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Master Thesis Defense

Entitled

*THE IMPACT OF BUILDING FORM ON ENERGY CONSUMPTION IN NEW SCHOOL MODELS OF
ABU DHABI*

By

Meriem Rahmani

Faculty Advisor

Prof. Khaled A. Al-Sallal, Department of Architectural Engineering
College of Engineering

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Abstract

The high rates of energy consumption by schools are mainly caused by inappropriate designs of architectural forms and limited access to free energy resources that can be provided by natural lighting and ventilation. Optimizing the architectural form with regards to its geometry, aspect ratio, spatial height to depth proportion, Form direction, spacing between building masses can help to improve connection to the outdoor environment including daylight, air and outdoor greenery. The optimized form can help not only to save energy but also to create educational environments that are more lively and cheerful; and hence improve students' performance, health and attitude. Investigating optimum architectural forms that help to consider natural lighting and contribute in reducing carbon emissions through limited use of energy consumption is tackled in this thesis. The main focus is performance improvement of the learning communities (i.e., the learning unit) that ADEC (Abu Dhabi Educational Council) adopts in all its new school model designs (NSM). The undertaken investigations are based on Abu Dhabi environmental conditions and take into consideration current design practices in Abu Dhabi schools, ADEC school design requirements, and Estidama green building rating system and guidelines. The investigation depends mainly on experimental methodology using computer simulation in addition to other methods conducted at the outset to collect data such as documents' surveying, interviews, and design data gathering and analysis. The analysis of the results shows significance of form verticality (i.e. higher number of floors) and compactness in reducing energy requirements and greenhouse gas emissions levels. The provided in-depth discussions reveal the complex interrelationships between the design and performance variables. The behaviors of these variables are modeled with governing equation; this can be considered as the main outcome of this thesis. Another important outcome is the graphical representations of the results; which are introduced in a manner that can directly help architects and decision makers to design low energy low carbon schools.

Keywords: Energy consumption, school, building form, relative compactness, aspect ratio, Form direction, window to wall ratio, New School Model.