SBS5421 Building Energy Efficiency cum Carbon Emission

http://ibse.hk/SBS5421/

Mini-Project 2018-2019

A higher education institute (called "IU") would like to improve the building energy efficiency of its campus (see Figure 1) so as to achieve higher building energy performance which will save energy and costs, enhance operational effectiveness and demonstrate their commitment to sustainability. You are playing the role of an engineering consultant team to provide professional advice and service to the Institute on the related energy efficiency improvement projects.

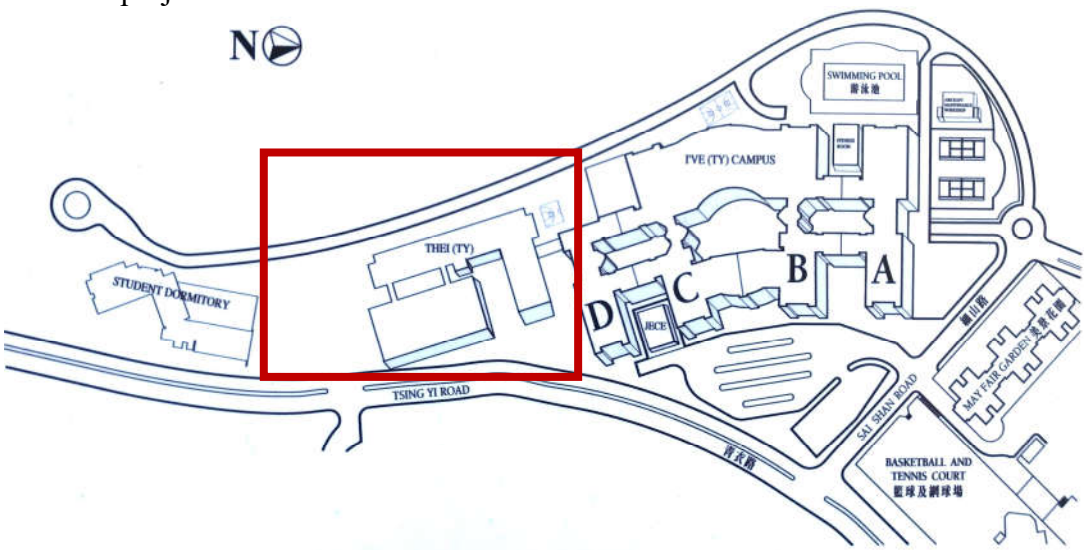

Figure 1. Site map of the campus

After discussion with the client's representatives, it was decided that the consultant team should focus on the following aspects to carry out investigation and prepare technical reports in order to develop critical information for setting a strategic plan for the Institute. Figures 2 and 3 in the Appendix show basic concepts of the investigation.

(a) Assessment of energy use characteristics and energy saving potential of the existing buildings on the campus.

(b) Evaluation of building energy performance and energy efficient building design of a new academic building on the campus.

This mini-project provides an opportunity for the students to examine building energy efficiency and energy improvement projects in a real-life practical situation by considering both technical and managerial approaches.

Objectives

- To assess energy use characteristics and energy saving potential of the existing buildings on the campus.
- To evaluate building energy performance and energy efficient building design of a new academic building.

Methodology

Students shall form a team of 4-5 persons to carry out the investigation and develop the technical reports. They should search and collect information from various sources to build up the basis of the investigation. If needed, they may make assumptions and/or suggestions for the building(s) and situation so that reasonable and appropriate information can be developed for the assessment and evaluation.

The professional advice from the engineering consultant team should target at strategic planning and critical issues important for future development of suitable measures and actions for implementation of the energy efficiency improvement projects. It is not necessary to have all the details and data established at this stage, but the information to be included in the reports should be relevant, clearly presented and well justified.

This mini project will enable students to strengthen what they have learned during the lectures and from previous education, by investigating practical situation and problems of building energy efficiency. The purpose is to help students to practice their skills in solving real-life engineering problems, and also in communicating results to others. It is important that students should clearly present the work (restate the objective of the problem, identify relevant information, assumptions, sources used in the solution, and include a discussion section on the results and their significance).

Results and Findings

After the investigation, the following information should be established to report the findings.

