
Extra for Heat Pump (with radiators)	£500
Hot air systems (extra for ductwork)	£400
extra for TRVs	£15 per radiator
extra for Boiler Energy Manager	£300
Solar Hot Water heater basic charge for tank and pump and pipework	£500
Extra per square metre of solar panel	£800
extra for mechanical ventilation with heat recovery (only possible with warm air systems)	£500

Data for environmental emission analysis will be issued later

SOFTWARE:

There is specifically written software for this project which is accessible from the Energy Desktop ICON in Lab D or Lab E. Provided you give several days warning, I can make a version suitable for running on your own computer, but I shall need the following information.

- Which is you default Hard Drive – usually this will be C: but in Labs D/E it is in fact D:
- Which drive is your Office Software installed on. Often this will be C:, but not always

If you only have one hard drive, then the drive letter in both case above will be C:

- Which version of Office are you running Office 97 or Office 2000/XP?
- Which Operating system are you using Windows 95, 98, NT, 2000, XP?

A Special Session in Week 4 will be devoted to demonstrating how the software works at 18:00 on Monday in Lab D – see Appendix for the Handout.

Marking:

The following criteria will be used in marking the project

Section 1

The overall design of the house, the presentation of the plans, the readability of the account (it should be concise), the justification of the options chosen. This section should not exceed 500 words.

Section 2, 3 and 4

The completeness of the analysis and discussions with respect to the standard base case house, and how the houses on the different sides of the roads compare. What is concluded by the use of different heating systems. The discussion on each section should be concise and not exceed 500 words

Section 5

The presentation and readability of the conclusions, the implications such a design would have on overall UK energy strategy. This section should also not exceed 500 words.

3. Deregulation Project Alternative: - 3 or 4 People per group recommended – 5 possible

Note: If you choose this option you must do the practical write-ups - you may not do the house design.

The Practical write-ups should be done as a group with each person doing one write-up

The write-ups must include

1) **The transport practical**
2) **An analysis of the class thermal comfort data collected at UEA**
3) **either**
   The steady state heat loss calculation practical in week 5/6 (using computers)
   or
   The dynamic heat loss practical in week 7/8

If there are 4 people in the group, then all the above 4 practicals should be written up
If there are 5 people in the group then all the above should be written up but the Transport Practical and Seminar should be written separately. For the person writing the seminar, you should also explore issues such as alternative fuels for vehicles – e.g. hybrids, hydrogen etc. – would they really help to conserve fuel?

The Deregulation Project

The aim of this project is to provide an independent means of checking which energy supplier gives the best deal for a particular domestic consumer. Emphasis will be placed on developing skills which will allow you to do this independantly of other information sources - e.g. OFGEM.

The report on the Project is due on Friday Week 10 , but you will also have to present a poster in week 11 which should cover no more than 4 sheets of A3 paper - or equivalent. Have a look at some of the posters on the walls in ENV to get an idea of what to present. You will not give a verbal presentation.

NOTE: In the last 18 months, several WEB Sites have appears which do a partial comparison of prices. While you may use these as a comparison and check with your analysis, if you do not develop you own analysis for demonstration in the Poster Presentation Session, then the maximum mark for the Group elements will be 25 – i.e. the maximum total mark will be 85.

WRITTEN REPORT

The marks for the written part of the project will be allocated as follows:-

- Group Introduction [30%] - 500 - 1000 words. This should give a historic perspective of changes in Energy Supply. You will need to consider how the prices have changed both in actual value terms and in real terms - allowing for inflation. 50% 0f this mark will include a component mark for the software you have developed.
- Individual Report on selected aspect [60%] There are several very useful sources of information on the WEB - see the Energy WEB Links Page
  http://www2.env.uea.ac.uk/gmmc/energy/enpoint.htm

  The individual topics must be agreed in advance with the course convenor, but might be one of the following:-

  1) a review of energy price changes from 1950's to onset of deregulation. For this you will need to consult data in the Library. Probably the best sources are the Digest of UK Energy Statistics (DUKES), and Energy Trends - in official publications section of library with latest version - on line an

accessible from the Energy Pages WEB Links. You will need to consider how the prices have changed both in actual value terms and in real terms - allowing for inflation.   For prices prior to 1971, you will need to know that 1 shilling was worth 5p and 2.4 old pennies equalled 1 new penny.

