T206 Energy for a sustainable future

T206 Project: Supplementary Guidelines

These guidelines give an outline of what I will be looking for in a good project report. They should be read alongside the T206 Project Guide and intended as interpretation of some of the points in that guide

General Items

Report Structure and Form

The project guide gives word count of not more than 4000 words. In practice you are allowed some leeway and a report of between 4000 and 5000 words will not be penalised. However, Word counts above 5000 will be penalised. I will not apply specific penalties to reports much shorter than 4000 words. They usually penalise themselves by not including sufficient information.

Please include a word count at the front of your report.

Follow the structure given in the Project Guide. Note that the main text should contain the following

- An Introduction
- The main body of the report divided into sections with headings and sub-headings
- A Conclusion. This may be in the form of recommendations. Your recommendations should include figures, e.g. CO_2 reductions, estimated cost of implementing your proposal

The report format includes an abstract or synopsis. This is a summary of your report, typically 150 – 200 words long and should include as a minimum;

- a brief statement of the problem you investigated.
- A summary of the main recommendations with figures (see conclusion above)

Your report *must* be properly referenced using an accepted convention. I have provided a separate document on referencing which describes the method used in the course texts. The T206 Project Guide asks you to use this method.

In summary the recommended format is

Citing in the text: Author + date only

Reference list at the end: Author, date, title, source.

***Notes on referencing*:**

1. Web sites must be referenced in *exactly the same way* as other sources. *Do not* include web urls as citations in the text. You do need to add the date you accessed the site as web sites are prone to change without notice.
2. All diagrams, graphs, tables which you have *not* created yourself should be sourced by citation in the manner above.

All three topics indicate a readership who are not experts in renewable energy, so the style of your report should reflect this. You need to include relevant numerical data in your report, but it is generally better to put details of calculations, including equations used, into the appendices and only include the final results in the body of the report. Graphs and tables are often the most effective way of summarising numerical data so make use of these in the body of your report.

Sources of Information

The course materials are very useful sources of much you will need but are not sufficient in themselves. They are a good source of methods but for information for your calculations etc. you will need to make use of outside sources. These can include print sources such as books and/or journals from local public or college/university libraries, but your main source is likely to be the internet. There are links from the T206 e-desktop to get you started. When using internet sources, be aware that some sources are better than others so be critical. For example, be very careful if you use Wikipedia, the quality of its information is very variable, so use it sparingly and cross check the information if possible.

The T206 spreadsheets are very useful for allowing you to size renewables. In some cases there is also costing information.

Topic Specific guidelines

Topic 1; Energy for a Field Centre

I strongly advise you to locate the field centre in an area you know. This does not have to be the UK and for students in mainland Europe, locating it in your own country means you are aware of local factors that will enable you to create a field centre that fits the specification given more effectively.

For a good answer I am looking for the following

1. A description of the centre and its location
2. An estimate of the current energy requirements of the building
3. An assessment of possible savings by bringing the building at least up to current standards of insulation and by provision of more efficient appliances.
4. At least *two* possible alternatives to the current energy provision for ***each*** of, with figures;
    - Space and water heating
    - Cooking
    - Electricity supply
5. A suggested scheme or scheme(s) which involves both energy saving measures and provision of sustainable energy supplies to meet the energy needs of the centre
6. A concluding section comprising a clear set of recommendations which includes estimates of both the CO_2 reductions and the costs of the scheme.

Notes

1. The description in the project guide gives information on accessibility of the site. This is there for purposes of setting the scene and it is not intended that you include transport to and from the site in your recommendations for energy savings.
2. Remember the name of the organisation buying the centre and the kind of use they are likely to put the centre to. Your proposals should be commensurate with their purpose. Proposals should involve more than simply renewing the diesel generator and running it on biodiesel and/or replacing fuel oil with LPG for heating.

Topic 2: Energy sustainability in a village

For similar reasons to the field centre, I strongly recommend that you locate your community in an area you know. This does not have to be the UK. Even if you give you community a fictitious name, it is a good idea to base it on a real location. This enables you to provide a realistic base for;

- location of and distances to places of work, shops, schools etc.
- current public transport services in the area.
- other local amenities, nature of countryside etc.

For a good report, I expect to see

1. A description of the community and its location
2. An estimate of the current energy needs of the community and hence, CO_2 emissions. This should include both household energy and transport energy.