(a) Methods to assess energy use characteristics of the existing buildings on the campus (such as energy audit and survey, energy benchmarking)
(b) Approach to investigate energy saving potential and identify energy saving measures
(c) Techniques to evaluate building energy performance and energy efficient building design of a new academic building
(d) Illustration and demonstration of the analysis results
(e) Evaluation of important factors for the energy efficiency improvement projects
(f) Discussion of practical issues and design of strategic plan for building energy efficiency

The results of the investigation should be developed stage by stage and the engineering consultant team should prepare an interim report in the middle of the study period to present the initial findings and the suggested plan to complete the investigation. At the end of the study period, they should make an oral presentation to summarize the key findings and then submit a final report to conclude the investigation. The proposed time schedule and weighting of the assessment components are shown as follows.

- Interim Report (25%): [normally not more than 30 A4 pages]
    - Submission deadline: 28 Mar 2019 (Thu)
- Oral Presentation (25%): [15 minutes for each group]
    - Date: 2 May 2019 (Thu)
- Final Report (50%): [normally not more than 60 A4 pages]
    - Submission deadline: 9 May 2019 (Thu)

The reports should be neat and properly formatted and organized. Proper credit and

referencing should be provided to the information sources. Students making direct copy of the information in other publications (plagiarism), if found, will be disqualified. The reports in electronic PDF format shall be submitted via Moodle. Late submission will receive reduction in marks.

For the reports, the assessment criteria include quality of the content, report organization, clarity of thought, teamwork skills, communication skills, and report writing skills. For the oral presentation, the assessment criteria include quality of the content, organization of presentation, pace and delivery, use of visual aids, and responsiveness to audience. Assessment marks for the whole group and individual members will be allocated respectively. Therefore, clear division of works should be indicated in the reports to show the role and responsibility of each student in the team.

References

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Borgstein E. H., Lamberts R. and Hensen J. L. M., 2016. Evaluating energy performance in non-domestic buildings: A review, *Energy and Buildings*, 128: 734-755.

Chung M. H. and Rhee E. K., 2014. Potential opportunities for energy conservation in existing buildings on university campus: A field survey in Korea, *Energy and Buildings*, 78: 176-182.

CIBSE, 2013. *Evaluating Operational Energy Performance of Buildings at the Design Stage, TM54: 2013*, Chartered Institution of Building Services Engineers (CIBSE), London.

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Krarti, M., 2011. *Energy Audit of Building Systems: An Engineering Approach*, 2nd ed., CRC Press, Boca Raton, Florida.

UCD, 1995. *Tools and Techniques for the Design and Evaluation of Energy Efficient Buildings*, THERMIE Action No. B184, THERMIE Maxibrochure, For the European Commission Directorate-General for Energy (DGXVII), Energy Research Group, School of Architecture, University College Dublin, Ireland. (available at http://erg.ucd.ie/UCDERG/pdfs/mb_design_tools.pdf)

Useful Web Links

Buildings Energy Efficiency Ordinance (Cap. 610) [EMSD] https://www.emsd.gov.hk/beeo/
Building performance simulation - Wikipedia
https://en.wikipedia.org/wiki/Building_performance_simulation
Energy Consumption Indicators and Benchmarks https://ecib.emsd.gov.hk/en/index.htm
Energy Efficient Retrofits Guide [BEC] https://bec.org.hk/resource-centre/eerguide
Energy Land [EMSD] https://www.emsd.gov.hk/energyland/
HK EE Net 香港節能網 http://ee.emsd.gov.hk/
Optimize Energy Use [WBDG]
https://www.wbdg.org/design-objectives/sustainable/optimize-energy-use