2)   an analysis of proposed tariffs for new suppliers for gas, and which ones give the best value and for what range of customers - i.e. does the best supplier vary depending on actual consumption etc.?.   Preliminary   data   for   this   analysis   may   be   found   on   the   WEB   at   http://www.ofgem.gov.uk/customers/index.htm, and a Template is available from the Energy Software or from the ENV-2D02 WEB site.   However, watch what happens as these figures are prone to change month by month.   Further, though most suppliers have a uniform tariff across the country, one or two have different tariffs in different parts, and you may have to check out data according to a Post Code.(see below).

You should explore both Standard Credit and one Direct Debit Tariff for each supplier.   Ideally you should not only be able to show general ranges of which is the "Best Buy", but should also allow people to enter either a specific annual consumption or an annual Bill with a particular company.

3)   an analysis of the best buys for electricity since deregulation. There is no one page which gives all the data, but most of the suppliers give their tariffs on line. You may access these from the list of suppliers shown on the Energy LINKS WEB Page
http://www2.env.uea.ac.uk/gmmc/energy/enpoint.htm .

On some Energy Supplier WEB Sites, the relevant link does take a little bit of searching.   What you need is the tariffs (prices) - not how much you can save.

Unlike gas, almost all suppliers have different tariffs in different regions. You can check out variation using the Post Codes indicated in the Appendix.   Some WEB Sites give you direct access to the tariffs. Some require you to enter data of current use and then give you a saving and show how this has been calculated by giving the tariffs at that stage.

You should explore both Standard Credit and one Direct Debit Tariff for each supplier.   Ideally you should not only be able to show general ranges of which is the "Best Buy", but should also allow people to enter either a specific annual consumption or an annual Bill with a particular company. With Electricity, there are often multiple Tariffs - e.g. Economy 7, Economy 10, Standard (general) etc.

For the purposes of this assignment you need only consider the Standard Tariff assuming that the consumer has gas central heating and hot water and thus would not normally be interested in the Economy 7/10 etc tariffs as these are designed for Off Peak Electric Space Heating.

If you are doing either section (2) or section (3), you are expected to develop your own facilities for comparing prices at any give price or consumption as will be shown in the special informal sessions held in weeks 2 - 4 for groups doing this project. Relying solely on the commercially available sites will not achieve a high mark.

If there are 4 or 5 people in the group then one (for 4) or both the following options should be done.

4)   If there are 4 people in the group, then a fourth task should explore the variations in tariffs in electricity across at least 4 different regions of the country.

5)   If there a 5 people in the group, then the fifth task should include a critique of the commercially available software – in particular do all the site give the same answers!

You will be expected to include a copy of your EXCEL Spreadsheet on floppy disk for the assessment.

- Group conclusion [10%] - 250 words maximum

The Poster Presentation

The Poster should summarise the findings of all memebers of the group and should cover no more than the equivalent of four A3 sheets of paper. Have a look at some of the posters on the walls in ENV to get an idea of what to present. You will not give a verbal presentation.

If you wish you may include a live demonstration of any software you have used to calculate the annual bills, but, unless you have your own Lap Top, a computer must be this must be booked well in advance.

Appendix

For many of the suppliers it may be necessary to specify a particular Post Code.

If you wish to explore variations across the country then there are basically the following regions to consider

Region	Use Post Code
Eastern	NR (Norwich)
London	HA (Harrow)
South Eastern	CT (Canterbury)
Southern	SO (Southampton)
South West	EX (Exeter)
South Wales	SA (Swansea)
Midlands	CV (Coventry)
East Midlands	LE (Leicester)
MANWEB - Merseyside and North Wales	LL (LLandudno)
North West	CA (Carlisle)
North East	NE (Newcastle)
Yorkshire	YO (York)
South of Scotland	EH (Edinburgh)
North of Scotland	AB (Aberdeen)

You can construct any dummy post code as long as you start with the above letters

e.g. NR1 1AA for Eastern Region and use that when prompted.

APPENDIX 1: 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 ths later session you should be able to use the Spreadsheet effectively for you Project.

