



*PASSIVE ENERGY EFFICIENCY TECHNOLOGY
SOLUTION FOR AL HAMRA MALL*

M.Sc. Thesis Proposal

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BACKGROUND:

Al Hamra Shopping Mall with area of thirty six thousand square meter is the part of Al Hamra Village Real state of area five million square meter project in Al Hamra area of Ras Al Khaimah (RAK) - United Arab Emirates (UAE). The mall is fully operational with facilities like supermarket, restaurants, shops etc and it is equipped with building management system (BMS) to monitor and control from a central location.

As depicted in the project vacancy, approximately 70% of the energy consumption of the mall is the share for the heating ventilating and air conditioning (HVAC) system used for the mall. That means 70% of the cost of energy goes to the HVAC system of the mall. We can eliminate the mechanical cooling or at least reduce the size and cost of the equipment and hence cost of energy by employing passive cooling techniques in to modern buildings like Al Hamra Mall.

OBJECTIVES:

The main objective of this work is:

- Explore the possibility of providing space conditioning and indoor air quality control services in the Al Hamra Mall by maximizing the use of passive/renewable energy systems.

The specific objective of this research includes:

- Theoretically model and simulate the detail dynamic cooling load trend of the Mall;
- Propose viable passive energy system alternatives for the Mall without changing physical structure;
- Identifying solutions for the reduction of cooling load of AL HAMRA Mall;
- Estimate the annual energy savings due to cooling load reduction; and
- Validate the cost efficiency and environmental performance of a number of proposed passive/ renewable system alternatives.

LITERATURE REVIEW:

The key issue for passive cooling is the availability of heat sinks for heat rejection. In hot- humid climates like UAE heat is not easily dissipated in the atmosphere. So the key issue for both comfort and conservation purposes in hot-humid climate zones is to reduce heat and moisture

indoor gains. For hot-humid climates the cooling degree day exceeds their heating, if any, degree day.

RESEARCH GAP:

We know the negative effect of humidity on comfort even if temperatures are reasonable. Therefore reducing interior humidity calls for; reducing moisture migration from exterior, eliminating/ controlling interior sources, and removing moisture. But practical passive dehumidification systems have not yet been developed.

METHODOLOGY:

- Analysis of weather and solar radiation data obtained from the CSEM-UAE station;
- Assess feasible low-energy cooling options to select the best suitable combinations for the site;
- Model the dynamic cooling loads at the mall before and after the implementation of proposed passive/ renewable solutions; and
- Evaluate related costs and energy consumption effectiveness of the proposed alternative system options, based on loads calculated per above.

TIME SCHEDULE:

The time schedule for the thesis work is 6 months that will start on March 15, 2010. Final report will be submitted on September 15, 2010.

EXPECTED RESULTS AND DELIVERABLES:

- Identified and valid passive energy efficiency technology solutions to be applicable for the mall and large buildings in UAE;
- Improved knowledge about potential of passive cooling techniques for different bioclimatic zones, with a focus on hot/humid climates; and
- Improved knowledge of building cooling load calculation techniques.

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