Appendix

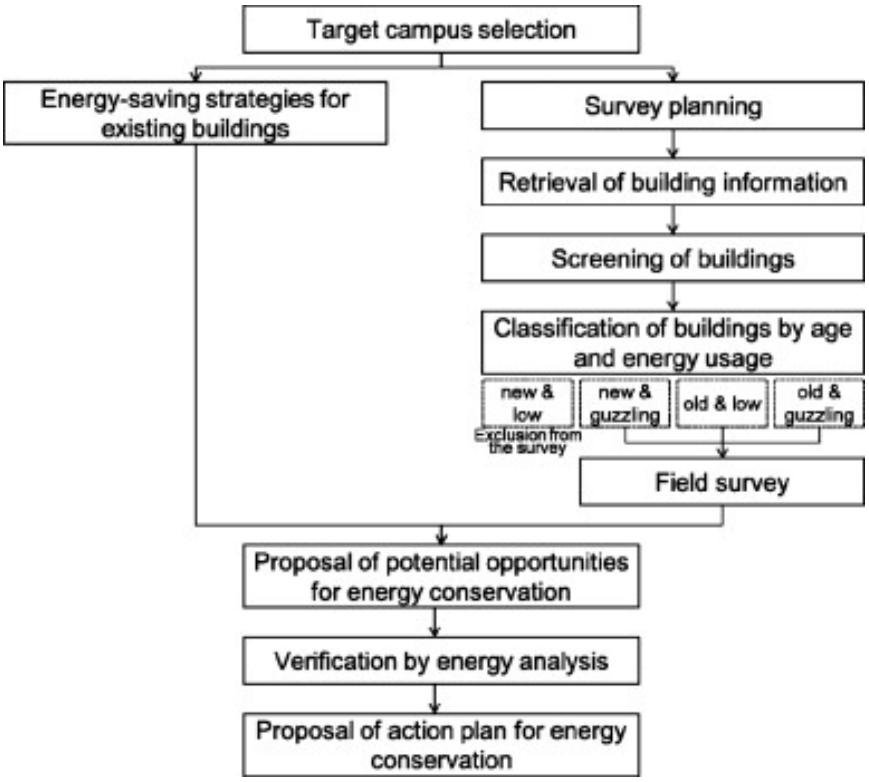

Figure 2. Process for proposal of energy saving in existing buildings
(Source: Chung and Rhee, 2014)

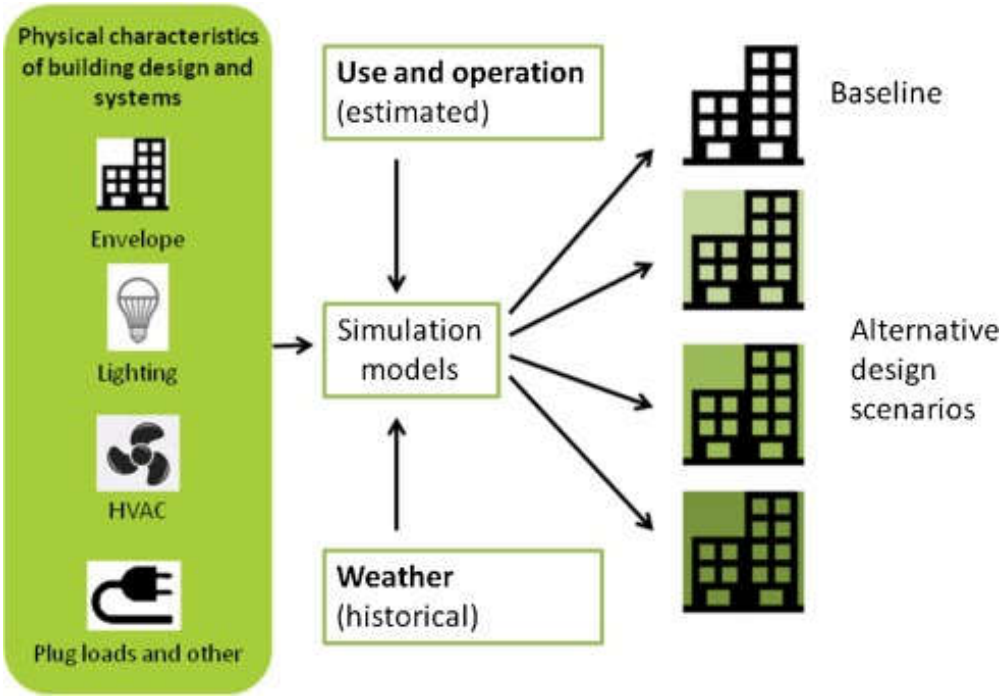

Figure 3. Evaluation of energy performance by simulation at design stage
(Source: Borgstein, Lamberts and Hensen, 2016)