First, you should obtain the TEMPLATE for this dmeonstration. 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 buy 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:-

$$= (J16 - D22)/E22*100$$

the 100 arises because of the pence   **(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**

So the formulae for cell **T22** is   **=(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 (1st 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(condition,true formula,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

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In the conditional part of the formula we can use any combination of arithmmtic 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 standout 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(l$17<>"","",T22)

- Similarly change the formula in Cell **N22** to
  = IF(l$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 diference 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(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 to 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.

=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.

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 **Y22** the formula   **=IF(B22="","",B22)** and then copy this formula in the range **Y22:Y99**

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

3) Enter into cell **T22** enter the formula
   =IF(Y22="","",Y22&": "&C22
   [note there are spaces after the : - you can add as many as you like]

3) Now copy this formula in the range **Z22:Z99**
   The cells in column **Z** contain both the Company and the tariff, where a company has more than one tariff or area.

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 11, and also at the boundary of columns J and K.

3) Select Menu **View, Toolbars, Forms -**

Select this Button

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.
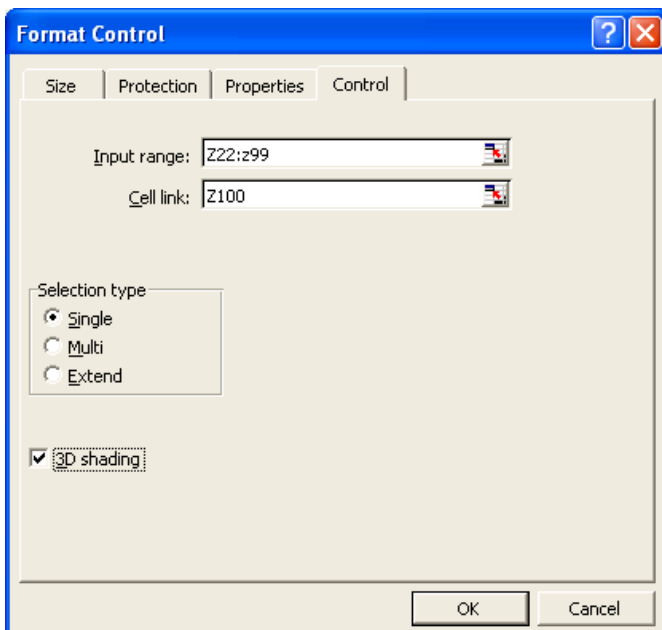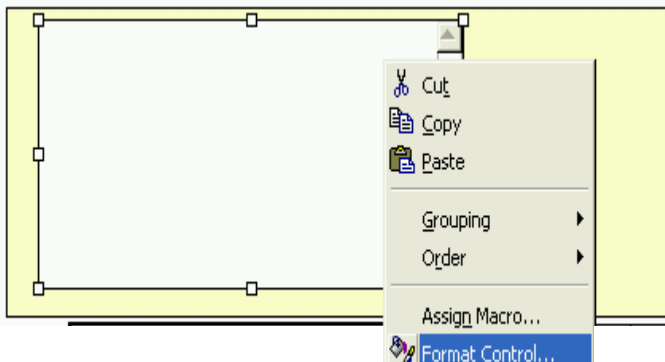
5) Now click on the box you have drawn with the **RIGHT MOUSE** button and select **FORMAT CONTROL**

   You should see a box such as that shown below appear

6) Now enter **Z22:Z99** into the Input Box dialog, and **Z100** into the Cell Link. You may wish also to check the **3D sharing option.**

   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.

7) Try selecting a particular tariff - then look at cell **Z100** - each time you select a different Tariff - the number in cell **Z100** changes - i.e. if you select Amerada Hess, the value in **Z100** is 1 whereas if you select Scottish Power/ Manweb Area 1, the value is 8 - or the 8th tariff in the list.

8) It is perhaps a good idea to enter **"Linked Cell"** into cell **Y100** to remind you that the cell in **Z100** is linked to the option box.

9) 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.

10) Into cell **Z101** enter the formula **=Z100 + 21** and you will find that this now has the row number of tariff selected.

11) Finally, enter "**B**" into cell **B100**, "**C**" into cell **C100**, "**D**" into cell **D100** etc across to cell **L100**

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(B100&Z101)** into cell **B13.** What this is doing is constructing a formula as contained in brackets - i.e. into **B13** we place the contents of the cell which is INDIRECTLY pointed to by the formula - in this case the column as defined by cell **B100**, i.e. column "**B**" and the row is the number contained in cell **Z101**. You should see the selected Tariff name replicated in cell **B13.**

2) Into cell **D13** enter **=INDIRECT(D100&$Z101)** - this places the standing charge (non-Direct debit) of your selected tariff in the cell. **NOTE:** the **$** in this formula.

