Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2021–2022

Environmental Technology

Internal Assessment Task

Unit AS 2

assessing

Renewable Energy Technologies

[SET21]

VALID FROM SEPTEMBER 2021

INSTRUCTIONS TO CANDIDATES

- Your report should be a maximum of 3250 words.
  - The introduction should not exceed 500 words.
  - The desktop research should not exceed 1000 words.
  - The practical investigation should not exceed 500 words.
  - The discussions and recommendations should be a maximum of 1250 words.

- Your work may be informed by working with others, but each candidate must provide an individual response.

Candidates' work to be submitted **May 2022**

Coursework must comply with the Regulations as detailed in the Subject Specification.

NB: Some Coursework Tasks instructions may constitute more than 1 page.

Please check you have all the information you need to complete the task if printing from a computer.

Assessment Task

Unit AS 2 gives you an opportunity to apply your knowledge and understanding of renewable energy technologies to a real life scenario. You will explore how different technologies can be adapted to suit particular situations and will use your skills of research and analysis to make decisions regarding the use of renewable energy on a commercially viable basis.

Scenario

You are employed as an Energy Consultant with Oldberry Consultancy Services Ltd.
The owners of a commercial restaurant have recently released a call for tenders for **'The replacement of the existing gas heating system and electricity generation plant in the restaurant'.**

In your capacity as the Energy Consultant with Oldberry Consultancy Services Ltd., you are required to consider the details provided below and carry out an assessment of the new generation plant with regards to the potential installation of wind, solar, or biomass technologies.

Briefing details for the tender are as follows:

- The owners require that the carbon footprint for the restaurant be as small as possible.
- The kitchen in the restaurant has an energy consumption as shown in **Table 1.**

Appliance category	No. of appliances in kitchen	Average daily energy usage (kWh)
Walk-in Fridge	1	13.8
Walk-in Freezer	1	39.2
Grill	1	3.69
Steamer	1	1.20
Heat Lamps	10	1.38 each
Bain Marie	1	2.72
Other Cooking Appliances	3	6.08 each
Fryers	2	2.72 each
Combi-ovens	2	2.38 each
Other	3 Fridges 2 Freezers	3.90 in total

