

UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualification:–

M.Sc.

The Built Environment: The Energy Context

COURSE CODE : BENVEE01

DATE : 02-MAY-06

TIME : 10.00

TIME ALLOWED : 2 Hours

University of London

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MSc DEGREE in SCIENCE in BUILT ENVIRONMENT 2006

Module BEN VE E01: THE BUILT ENVIRONMENT: The Energy Context

Answer TWO questions only. Answer all parts of the questions chosen.

1. The architect of an energy efficient building in London has involved you as a energy consultant to explain to his client the importance of energy efficient building design. In particular the architect would like you to comment on the following.
 - (a) The evidence that man-made climate change is occurring. *(5 marks)*
 - (b) The role that building energy use plays in climate change. *(10 marks)*
 - (c) The potential methods for reducing building energy use. *(10 marks)*
 - (d) The main mechanisms that governments can use to motivate the design of energy efficient buildings, and their advantages and disadvantages. *(10 marks)*
 - (e) The future impact that climate change may have on the environmental performance of buildings. *(5 marks)*
 - (f) The potential impact of limited reserves of fossil fuels. *(5 marks)*
 - (g) The role of renewable energy compared to that of energy efficient design. *(5 marks)*

2. A friend is about to buy an old end-of-terrace house and has been told that it has a rather poor SAP rating of 55. He knows that the SAP (Standard Assessment Procedure) is the UK Government's scheme for rating the energy performance of houses, but very little else about it, and is seeking your help and advice on what might need to be done to improve the house's energy performance once he moves in. Write a report for your friend explaining:
 - (a) what a SAP rating is, how it is calculated and what the aims of its use are *(15 marks)*
 - (b) the relationship between SAP rating and the carbon index *(5 marks)*
 - (c) what issues relating to the building fabric might be contributing to the low SAP rating and how these might be improved *(10 marks)*
 - (d) what issues relating to the heating system might be contributing to the low SAP rating and how these might be improved *(10 marks)*
 - (e) why SAP is not a good predictor of actual energy performance in individual houses. *(10 marks)*

TURN OVER

3. (a) Discuss the meaning of the term “renewable energy”, and explain why it can be applied to electricity generated by wind turbines. (5 marks)
- (b) What are the main disadvantages of using wind turbines to produce more than, say, 25% of the UK’s total electricity requirements? What other disadvantages are there in using wind power to produce electricity for the UK’s national grid? (10 marks)
- (c) Explain the meaning of solidity as applied to wind turbines. (5 marks)
- (d) Explain the meaning of “rated power”, “rated wind speed”, “cut-in wind speed” and “shut-down wind speed” for a wind turbine. (5 marks)
- (e) Explain the meaning of “stall” in the context of an aerofoil. Explain how “stall control” can be used to protect wind turbines at high wind speeds. (10 marks)
- (f) A conventional horizontal-axis wind turbine has been constructed on a site with an average wind speed of 4.5 m/s. If the blades of the turbine sweep out a circular area with a diameter of 20 m, and are able to extract 35% of the maximum kinetic energy in the wind, what would be the average electrical power (in kW) produced? If the turbine operates at this speed for 24 hours, how much energy would be produced? It can be assumed that the density of the ambient air is 1.12 kg/m^3 . (10 marks)
- (g) Explain why it is crucially important to locate the wind turbine on the site where the wind speed is greatest. (5 marks)
4. (a) Compare and contrast the following two methods of economic analysis (10 marks):
- payback
 - discounted cash flow
- (b) Explain why a compact fluorescent light bulb may be considered a cost-effective replacement for a tungsten filament light bulb, when used for 24 hour corridor lighting in an institutional building, but not cost effective if used for a living room lit for 1 hour a day in an owner occupied house. Discuss the benefits and disbenefits in using discounted cash flow analysis and payback analysis to examine the cost effectiveness in both cases. (30 marks)
- (c) Despite significant improvement in the energy efficiency of buildings over the last 30 years, energy consumption has risen in the domestic and commercial sectors. Explain why, and the impact that future price rises may have on the introduction of energy efficiency measures. (10 marks)

END OF PAPER