3) Now copy **D13** to **E13:G13**

4) At this stage, all the relevant parameters for Non Direct Debti should appear in row 13. Try changing the selection of the tariff in the List-Box and you will see the values change accordingly.

5) Now we do the same for the Direct Debit as shown below.

6) Enter **=IF(B13="","",B13)** into cell **B14**

7) Enter **= INDIRECT(D100&$Z101)** into **D14**

8) Copy **D14** into cells **E14:H14**

Option Boxes

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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 indicated above and it would be a useful exercise for you to try.

9)　　　Enter **= INDIRECT(D100&$Z101)** into **D14**

10)　　　Copy **D14** into cells **E14:H14**

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 indicated 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**

3)　Now click on the rectangle just drawn and select **FORMAT CONTROL** - enter a suitable cell reference into the **CELL LINK** - e.g. **AA100.** Highlight the text and change it to Non-Direct Debit

4)　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!!]. Highlight the text and change it to Direct Debit

5)　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**
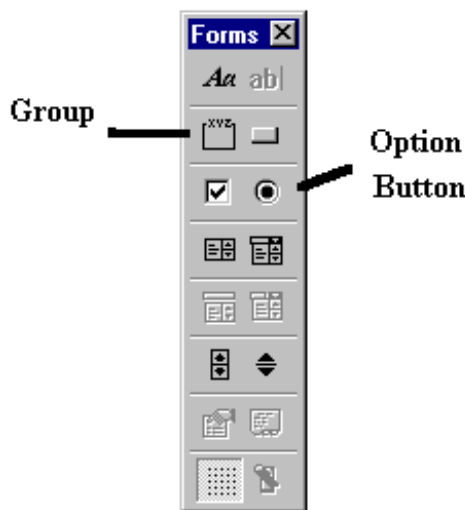
the option box rectangles]
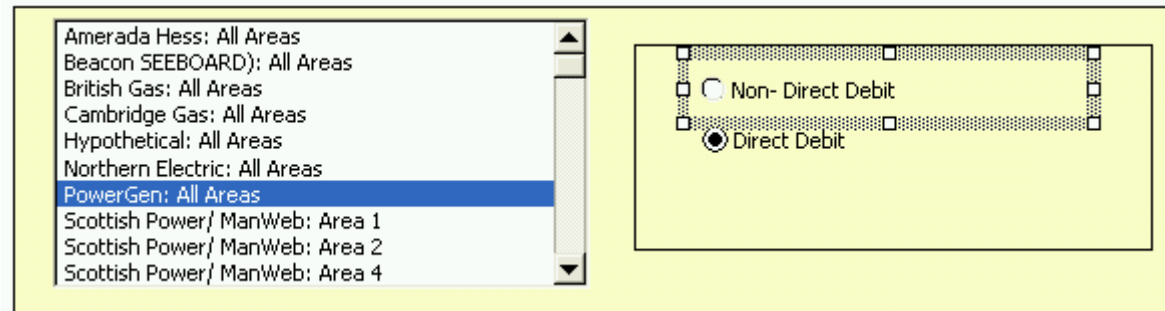
5)　If you have got things correct, you should now be able to select one option box, and if you select the other, the first automatically changes. You will also find that the linked cell - i.e. **A100** changes each time. Using this you can automatically provide the option to select either the Direct debit or the Non-Direct Debit Tariffs.

6)　You will see that formulae have already been entered into the block of cells K6:N9. You are encouraged to check you are satisfied with the formulae in these cells.

7)　Finally, Enter the following formula into cell **J17**

　　　=INDIRECT("M"&AA100+7)

　　　What this is doing is another **INDIRECTION** as set by the option buttons (remember the link cell is **AA100**, and the value will pick of either the Direct or Non-Direct Debit number of units in cells **M8** or **M9.**

The Spreadsheet is now ready for use and should cover most options

You will find you can select any company and any tariff and either Direct Debit or Non-Direct Debit and as you change the consumption all the other tariffs change accordingly