EEE404 –Renewable Kinetic Energy Technologies

Lab Assignment 2 -

Design of a Wind/Diesel Hybrid Power System for an Example Remote Island

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A. Marks

The marks for both the developed program and lab report will account for 15% of your total mark for this module.

B. Submission

Hard and soft copies should be submitted to the module leader no later than 24.00, 18th May, 2018.

C. The Problem

The domestic consumers in the remote areas not served by the main electrical grid network, diesel generators are the usual choice for power supply. As a result, plenty of servicing and maintenance needed onto these diesel generators. Thus, an idea of introducing wind turbines working together with diesel generators and energy storage to form a hybrid power system is proposed.

Masirah is Oman's largest island. It is located some 15 km from the coast of Al Wusta in Central Oman. There are steady Khareef winds blowing from Southwest along the coast of Oman. Masirah Island is therefore abundant in renewable resources, such as wind power and solar photovoltaic.

At present, all electric power demand at Masirah Island is met by ten diesel powered generators located at central power station. The capacity of power rating ranges between 265 and 3,136 kW. With total installed power capacity of more than 8,200 kW.

The power system of Masirah Island consists of 54% residential load demands, 40% commercial and governmental usage and 6% industrial loads. The electric power is used increasingly to meet air-conditioning load in summer months.

In this lab session, a hybrid power system using both renewable energy sources and the existing diesel generators needs to be designed. Data of wind speed profile and daily load are attached in the Appendix. Students can select wind turbines from the candidate wind turbines listed in the Appendix. Energy storage devices such as batteries and pumped storage are also allowed to use in the design with proper justification. A basic economic analysis should be included for the proposed design.

Students are encouraged to use software such as HOMER ENERGY to model and verify the proposed design. Alternatively, students may also develop a MATLAB or EXCEL based program to model and verify the proposed design.

D. The structure of a Report

The structure of a report is determined by its components and their interrelationships. An experimental report will normally contain the following sections:

1. Title page - the report cover giving the title of the experiment, the data on which it was performed and the author's name.

2. Summary (or abstract) - a short section of between 50 and 300 words which must be capable of being read and understood independently of the rest of the report. This section should briefly summaries (a) the purpose and scope of the experiment, (b) the experimental procedures that were carried out, and (c) the main conclusions. This section is possibly the most difficult to write and you are advised to write it last.

3. Introduction - this should be a brief section, which describes, in general terms, the scope of the experiment and its relevance to the field of study you are engaged in. A statement of objectives should be given along with general comments about how the

experiment will be carried out.

4. Theory - describing the theoretical background to the experiment and maybe anticipating some of the expected results.

5. Experimental method - giving details of what equipment/software was required and how it was used.

6. Results and Calculations - Present experimental readings in tabular form with estimates of reading errors. Calculations based on experimental readings should be presented in a form, which allows them to be checked. Graphs are normally more informative than tabular results and should be presented whenever appropriate, even when not specifically requested. Do not quote readings or calculated results to more significant figures than the accuracy of the experiment provides; e.g. 7.400 indicates four significant figures of accuracy whereas 7.4 indicates two.

7. Discussion - always included to give an assessment of the significance and reliability of the results, to consider the implications of experimental errors and to propose possible alternative approaches and further experiments that could be carried out.

8. Conclusion - a concise statement of what has been learnt from or confirmed by the experiment. This section must be consistent with earlier sections.

10. References.

E. Style

The style of a technical report should be clear, precise, concise and objective. Clarity and precision are often interdependent and can be achieved only when the author has mastered the subject matter, and clearly understands his terms of reference. The author must be able to distinguish important and unimportant detail so that emphasis is correctly placed.

Concise writing conveys its meaning in the fewest possible words, and is generally easy to read because it appears direct and natural. The style of a report can often be greatly improved by eliminating redundant expressions, such as "... it will be noted that...", or rephrasing a few complicated sentences.

The style of a technical report should be objective in that it excludes any personal feelings or prejudices and focuses attention on facts. The use of first person pronouns "we" and "I" referring to the writer(s) alone should be avoided. For example, "we tested the circuit" should be re-expressed in the passive voice as "the circuit was tested". "We" is sometimes used to refer to the author and reader collectively, e.g. "We now see that...", but is generally best avoided or used very sparingly.

Colloquial expressions should not be used in a report and jargon should be used only with very great care. For example, 'chip' is now probably acceptable for 'integrated circuit' but 'tweaking' a potentiometer is definitely not allowed. Ironical, cynical or light-hearted comments are invariably out of place, and serve only to antagonize the reader.

F. Bibliography

Many books and articles have been written about technical writing. An example is thefollowing:

[1] H.M. Weisman, “Technical Report Writing”, 2nd Edition, Charles E. Merrill Publishingco., Columbus, Ohio, U.S.A., 1975.