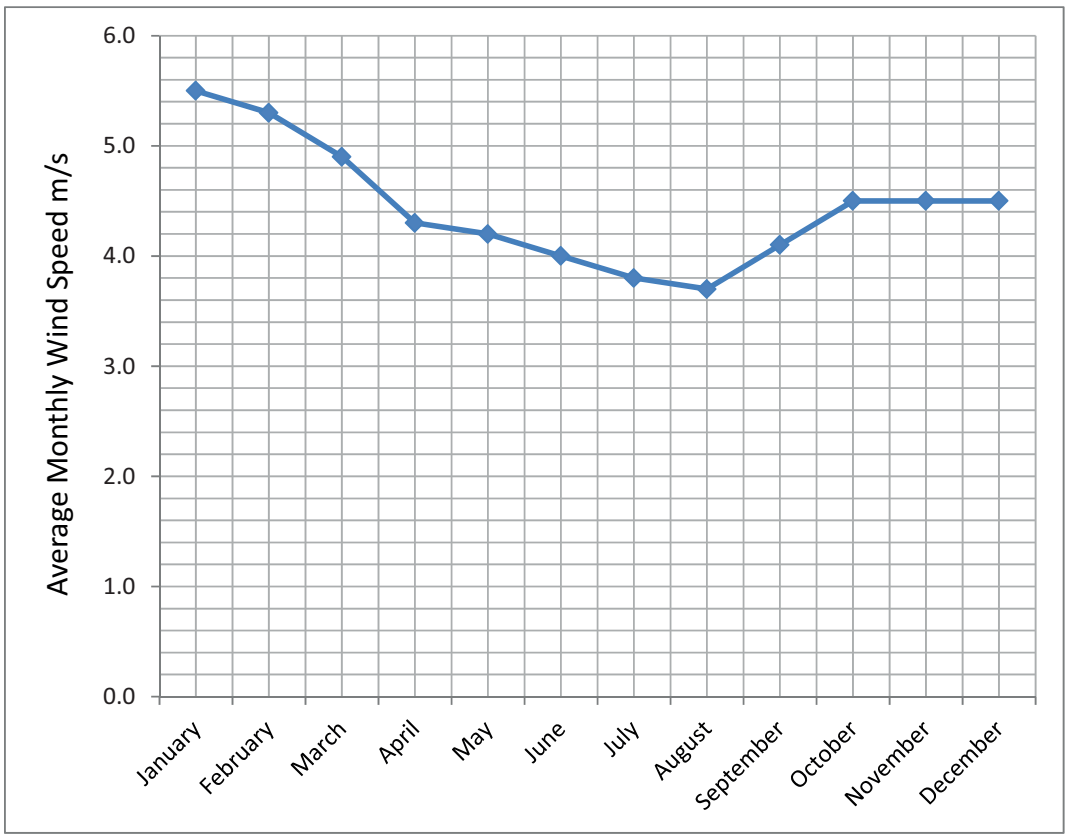
Table 1

- In addition to this, there are other energy requirements as shown in **Table 2**.

	Average daily energy usage (kWh)
Restaurant	31.8
Cellar	4.9
Bar	23.9

Table 2

- The restaurant is open 6 days per week throughout the year. All the fridges and freezers run continuously and the temperature in the cellar is always maintained at a constant value.
- The owners of the restaurant are conscious of the need to reduce the reliance on fossil fuels. They wish that at least 75% of the total energy required for the restaurant should be obtained from renewable sources.
- The restaurant is located on the outskirts of a town and 2 hectares of moist arable land are available nearby with full exposure to sun and wind. The site is suitable for the growing of willow and is available to the restaurant owners.
- A wind survey graph indicates that the location of the restaurant experiences an average monthly wind speed over a ten year period as shown in the graph below.



- Meteorological surveys reveal that the average solar radiation for the area is as given in **Table 3**.

Month	**Average Solar Radiation in kWh/m^2/day**
January	0.56
February	1.07
March	1.97
April	3.32
May	4.40
June	4.30
July	4.30
August	3.40
September	2.69
October	1.43
November	0.77
December	0.43

Table 3

- The building is on a site which does not restrict wind or solar energy supply.

Consultancy requirements

To fulfil the assessment criteria for this unit you must produce a technical consultancy report which will be submitted by Oldberry Consultancy Services Ltd. as part of the tendering process. The report should detail the renewable sources and associated technologies which can be availed of at the proposed site, together with evidence to support any recommendations proposed.

The technical consultancy report will consist of **three** elements:

(i) Desktop research.
(ii) A practical investigation on **one** renewable technology.
(iii) Discussions and recommendations.

(i) Desktop Research

Your desktop research should include the following for each technology:

- An overall description of the use of the energy technology in this particular scenario.
- Consideration of the following assessment criteria for each energy technology researched:
  - Its energy efficiency.
  - Its cost effectiveness to include construction, maintenance and cost benefit analysis.
  - Its environmental impact.
  - Its ability to provide energy security and continuity of supply.

(ii) Practical Investigation

In the classroom setting, using your research and knowledge gained in Unit 1, explore **one** relevant factor related to the use of **one** of the renewable technologies under consideration.

For example you could:

- Investigate the effect wind speeds have on the performance of a turbine.
- Investigate the effect of blade diameter on the power output of a wind turbine.
- Investigate the effect of hub height on the performance of a wind turbine.
- Investigate the power curve and power variation of a photovoltaic panel over a typical day.
- Investigate the effect of the actual temperature of a photovoltaic cell on cell performance.
- Investigate the energy output of a photovoltaic solar panel with differing solar radiance levels.
- Design and build an experimental test rig to allow calculations of thermal energy absorbed by a thermal collector.
- Design and conduct an experimental procedure to calculate the energy content of willow chippings.

(iii) Discussions and Recommendations

You will use your knowledge gained from the desktop research, along with your findings from your practical investigation, to present recommendations with associated rationales for inclusion in the consultancy report.

For the recommended technologies consideration should be given to the following:

- Suitability of each technology for this particular scenario.
- Cost benefit analysis.
- Environmental impact.
- Security and continuity of supply.
- Capacity of the chosen technologies to meet the target of 75% energy needs.

Additional guidance on the format and structure of the technical report can be found in section 3.2 of the Environmental Technology specification.

Word Limit

- The technical report must not exceed **3250** words.
- The introduction to the task should not exceed **500** words.
- The desktop research should not exceed **1000** words.
- The practical investigation should be a maximum of **500** words.
- The discussions and recommendations should be a maximum of **1250** words.