3. *At least one* proposal for *each* of the following, with figures for energy saving/CO_2 reduction;
    - Reducing household energy demand
    - Reducing transport energy demand
    - Providing a sustainable energy supply
4. A suggested scheme or schemes involving some combination of the proposals above which will achieve the desired reduction in CO_2 emissions.
5. A clear set of recommendations which includes estimates of both the CO_2 reductions and the costs of the scheme. Your CO_2 figures must show your proposals will meet the 10% reduction specified in the project guide.

Notes:

1. Estimates of household energy may be made on a basis of typical figures found in available literature or, you can take a typical dwelling (say for a family of four) and use the methods in the course materials to estimate annual electricity and space heating requirements. Multiply this figure up by the number of houses in the community to give a total figure.
2. For electricity supply you will need to get some typical figures for the mix of types of power generation (gas, coal, nuclear etc.) in your region and estimate CO_2 emissions from that.
3. For transport energy, assume a mix of personal and public transport and take appropriate average figures for fuel consumption/CO_2 emissions. Multiply these up accordingly. Remember that other local communities will also be using the public transport.
4. The project guide says that simply buying electricity from green suppliers is an unacceptable proposal. Similarly simply replacing diesel fuel in vehicles with biodiesel is also unacceptable. You must come up with something more.
5. The 10% figure given in the project guide simply means you have to show a reduction of at least 10% at the end of the 10 year period. You do not have to achieve a 10% reduction every year.

Topic 3: Investment in sustainable energy

This topic is first and foremost about investment. You are recommending investment of up to £250 million, so there must be a financial case to be made. It is not your job to make it in detail, but you do need to indicate that it is likely that investors can expect a reasonable return for the money they put into the project.

This is also about ethical investment. You need to show that in making their investments they will help to reduce CO_2 emissions. The topic specifies a “significant reduction” in CO_2 emissions but does not say what that is. I suggest you aim for around 5% reduction compared with existing technologies.

For a good answer I am looking for;

1. A brief description of the technologies involved in each of the four given areas in layman's terms including;
    - Advantages and disadvantages
    - A brief outline of current developments and future prospects
    - Potential prospects for investment

2. A selection of two areas for investment with reasons
3. For each of the areas selected for investment
   - More details of the specific technologies
   - Estimates of contributions to CO_2 reduction
   - Indication of how much should be invested and prospects for a reasonable return on investment.
4. An overall concluding statement with firm proposals including potential financial returns and CO_2 reductions.

Notes

1. You need to think carefully about how you allocate the available word count. I suggest you should think in terms of 50 – 60% of your report on the four areas and 40 – 50% of the report on the selected topics. This means about 500 – 600 words on describing each of the four given areas and 1600 – 2000 words on your specific proposals. Don't forget the need for an introduction and conclusion, though.
2. Estimates of emission reductions will inevitably be of a somewhat "ballpark" nature. Data on CO_2 emissions per installed kW are available I suggest you select a "conventional" power station as a baseline (CCGT or a coal fired power station, for example) and compare your emissions against that baseline and express them as a percentage of the baseline figure.
3. A similar consideration applies to the financial side. You need to give an indication of the return investors might expect. This is only a very approximate figure at this stage. The conventional method of measuring return is the ratio of annual income to capital invested. For example if you invest £100 and earn £5 from it in a year, your return is 5%.

   A sufficient estimate of return in this case can be obtained by using the generic figures for capital cost of a power station per installed kW and the figures for generating cost per kWh. You will need a figure for kWh energy generated per year. This can be obtained from;

   Annual generation (kWh) = installed power (kW) × load factor × 8760 hours/year.

   Load factor can vary from about 30% (for a wind turbine) to over 80% (for a baseload conventional power station).

   Example: A 1MW wind turbine has a capital cost of £750 per installed kW and a load factor of 30%. The total generating cost is 3p per kWh and the selling price is 5p per kWh.

   Total capital cost = 750 x 1000 = £750 000

   Annual energy generated = 1000 × 0.3 × 8760 = 2 628 000 kWh.

   Annual generating costs = 2 628 000 × 3/100 = £78 840

   Annual income = 2 628 000 × 5/100 = £131 400

   Return on investment = (131 400 – 78 840)/750 000 × 100 = 7%

   Acceptable returns vary from around 5 – 8% for a low risk investment to 25 – 30% for a high risk investment. The minimum acceptable return is usually determined by the current bank rate. For a low risk investment, you should look for a return of bank rate + 2 – 4% with the figure being higher as the risk increases. Risk in this context means the risk of the project failing to prove profitable.